ENVIRONMENTAL ASSESSMENT

Reducing Canada Goose Damage Throughout the State of Mississippi

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AAWV American Association of Wildlife Veterinarians
AC Alpha chloralose
ADC Animal Damage Control
APHIS Animal Plant Health Inspection Service
AVMA American Veterinary Medical Association
BO Biological Opinion
CDC Centers for Disease Control and Prevention
CEQ Council of Environmental Quality
CFR Codes of Federal Regulation
EA Environmental Assessment
EPA U.S. Environmental Protection Agency
EPP Eastern Prairie Population
ESA Endangered Species Act
EIS Environmental Impact Statement
FAA Federal Aviation Administration
FDA U.S. Food and Drug Association
FEIS Final Environmental Impact Statement
FONSI Finding of No Significant Impact
FIFRA Federal Insecticide, Fungicide, and Rodenticide Act
IWDM Integrated Wildlife Damage Management
MA Methyl Anthranilate
MBTA Migratory Bird Treaty Act
MDAC Mississippi Department of Agriculture and Commerce
MDWFP Mississippi Department of Wildlife, Fisheries and Parks
MFGP Mississippi Flyway Giant Population
MOU Memorandum of Understanding
NEPA National Environmental Policy Act
NHPA National Historic Preservation Act
NWRC National Wildlife Research Center
RPA Reasonable and Prudent Alternative
ROD Record of Decision
RPM Reasonable and Prudent Measure
SJBP Southern James Bay Population
SOP Standard Operating Procedure
T&E Threatened and Endangered Species
USFWS U.S. Department of Interior, Fish and Wildlife Service
USAF United States Air Force
USDA U.S. Department of Agriculture
USGS U.S. Geological Survey
WAC Wildlife Acceptance Capacity
WS Wildlife Services

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

Human colonization, settlement, and population expansion in North America has forced a fragile coexistence with wildlife. Through various land use practices, wildlife habitat has changed dramatically throughout the years. In many cases human uses and needs often compete with wildlife which, in turn, increases the potential for interactions between people and wildlife. Some individuals portray wildlife encounters as a majestic intervention which provides a sense of beauty and a sustainable coexistence. Others view wildlife interactions as conflicting with human uses and needs (Conover 2001). These diverse views are evident in the public perception of the Canada goose (*Branta canadensis*), where exploitation nearly extirpated the species from much of eastern North America in the early 1900s. Today, with proper management and growth promotion, along with changes in land use, behavioral adaptation and changes in social views, Canada goose populations have grown to the level where negative interactions with people have increased (USFWS 2005a, Adams et al. 2006).

Some species of wildlife, including Canada geese, have adapted to and thrive in human altered habitats. Those species, in particular, are often responsible for the majority of conflicts between humans and wildlife that lead to requests for assistance to reduce damage to resources and to lessen the threat to human safety. The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Animal Damage Control (ADC)[1] programmatic Final Environmental Impact Statement (FEIS) summarizes the relationship in American culture of wildlife values and wildlife damage in this way (USDA 1997):

> "*Wildlife has either positive or negative values, depending on varying human perspectives and circumstances . . . Wildlife is generally regarded as providing economic, recreational and aesthetic benefits . . . and the mere knowledge that wildlife exists is a positive benefit to many people. However . . . the activities of some wildlife may result in economic losses to agriculture and damage to property . . . Sensitivity to varying perspectives and value is required to manage the balance between human and wildlife needs. In addressing conflicts, wildlife managers must consider not only the needs of those directly affected by wildlife damage but a range of environmental, sociocultural and economic considerations as well*."

When considering wildlife interactions with people, both sociological and biological carrying capacities must be applied to resolve wildlife damage problems. The wildlife acceptance capacity (WAC), or cultural carrying capacity, is the limit of human tolerance for wildlife or the maximum number of a given species that can coexist compatibly with local human populations. Biological carrying capacity is the land or habitat's ability for supporting healthy populations of wildlife without degradation to the species' health or their environment during an extended period of time (Decker and Purdy 1988). These phenomena are especially important because they define the sensitivity of a community to a wildlife species. For any given damage situation, there are varying thresholds of tolerance exhibited by those directly and indirectly affected by the species and any associated damage. This damage threshold determines the WAC. While Mississippi may have a biological carrying capacity to support a higher population of Canada geese, in many cases the WAC is lower or has been met. Once the WAC is met or exceeded, people begin to implement population or damage management, including lethal methods, to alleviate damage or address threats to human health and safety.

The alleviation of damage or other problems caused by or related to the behavior of wildlife is termed wildlife damage management and is recognized as an integral component of wildlife management (The Wildlife Society 1992, Conover 2001). The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated and the need for Canada goose damage management is derived from the specific threats to resources. Canada geese have no *intent* to do harm. They utilize habitats (*i.e.,* reproduce, walk, forage, deposit feces) where they can find a *niche*. If their activities result in actions resulting in lost economic value of resources or threaten human safety, people characterize this as damage.

[1] On August 1, 1997, the Animal Damage Control program was officially renamed to Wildlife Services. The terms Animal Damage Control, ADC, Wildlife Services, and WS are used synonymously throughout this document.

An adaptive Integrated Wildlife Damage Management (IWDM) approach is often employed to resolve wildlife damage or threats to human safety, where a combination of methods may be used or recommended to resolve the damage or threat. Adaptive IWDM is the application of safe and practical methods for the prevention and reduction of damage caused by wildlife based on local problem analyses (Slate et al. 1992) and the informed judgment of trained personnel. Adaptive IWDM is a site-specific strategy to evaluate each damage situation and devise a management approach to resolve/alleviate the damage in the most effective and environmentally friendly manner. Adaptive management may require the modification of human or animal behavior, or that the animal responsible for the damage is removed or that local populations or groups are reduced through lethal methods. Potential environmental effects resulting from the application of various Canada goose damage management techniques are evaluated in this Environmental Assessment (EA) (See Appendix B for a description of potential methods).

The USDA is authorized to protect agricultural resources, natural resources, and property from damage along with threats to human health and safety from wildlife. This function is carried out by the USDA, APHIS, Wildlife Services' (WS) program. WS is authorized to protect resources from wildlife damage 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). Wildlife damage management is the alleviation of damage or other conflicts caused by wildlife. WS uses an adaptive IWDM approach (WS Directive 2.105[2]), in which a combination of methods may be used or recommended to reduce wildlife damage. WS' IWDM approach to managing wildlife damage is further described in WS' FEIS (USDA 1997).

WS' mission, developed through its strategic planning process, is to provide leadership in wildlife damage management in the protection of America's agricultural, industrial and natural resources, and to safeguard public health and safety. WS' policy manual reflects this mission and provides guidance for engaging in wildlife damage management through:

- Training of wildlife damage management professionals;
- Development and improvement of strategies to reduce losses and threats to humans from wildlife;
- Collection, evaluation, and dissemination of management information;
- Informing and educating the public on how to reduce wildlife damage;
- Providing data and a source for limited-use management materials and equipment, including pesticides (USDA 1989).

WS' activities are conducted to prevent or reduce wildlife damage to agricultural, industrial and natural resources, property, livestock, and threats to public health and safety on private and public lands in cooperation with federal, state and local agencies, private organizations, and individuals. This EA evaluates a portion of WS' activities, specifically damage to agriculture, property, natural resources, and threats to human health and safety caused by Canada geese in Mississippi.

1.2 PURPOSE

Normally, individual wildlife damage management actions conducted by the WS program could be categorically excluded from further National Environmental Policy Act (NEPA) analysis, in accordance with APHIS implementing regulations for NEPA (7 CFR 372.5(c), 60 Fed. Reg. 6,000, 6,003, (1995)). WS is preparing this EA to: 1) facilitate planning, interagency coordination and the streamlining of program management; 2) clearly communicate to the public the analysis of individual and cumulative impacts of program activities; and 3) evaluate and determine if there are any potentially significant or cumulative adverse affects from the proposed program. All Canada goose damage management activities in Mississippi are undertaken in compliance with relevant laws, regulations, policies, orders and procedures, including the Endangered Species Act (ESA) of 1973, as amended (16 USC 1531-1543), and the Migratory Bird Treaty Act (MBTA), as amended (16 USC 703 et seq.). This analysis relies on existing data contained in published documents (Appendix A), WS' Management Information System, WS' FEIS[3] (USDA 1997), and the United States Fish and Wildlife Service's (USFWS) FEIS[4] entitled "*Resident*

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

[3] WS' FEIS may be obtained by contacting USDA/APHIS/WS Operational Support Staff at 4700 River Road, Unit 87, Riverdale, MD 20737-1234.

Canada Goose Management" (USFWS 2005a); information from WS' FEIS and the USFWS FEIS is incorporated by reference. WS' FEIS and the USFWS FEIS contain a detailed discussion of potential environmental impacts of methods available to manage goose damage in Mississippi.

This EA evaluates ways by which this responsibility can be conducted to resolve damage, health risk, and conflicts associated with Canada geese in Mississippi. WS strives to reach and maintain a balance between both wildlife and human needs and welfare. Humans and waterfowl are both essential elements in today's evolving environment. Through human expansion and environmental degradation, waterfowl and human interaction is steadily rising each year. WS realizes that both have sets of needs and welfare that must be considered when selecting proper methods and approaches for a goose damage management program. WS conducts wildlife damage management as a means of reducing damage by relocation, deterrence, exclusions, and removal.

WS is preparing this EA to determine if the proposed Canada goose damage management program could have a significant impact on the environment for both humans and other organisms, analyze other alternatives, coordinate efforts, inform the public, and to comply with NEPA. This EA analyzes the potential effects of goose damage management, as coordinated with the USFWS, other governmental agencies, and private entities, as appropriate, in Mississippi under Memoranda of Understanding (MOU), Cooperative Service Agreement, or other comparable document. The EA also addresses the effects of goose damage management on areas where additional agreements may be signed in the future. Because the proposed action is to conduct a coordinated goose damage management program in accordance with plans, goals, and objectives developed by WS to reduce damage, and because the program's goals and directives are to provide services when requested, within the constraints of available funding and workforce, it is conceivable those additional damage management efforts could occur. Thus, this EA anticipates these additional efforts and the analyses are intended to apply to actions that may occur in any locale and at any time within the State of Mississippi as part of a coordinated program. This analysis covers current and future goose damage management activities by WS encompassing 30,997,636 acres (82 counties) of Mississippi.

1.3 NEED FOR ACTION

Wildlife management is often based on balancing wildlife populations and human perceptions, in a struggle to preserve rare species, regulate species populations, oversee consumptive uses of wildlife, and conserve the environment that provides habitat for wildlife resources. Increasingly, cities, towns, parks, airports, and private properties have become sites of some of the greatest challenges for wildlife management (Adams et al. 2006). When the presence of a prolific, adaptable species such as the Canada goose is combined with human expansion, land management conflicts often develop. Long thought of as a spectacular sight during the spring and fall migration, Canada geese are now frequently and abundantly present in cities and towns throughout Mississippi and across the United States. They are generally regarded as providing ecological, educational, economic, recreational, and aesthetic benefits (Decker and Goff 1987), and there is enjoyment in knowing wildlife exists and contributes to natural ecosystems (Decker et al. 2001). Native waterfowl add an aesthetic component to wetlands, sometimes provide opportunities for recreational hunting, and like all wildlife, provide people with valued close contact with nature. Many people, even those experiencing damage, consider Canada geese to be a charismatic and valuable component of their environment, however, tolerance differs among individuals (Smith et al. 1999). Because of their prolific nature, site tenacity, longevity, size, and tolerance of human activity, Canada geese are often associated with problem situations. Geese are extremely adaptable and may use the resources provided by humans in urban landscapes for nesting, raising young, molting, feeding, and resting. Increasing populations of resident geese are resulting in increasing numbers of conflicts with human activities (Conover and Chasko 1985, USFWS 2005a, Dolbeer and Seubert 2006), and increasing concerns related to human health and safety (Ankney 1996, Seubert and Dolbeer 2004, Dolbeer and Seubert 2006). Geese are a difficult species to manage because they are highly mobile, able to exploit a variety of habitat types within a given area, and cannot be permanently excluded from large areas. It is rarely desirable or possible to eliminate all problem geese from an area, but with a proper management scheme, numbers of nuisance birds and associated problems may be reduced to a level that a community can tolerate. Additionally, management of goose-related problems often exceeds the capabilities of single landowners to reduce damage to tolerable levels. In Mississippi, as with other Flyway states, problem situations associated with Canada geese typically involve, but are not limited to, unacceptable and potentially dangerous accumulations of feces,

[4] The USFWS FEIS may be obtained by contacting the Division of Migratory Bird Management, U.S. Fish and Wildlife Service, 4401 North Fairfax Drive, MBSP-4107, Arlington, Virginia 22203 or by downloading it from the USFWS website at http://www.fws.gov/migratorybirds/issues/cangeese/finaleis.htm.

aggression during the nesting season, grazing of landscaped vegetation, damage to agricultural and natural resources, and unacceptable safety hazards for vehicles (automobiles, boats, airplanes). These problems frequently occur on private properties, residential communities, apartment/condominium complexes, municipal parks, schools, hospitals, natural/habitat restoration sites, corporate and industrial sites, office complexes, roadways, airports, and other areas (USFWS 2005a).

1.3.1 Canada Geese in Mississippi

The WS program has received requests for assistance to manage damage and threats to human safety throughout the state of Mississippi, where there are two behaviorally distinct types of Canada goose populations: Resident and Migratory. There are 4 primary migratory routes in North America, each of which has a Flyway Council governing migratory game bird management. These councils are comprised of representatives from member States and Canadian Provinces, and they make recommendations to the USFWS on management of waterfowl populations. The flyway system is divided into four administrative units; the Atlantic, Mississippi, Central, and Pacific Flyway Councils. The State of Mississippi is considered part of the Mississippi Flyway Council designated for the management of migratory birds.

Resident Canada Geese: The majority of Canada geese present in Mississippi are considered resident. These birds reside in Mississippi year round, and fly short distances between their summer and winter grounds. The population estimate for resident Canada geese in Mississippi for 2005 was approximately 28,250 (S. Baker, Mississippi Department of Wildlife Fisheries and Parks (MDWFP), pers. comm. 2006). The MDWFP population management goal for resident Canada geese in Mississippi is 20,000 geese (Mississippi Flyway Council Technical Section 1996, USFWS 2005a).

Migrant Canada Geese: The range of 3 different populations of Canada geese extend into Mississippi. The majority of Canada geese found within the State are from the Mississippi Flyway Giant Population. Both the Eastern Prairie Population and the Southern James Bay Population of geese extend into northern portions of Mississippi. Those three populations are thought to comprise the majority of the migrant birds that inhabit the State (USFWS 2006a).

1.3.1.1 Ecology, Behavior, and Population Status

1.3.1.1.1 Resident Canada Geese

Canada geese are considered residents when one of the following criteria are met: 1) nests and/or resides on a year round basis within the contiguous United States; 2) nests within the lower 48 States in the months of March, April, May, or June; or 3) resides within the lower 48 States and the District of Columbia in the months of April, May, June, July, August (Rusch et al. 1995, Ankney 1996, USFWS 2005a). The Mississippi Flyway defines resident Canada geese as geese nesting in states comprising the Mississippi Flyway as well as Canada south of latitude 50° N in Ontario and 54° N in Manitoba (Mississippi Flyway Council Technical Section 1996). The USFWS and the states estimate the current resident Canada goose population at 3.2 million in the United States; about 30% to 35% above the number states believe to be acceptable based on their needs to manage conflicts and problems caused by excessive numbers of resident Canada geese (USFWS 2005a). Resident Canada geese were introduced into the Mississippi Flyway during the early 1900s, with early restoration focusing on northern latitudes of the Flyway. By the 1960s, southern states in the Flyway had worked to establish nesting populations. By the 1980s both state and federal agencies had made efforts to establish nesting populations in the Flyway, with relocation of birds from neighboring states common, with internal redistribution of nesting birds occurring into the mid-1990s (Mississippi Flyway Council Technical Section 1996). Spring surveys in 2005 indicated there were 1.58 million birds in the Mississippi Flyway, which is similar to the 2002-2004 final estimates of approximately 1.60 million birds (for both the United States and Canada). These estimates have recently leveled at this mark, where between 1993 and 2000 Canada goose numbers doubled (Mississippi Flyway Council 2005). As reported by the North American Breeding Bird Survey, resident breeding populations of Canada geese in Mississippi increased 15.0% per year from 1966-2006 (Sauer et al. 2007). Spring estimates indicate

that the Mississippi Flyway Giant Canada goose population has increased at approximately 5% per year since 1996 (USFWS 2005a).

Resident Canada geese become sexually mature and breed at two to three years of age and have a relatively high nesting success compared to migrant Canada geese (USFWS 2005a). The highest concentration of breeding Canada geese in Mississippi occurs in the Delta region, but birds are observed throughout the state (Mississippi Flyway Council Technical Section 1996, Sauer et al. 2007). Nesting for resident Canada geese primarily occurs during March-May each year. In Mississippi, resident Canada geese nest in traditional sites (along shorelines, on islands and peninsulas, small ponds, lakes, and reservoirs), as well as on rooftops, adjacent to roadways, swimming pools, and in parking lots, playgrounds, planters, and abandoned property (tires, automobiles). These areas provide optimal habitat for Canada geese. In addition, Mississippi is comprised of many man-made ponds used for aquaculture production. These sites provide ideal habitat because they not only provide a water resource, but they are often located in or near agriculture areas which provide supplemental food resources (S. Baker, MDWFP, pers. comm. 2005).

In Mississippi, resident Canada geese molt, and are flightless, from mid-June through mid-July each year. Molting is the process whereby geese annually replace their primary and secondary flight (wing) feathers (Welty 1982). Portions of a flock of geese can be flightless from about one week before and two weeks after the primary molt period due to the asynchronous molting by individual birds. Non-breeding resident Canada geese which have failed nesting attempts sometimes move to other areas in late spring prior to molting (Nelson and Oetting 1998).

The first management plans for Canada geese in the Mississippi Flyway were developed in 1996, to help manage sport harvest and manage human/goose conflicts. The Mississippi Flyway Giant Canada Goose Management Plan outlines the main goals relating to Canada geese in the Mississippi Flyway. There are 3 main subject areas covered in this plan as they relate to population management focusing on population objectives, harvest management, and population control. The following is a summary of the management goals and the strategies for completing those goals (Mississippi Flyway Council Technical Section 1996):

> A. Population Objective: To maintain a population of approximately 1 million giant Canada geese, as measured by coordinated spring surveys, distributed in the Flyway in proportion to state and provincial objectives.
>
> B. Harvest Objective: Provide maximum harvest opportunity for giant Canada geese that is consistent with the population objectives identified in this plan, the objectives for other Canada geese populations in the Flyway, and the control of over-abundant goose populations in areas with high human/goose conflicts.
>
> C. Population Control Objectives: At the discretion of the state or provincial wildlife agency and with the concurrence of the respective federal wildlife agencies, control local populations of giant Canada geese where they create conflicts such as endangering human health or safety, damaging crops, damaging habitats important to other wildlife populations, or creating other injurious or nuisance situations.
>
> > Strategy 1: Manage harvests of local giant Canada goose populations using appropriate hunting regulations to help achieve population objective levels and minimize harvests of Canada goose populations of concern.
> >
> > Strategy 2: State, provincial and federal wildlife agencies should jointly develop policies and programs that will give states and provinces authority to implement appropriate actions to alleviate human/goose conflicts.

Strategy 3: Where population control through harvest management has not resolved site-specific human/goose conflicts, abatement techniques, habitat manipulation or other site-specific methods should be considered to alleviate these situations.

Strategy 4: Where hunting and other methods are ineffective at controlling local giant Canada goose populations, other lethal methods may be used to reduce these populations.

1.3.1.1.2 Migratory Canada Geese

In the Mississippi Flyway, migratory Canada geese consist primarily of the Mississippi Flyway Giant Population (MFGP), Eastern Prairie Population (EPP), and the Southern James Bay Population (SJBP) (USFWS 2006a). The wintering migratory population in Mississippi is mostly comprised of the MFGP, SJBP, and to a lesser extent EPP. Migrant Canada geese that rest or bay in route to their wintering grounds vary by year, with Mississippi Christmas Bird Count data from 1966-2006 showing an increasing trend for wintering populations of Canada geese throughout the state (National Audubon Society 2002). The USFWS provides the following status report for the three migratory populations of Canada geese in the Mississippi Flyway for 2006 (USFWS 2006a):

Mississippi Flyway Giant Population
Giant Canada geese have been reestablished or introduced in all Mississippi Flyway states. This subspecies now represents a large proportion of all Canada geese in the Mississippi Flyway. During spring 2006, biologists tallied 1,686,300 MFGP geese, a record high, and 7% more than were tallied in 2005. These estimates have increased an average of 5% per year since 1997 ($P < 0.001$). Most MFGP states expected average production in 2006, with especially good nesting conditions in Iowa, Indiana, and Michigan. A large fall flight, similar to that of 2005 was expected.

Southern James Bay Population
The Southern James Bay population nests on Akimiski Island and in the Hudson Bay Lowlands to the west and south of James Bay in Canada. The SJBP winters from southern Ontario and Michigan to Mississippi, Alabama, Georgia, and South Carolina. Breeding ground surveys indicated a spring population of 160,400 (± 35,700) geese in 2006, 247% higher than the previous year ($P < 0.001$), and 59% higher than the 2004 survey estimate ($P = 0.24$). The 2006 level was a record high since surveys started in 1990.

Overall, spring population estimates have decreased an average of 2% per year since 1997 ($P = 0.646$). The estimate of breeding pairs in 2006 increased to 64,400 (± 13,900), 205% higher than in 2005 ($P < 0.001$), and 71% higher than in 2004 ($P = 0.075$). Biologists believed the 2005 survey results underestimated the population due to unusual variation in survey timing and reduced goose detection resulting from the use of a different survey aircraft. Surveys in 2006 were conducted within the target period with the traditionally used aircraft. Survey biologists indicated that temperate-nesting molt migrants likely were not a factor in survey estimates during 2004-2006. Lower than average winter snowfall and above average spring temperatures contributed to a spring thaw in 2006 that was even earlier than in 2005, and 3-4 weeks earlier than average. On Akimiski Island, nesting phenology was similar to 2005, which was the earliest recorded since 1993. Nest density and average clutch size on Akimiski Island were above the recent average. Nest success was lower than in 2005, but still higher than average. Biologists anticipate the fall flight in 2006 to be well above average.

Eastern Prairie Population
The Eastern Prairie population nests in the Hudson Bay Lowlands of Manitoba with concentrations primarily in Manitoba, Minnesota, and Missouri during winter. The 2006 spring estimate of EPP geese was 185,400 (± 30,400), 27% lower than the 2005 estimate ($P = 0.002$). Spring estimates have increased an average of 3% per year over the last 10 years ($P = 0.222$). The 2006 survey estimate of singles and pairs was 134,800 (± 18,700), 17% lower than the previous

year ($P = 0.063$). Estimates of these population components have increased an average of 2% per year during 1997-2006 ($P = 0.113$). The estimated number of productive geese in 2006 was similar to 2005. Mild April temperatures and low winter snowfall in 2006 led to an early nesting chronology throughout the EPP range. In 2006, biologists on Cape Churchill observed a median hatch date of 17 June, about 1 week earlier than the long-term average (1976-2005). Nest density in 2006 was the highest recorded since 1990 and mean clutch size (4.1) was above the long-term average. Estimates of nest density, clutch size, and nest success indicated production would be better than most recent years, but still slightly below the average value since 1976. Canada goose nest density, clutch size, and nest success indices compiled at Broad River also indicated good production in 2006. A fall flight similar to that of 2005 was expected.

1.3.1.2 Historical Information

1.3.1.2.1 Resident Canada Geese

Initially, management goals for Canada geese involved establishment of local breeding populations throughout the Flyway. Many states in the Flyway worked to reestablish or introduce geese in the beginning of the 20th Century. Birds were often trapped in neighboring states or translocated from captive stock to areas of high quality habitat. Many states stocked Canada geese and by the late 20th century all states in the Flyway had established breeding populations from stocking and natural recruitment. The history of Canada geese in Mississippi is no different; the USFWS began a small scale program in the 1960's to re-establish Canada geese to national wildlife refuges in the state. At the same time, MDWFP also began re-establishing geese to portions of Mississippi. From 1985-1995, approximately 20,000 geese were imported from other states and released throughout Mississippi in hopes of establishing a breeding population. In 1987, MDWFP set a goal to establish a state population of 15,000 Canada geese. In 1995, the MDWFP Canada goose translocation program was terminated and annual recruitment from established flocks was believed to be sufficient to meet target goals (Mississippi Flyway Council Technical Section 1996). Maintenance of the population is established by hunting laws/seasons and nuisance waterfowl removal from specified areas. Mississippi continued importing birds until 1995, and until recently used nuisance birds captured within the State for stocking purposes. Currently, a Canada goose season is offered in all 82 counties. Canada geese increased at astounding rates in Mississippi, tripling between 1995 (9,000 bird estimate) and 2006 (28,500 bird estimate). The estimated 2004 Canada goose harvest for Mississippi was determined to be approximately 8,700 birds, with 43.7% (3,800 birds) taken during the special September season. This is a significant increase from the 2003 harvest where only 2,000 birds were taken during the entire season (USFWS 2005b). In 2005, harvest of Canada geese dropped to only 2,900 birds, with 69.8% (2,000 birds) of those geese taken during the special September season which targets resident birds (USFWS 2006b).

Canada geese have adapted so well in some urban and suburban areas that they have become problematic and in some situations have become a health and safety risk. In 2001, Mississippi set a target goal of approximately 20,000 birds to permit a harvestable population, provide viewing opportunities for the public, and manage human/goose conflicts. The Mississippi statewide resident Canada goose population for 2006 was estimated at approximately 28,500 birds (S. Baker, MDWFP, pers. comm. 2006, USFWS 2007). With the number of resident Canada geese increasing each year, the 2006 population estimate is 43% over that goal. MDWFP currently uses the Canada goose hunting season to manage populations with consideration given to the harassment, capture and lethal control of geese to address damage complaints and threats to human safety.

1.3.1.2.2 Migratory Canada Geese

Historically, giant Canada geese were not believed to migrate as far south as Mississippi, but with the restoration and reestablishment of wild goose populations across North America migratory individuals are now part of the Mississippi ecosystem in winter (Mississippi Flyway Council Technical Section 1996). Low numbers of birds from the EPP, SJBP, and MFGP enter the state for wintering and as a resting area during migration (USFWS 2005a).

1.3.1.3 Canada Goose Harvest in Mississippi

1.3.1.3.1 Resident and Migratory Canada Geese (2004-2006)

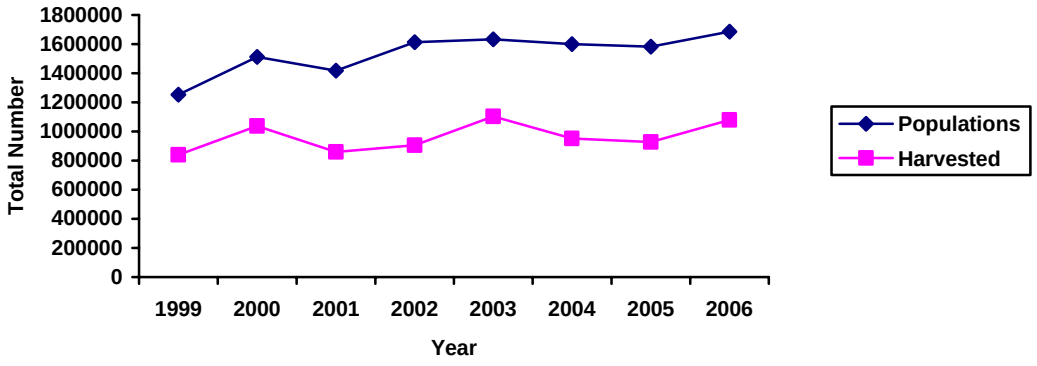
There are two distinct seasons for Canada goose hunting in Mississippi; the early September season and the regular season. The early Canada goose season for all of Mississippi is from September 1 - 15, (5 birds allowed daily, 10 in possession). The regular Canada goose season is from Nov. 14 – Nov. 25 and Dec. 1 - Jan. 27 (3 birds allowed daily, 6 in possession; Table 1).

Table 1. Mississippi Canada Goose Season and Bag Limits for 2007-2008.

Canada Goose	Sept. 1, 2007 - Sept. 15 2007	5 Bag Limit 10 possession Limit
Canada Goose	Nov. 14, 2007 - Nov. 25, 2007 AND Dec. 1, 2007 - Jan. 27, 2008	3 Bag Limit 6 Possession Limit

While these seasons have contributed in targeting harvest of resident geese, additional strategies are needed to effectively manage the resident goose population. Resident geese also avoid hunting mortality through their extensive use of urban and suburban environments. Resident Canada goose harvest rates are not uniform throughout a large area. Harvest rates greater than 25% may occur during special seasons in some rural areas, while geese in urban-suburban areas may experience no harvest at all in some years (Atlantic Flyway Council 1999). In Mississippi, harvest rates have varied during the past 5 years while population trends have increased (USFWS 2006b; see Table 2). Although harvest across the Flyway has ranged from 67% - 91% of the estimated spring populations from 1999-2005, it has had little effect on controlling resident Canada geese populations (Figure 1). Mississippi shows the same trend with a harvest of up to 98% of the spring estimate during 2000. Harvest has dropped to 8%-33% of the spring estimates during 2001- 2006. Those data indicate that harvest may not be an effective control measure for Canada geese in Mississippi. This may be due to the increased use of urbanized areas by the species. Urban-suburban areas often provide exceptional goose habitat and allow geese to remain in "refuges" and avoid peak harvest periods (i.e., weekends). Geese that live near people also often benefit from the availability of food handouts. Urban-suburban geese however, are subjected to herbicides, pesticides, pollution, automobiles, illegal take, pets, and transmission of disease from domestic birds (USFWS 2005a, Adams et al. 2006). Geese living in rural areas are also subject to those same affects, albeit at differing rates. The USFWS decision to allow the extension of the resident goose season (August 1 – August 31) should aid in reducing the resident population but will likely be limited due to the above listed difficulties in managing resident birds through harvest (USFWS 2005a).

Figure 1 - Resident Canada Goose Population Estimates and Geese Harvested in the Mississippi Flyway, 1999-2006[a]



[a]USFWS HIP data, D. Fronczak, USFWS, pers. comm. 2005, USFWS 2005a, USFWS 2006a, Dolbeer and Seubert 2006, USFWS 2007

Table 2. Number of Canada Geese Harvested in Mississippi, Population Estimates, Hunter Estimates, and Hunter Days from 1999 – 2006[a].

Year	Number of Reported Canada Geese Harvested by Hunters	Population Estimate	Goose Hunters	Estimated # of Days Hunting All Geese
1999	14,100	20,000	3,900	19,700
2000	19,562	20,000	6,400	30,400
2001	5,400	20,000	4,600	16,000
2002	3,237	20,000	3,200	14,200
2003	2,045	25,000	4,200	15,500
2004	8,707	26,250	6,500	31,800
2005	2,864	28,500	4,600	17,000
2006	10,026	28,500	6,000	21,400

[a]**USFWS 2005b, USFWS 2006b, D. Fronczak USFWS, pers. comm. 2005, S. Baker, MDWFP, pers. comm. 2006, USFWS 2007**

1.3.2 Canada Goose Damage and Conflicts

The management of goose damage to protect human safety, property, agriculture and natural resources invariably leads to a better quality of life for affected parties. WS is not legislatively mandated to protect quality of life, but it is accomplished, indirectly, as a secondary result of goose damage management practices. The Mississippi WS' program has received a number of reports of damage and requests for assistance concerning Canada geese. From 1993 – 2006, WS in Mississippi conducted a total of 132 technical assistance projects by providing information and putting on demonstrations on how to manage damage and threats to human safety caused by Canada geese. Damages focused on 4 basic resources, which included damage or threats to agriculture, human health and safety, property, and natural resources. The most common resource reportedly damaged in Mississippi by Canada geese has been property (approximately 67% of damage recorded), followed by human safety threats (19% of damage recorded; see Table 3). Requests for assistance with damage to agriculture and natural resources are less frequent. Most nuisance complaints are associated with suburban areas where waterfowl congregate on public or private ponds and forage on lawns and mowed areas associated with parks, beaches, golf courses, schools, business campuses, and residences (Conover 1991, Powell et al. 2003, VerCauteren and Marks 2003). The major problems are associated with the impacts of feces and grazing damage to lawns and other areas (including sidewalks, driveways, swimming pools, beaches). Agricultural losses occur primarily in the fall and winter. Crop damage occurs primarily to winter wheat and soybeans (although 10 different agricultural resources have been recorded as receiving damage).

More recently, the WS program in Mississippi has taken an active role in conducting operational goose management. The primary method used to prevent damage and to reduce damage occurring is corral trapping during the molt (commonly referred to as goose round-ups). Direct control has been conducted in Mississippi since 2003, with a total of 2,871 birds taken using the corral trapping method. Other methods used to manage damage caused by geese include shooting (primarily conducted at airports) and the application of alpha chloralose (Table 4). Other techniques employed by WS to manage goose damage and damage threats include behavior modification through harassment, reduction in feeding of geese, and public education.

Table 3. Summation of WS' Canada Goose Damage Management Technical Assistance Projects for the Fiscal Years of 1993-2006.

Fiscal Year (Oct.1 – Sept 30)	**Related Damage** Ag-Damage to Agriculture HS-Damage to Health and Safety P-Damage to Property NR-Damage to Natural Resources T-Total	**Total** (Total Goose Technical Assistance Projects)
1993	Ag-3; HS-1; P-0; NR-0	4
1994	Ag-0; HS-0; P-0; NR-1	1
1995	Ag-1; HS-1; P-0; NR-0	2
1996	Ag-0; HS-2; P-4; NR-0	6
1997	Ag-0; HS-3; P-6; NR-0	9
1998	Ag-1; HS-0; P-3; NR-0	4
1999	Ag-5; HS-4; P-0; NR-0	9
2000	Ag-0; HS-0; P-3; NR-0	3
2001	Ag-2; HS-0; P-8; NR-0	10
2002	Ag-3; HS-6; P-10; NR-0	19
2003	Ag-1; HS-5; P-20; NR-0	26
2004	Ag-2; HS-3; P-16; NR-0	21
2005	Ag-5; HS-6; P-17; NR-1	29
2006	Ag-1; HS-7; P-10; NR-0	18

Table 4. Total number of Canada Geese Lethally Removed Through WS' Operational Damage Management Assistance Projects for the Fiscal Years of 2003-2006.

Removal Method	Fiscal Year 2003	Fiscal Year 2004	Fiscal Year 2005	Fiscal Year 2006
Corral Trapping	353	48	608	930
Shooting	0	21	24	30
Alpha chloralose	4	0	0	0

1.3.2.1 Threats to Human Safety

Waterfowl may impact human health through the distribution and incubation of various pathogens and through nutrient loading. For instance, a foraging Canada goose defecates between 5.2 and 8.8 times per hour (Bedard and Gauthier 1986). Kear (1963) recorded a maximum fecal deposition rate for Canada geese of 0.39 pounds per day (dry weight). Public swimming beaches, private ponds, and lakes can be affected by goose droppings. There are several pathogens involving waterfowl which may be contracted by humans, however, the risk of infection is believed low (Centers for Disease Control and Prevention (CDC) 1998). Flemming et al. (2001) reviewed the impacts of Canada geese on water quality addressing pathogens and nutrient loading and identified a number of hazards that geese are associated with. The USFWS has documented threats to public health from geese and authorized depredation to reduce this threat in the FEIS (USFWS 2005a).

Cryptosporidiosis is a disease caused by the parasite *Cryptosporidium parvum* and was not known to cause disease in humans until as late as 1976 (CDC 1998). A person can be infected by drinking contaminated water or direct contact with the droppings of infected animals (CDC 1998). The public is advised to be careful when swimming in lakes, ponds, streams, and pools, and to avoid swallowing water while swimming (Colley 1996). The public is also advised to avoid touching stools of animals and to drink only safe water (Colley 1996). *Cryptosporidium* can cause gastrointestinal disorders (Virginia Department of Health 1995) and produce life threatening infections in immunocompromised and immunosuppressed people (Roffe 1987, Graczyk et al. 1998). Cryptosporidiosis is recognized as a disease with implications for human health (Smith et al. 1997). Canada geese in Maryland were shown with molecular techniques to disseminate infectious *Cryptosporidium parvum* oocysts through mechanical means in the environment (Graczyk et al. 1998). Kassa et al. (2001) found that *Cryptosporidium* was the most common infectious

organism found in 77.8% of sample sites comprised primarily of parks and golf courses indicating that occupational exposure to this pathogen is very plausible although the risk to humans is relatively low.

Giardiasis (*Giardia lambia*) is an illness caused by a microscopic parasite that has become recognized as one of the most common causes of waterborne disease in humans in the United States during the last 15 years (CDC 1999). Giardiasis is contracted by swallowing contaminated water or putting anything in your mouth that has touched the stool of an infected animal or person. Symptoms of giardiasis include diarrhea, cramps, and nausea (CDC 1999). Canada geese in Maryland were shown with molecular techniques to disseminate infectious *Giardia* sp. cysts in the environment (Graczyk et al. 1998). Kassa et al. (2001) also found *Giardia* in goose feces at numerous urban sites.

Avian Botulism is produced by the bacteria *Clostridium botulinum* type C which occurs naturally in wild bird populations across North America. Ducks are most often affected by this disease, but it can also affect Canada geese. Avian botulism is the most common disease of waterfowl. Increased numbers of Canada geese using recreational areas increases the risk to the pubic (McLean 2003).

Salmonella (*Salmonella* spp.) may be contracted by humans by handling materials soiled with bird feces (Stroud and Friend 1987). Salmonella causes gastrointestinal illness, including diarrhea.

Chlamydia psittaci, which can be present in diarrhetic feces of infected waterfowl, can be transmitted if it becomes airborne (Locke 1987). Severe cases of Chlamydiosis have occurred among wildlife biologists and others handling snow geese, ducks, and other birds (Wobeser and Brand 1982). Chlamydiosis can be fatal to humans if not treated with antibiotics. Waterfowl, herons, and rock pigeons are the most commonly infected wild birds in North America (Locke 1987).

Campylobacteriosis is an infectious disease caused by bacteria of the genus *Campylobacter*. In persons with compromised immune systems, *Campylobacter* occasionally spreads to the bloodstream and causes a serious life-threatening infection, but normally causes diarrhea and is one of the most common diarrhea illnesses in the United States (CDC 2007). Canada geese have been found to be a carrier of *Campylobacter* and can spread the bacteria in their feces (Kassa et al. 2001).

Escherichia coli (*E. coli*) are fecal coliform bacteria associated with fecal material of warm blooded animals. There are over 200 specific serological types of *E. coli* with the majority of serological types being harmless (Sterritt and Lester 1988). Probably the best known serological type of *E. coli* is *E. coli* O157:H7, which is usually associated with cattle (Gallien and Hartung 1994). Recent research has demonstrated that Canada geese can disseminate *E. coli* into the environment which can elevate fecal coliform densities in the water column (Hussong et al. 1979, Alderisio and DeLuca 1999, Cole et al. 2005). Many communities monitor water quality at swimming beaches and lakes, but lack the financial resources to pinpoint the source of elevated fecal coliform counts. When fecal coliform counts at swimming beaches exceed established standards, the beaches are temporarily closed which can adversely affect the human quality of life, even though they may not have been able to determine the serological type of the *E. coli*. Unfortunately, linking the elevated bacterial counts to frequency of waterfowl use and attributing the elevated levels to human health threats has been problematic until recently. Advances in genetic engineering have allowed microbiologists to match genetic code of coliform bacteria to specific animal species and link these animal sources of coliform bacteria to fecal contamination (Simmons et al. 1995, Jamieson 1998). Simmons et al. (1995) used genetic fingerprinting to link fecal contamination of small ponds on Fisherman Island, Virginia to waterfowl. Microbiologists were able to implicate waterfowl and gulls as the source of fecal coliform bacteria at the Kensico Watershed, a water supply for New York City (Klett et al. 1998, Alderisio and DeLuca 1999). Also, fecal coliform bacteria counts coincided with the number of Canada geese and gulls roosting at the reservoir. Cole et al. (2005) found that geese may serve as a vector of antimicrobial resistance genes, indicating that they not only harbor and spread zoonotic diseases like *E. coli* but may spread strains that are resistant to current control measures.

Roscoe (1999) conducted a survey to estimate the prevalence of pathogenic bacteria and protozoa in resident Canada geese in New Jersey and found no *Salmonella* sp., *Shigella* sp., or *Yersinia* sp. isolated from any of the 500 Canada goose samples. However, he did report finding *Cryptosporidium* sp. in 49

(10%) of the 500 geese, and *Giardia* sp. in 75 (15%) of the geese. Additionally, the United States Geological Survey (USGS) conducted field studies in New Jersey, Virginia, and Massachusetts to determine the presence of organisms that could cause disease in humans exposed to feces of Canada geese at sites with a history of high public use and daily use by geese (USGS 2000). *Salmonella* spp., *Listeria* spp., *Chlamydia* spp., and *Giardia* spp. were isolated from goose feces in New Jersey (USGS 2000).

While transmission of disease or parasites from waterfowl to humans has not been well documented, the potential exists (Luechtefeld et al. 1980, Wobeser and Brand 1982, Hill and Grimes 1984, Pacha et al. 1988, Blandespoor and Reimink 1991, Graczyk et al. 1997, Saltoun et al. 2000). In worst case scenarios, infections may even be life threatening for immunocompromised and immunosuppressed people (Roffe 1987, Graczyk et al. 1998). Even though many people are concerned about disease transmission from feces, the probability of contracting disease from feces is believed to be small. Financial costs related to human health threats involving waterfowl may include testing of water for *coliform* bacteria, cleaning and sanitizing beaches regularly of feces, contacting and obtaining assistance from public health officials, and implementing non-lethal and lethal methods of wildlife damage management. WS recognizes and defers to the authority and expertise of local and state health officials in determining what does or does not constitute a threat to public health.

Other impacts of Canada geese on human health and safety result from the aggressive behavior exhibited by geese during the nesting season. Waterfowl, especially Canada geese, aggressively defend their nests, nesting areas, and young, and may attack or threaten pets, children, and adults (Smith et al. 1999). This is a significant threat because resident Canada geese often nest in high densities at areas used by humans for recreational purposes such as parks, beaches, and sports fields (VerCauteren and Marks 2003). Additionally, slipping hazards can be created by the buildup of feces from waterfowl on docks, walkways, and other foot traffic areas.

1.3.2.2 Threats to Aviation Safety Associated with Canada Geese

Canada geese can also pose a threat to aircraft and passenger safety. Aircraft striking geese can lead to substantial damages to the aircraft and can lead to catastrophic failure of the aircraft which threatens human safety. Generally, bird collisions occur when aircraft are near the ground. From 1990-2000, approximately 56% of reported bird strikes to United States civil aviation occurred when the aircraft was at an altitude of 100 feet above ground level or less. Additionally, 78% occurred less than 900 feet above ground level and about 86% occurred under 2,000 feet above ground level. From 1990-2000, birds were involved in more than 97% of the reported wildlife strikes to civil aircraft in the United States (Cleary et al. 2002, Dolbeer and Seubert 2006).

Bird strikes cause an estimated seven fatalities involving civilian and military aircraft each year (Linnell et al. 1996). For the period 1990-2000, waterfowl (geese and ducks) comprise 11% of all bird-aircraft strikes to civil aviation reported to the Federal Aviation Administration (FAA) for which bird species or group were reported (Cleary et al. 2002). For the period 1990-2000, more than 50% of Canada goose-aircraft strikes resulted in damage to the aircraft, and 28.5% resulted in a negative effect on the flight (Cleary et al. 2002). For example, in 1995, a Boeing 707 E38 AWACS jet taking off from Elmendorf Air Force Base in Alaska ingested at least 13 geese into the number 1 and 2 engines and crashed, killing all 24 crew members. The Canada goose is the largest bird (8-15 pounds) that is commonly struck by aircraft, and nationally, this species was responsible for a disproportionately large amount of damage to civil aircraft involved in strikes with wildlife during 1990-1999 (Cleary et al. 2000). Nationally, the resident Canada goose population probably represents the single most serious bird threat to aircraft safety at this time (Alge 1999, Suebert and Dolbeer 2004, Dolbeer and Seubert 2006). From 1990-2006 over 472 bird strikes were reported to the FAA in Mississippi, with 2 strikes involving Canada geese (FAA 2007). The number of bird strikes actually occurring is likely to be much greater, since it is estimated that only 20-25% of all bird strikes are reported (Conover et al. 1995, Dolbeer et al. 1995, Linnell et al. 1996, Linnell et al. 1999, Cleary et al. 2000). Additionally, many of the strikes that have been reported in Mississippi are of unknown species (FAA 2007).

Resident Canada geese are of particular concern to aviation because of their 1) large size (typically 8-15 lbs which exceeds the 4-lb bird certification standard for engines and airframes), 2) flocking behavior which increases the likelihood of multiple bird strikes, 3) attraction to airports for grazing, and 4) year-around presence in urban environments near airports (Seubert and Dolbeer 2004). From 1990-2006 approximately 1,005 Canada goose strikes were reported to the FAA in the United States. Canada geese represent 5% of all reported civilian aircraft strikes in the United States (Seubert and Dolbeer 2004). The United States Air Force (USAF) reports that Canada geese have caused over $85 million in damage and have been involved in 129 strikes since the beginning of their recording period through June 2007. Although Canada geese are ranked at a relatively low strike rate, they are the third most costly when strikes occur, averaging over $700,000 per strike (USAF 2007).

WS receives requests for assistance regarding bird damage management at airports and military airbases in Mississippi. These requests are considered serious because of the potential for loss of human life and because damage to aircraft can be extremely costly. With the implementation of a damage management program using an adaptive integrated approach in Mississippi, WS could provide direct management and technical assistance at the request of any aviation facility in the State. The USFWS has also determined a significant threat exists to aviation and has authorized the take of birds at airports as outlined in the Canada goose management FEIS (USFWS 2005a).

1.3.2.3 Need to Protect Property from Canada Goose Damage

Geese may cause damage to aircraft, landscaping, piers, yards, boats, beaches, shorelines, parks, golf courses, driveways, athletic fields, ponds, lakes, rafts, porches, patios, gardens, foot paths, swimming pools, play grounds, school grounds, and cemeteries. Damage reported through technical assistance generally is not verified by field investigation by WS. The majority of people that contact WS for assistance describe a general decline in their quality of life due to local overabundance of geese. In many cases, people are unable to use and enjoy their own property, public parks, and other areas because of goose feces. Costs associated with property damage include labor and disinfectants to clean and sanitize the area, loss of property use and resale value, loss of aesthetic value of plants, gardens, aquatic vegetation, and lawns where geese feed and loaf, loss of customers or visitors irritated by having to walk on feces, loss of time contacting wildlife management agencies on health and safety issues and damage management advice, and implementation of non-lethal and lethal wildlife management methods. The costs of reestablishing overgrazed lawns and cleaning waterfowl feces from sidewalks has been estimated at more than $60 per bird (Conover 1991, Allan et at. 1995).

1.3.2.4 Need to Protect Agricultural Resources from Canada Goose Damage

Damage caused by geese to agricultural resources occurs primarily from consumption of crops, through grazing (loss of the crop and revenue), but also consists of unacceptable accumulations of feces on horse pastures, trampling of wheat, and increased erosion and runoff from fields where the cover crop has been grazed. Canada geese graze on a variety of crops, including alfalfa, barley, beans, corn, soybeans, wheat, rye, rice, oats, spinach, and peanuts (Atlantic Flyway Council 1999, Nichols 2003, USFWS 2005a, Haramis and Kearns 2006). A single intense grazing event by Canada geese in the fall, winter or spring can reduce the yield of winter wheat by 16-30% (Fledger et al. 1987), and reduce growth of rye plants by >40% (Conover 1988). However, some have reported that grazing by geese during the winter may increase rye or wheat seed yields (Clark and Jarvis 1978, Allen et al. 1985). Canada geese were found to significantly impact wild rice (*Zizania aquatica*) by grazing, and considerable reduction in the local goose population produced recovery of rice and other vegetation (Haramis and Kearns 2006). The USFWS has also documented a need to protect agriculture from non-migratory Canada geese and authorized the take of geese for crop protection outlined in the USFWS Canada goose management FEIS (USFWS 2005a)

1.3.2.5 Need to Protect Natural Resources from Canada Goose Damage

Soil erosion and sedimentation can cause damage to natural resources. Excessive numbers of waterfowl can cause damage to natural vegetation and remove bank vegetation resulting in erosion of the shoreline and soil sediments being carried by rainwater into lakes, ponds, and reservoirs. Overabundant resident

Canada geese can negatively impact crops and habitats that are maintained as food and cover for migrant waterfowl and other wildlife.

Nutrient loading has been found to increase in wetlands in proportion to increases in the numbers of roosting geese (Manny et al. 1994, Kitchell et al. 1999). In studying the relationship between bird density and phosphorus (P) and nitrogen (N) levels in Bosque Del Apache National Wildlife Refuge in New Mexico, Kitchell et al. (1999) found an increase in the concentration of both P and N correlated with an increase in bird density. Scherer et al. (undated) stated that waterfowl metabolize food very rapidly and most of the phosphorus contributed by bird feces probably originates from sources within the lake being studied. In addition, assimilation and defecation converted the phosphorus into a more soluble form and therefore was considered a form of internal loading. Waterfowl have contributed substantial amounts of P and N into lakes through feces creating excessive aquatic macrophyte growth and algae blooms (Scherer et al. undated) and accelerated eutrophication through nutrient loading (Harris et al. 1981).

Waterfowl are considered by the American Association of Wildlife Veterinarians (AAWV) as susceptible to and carriers of disease and parasites. Because of the potential threat to free-ranging waterfowl, the AAWV put forth the following resolution (AAWV, undated):

...wild and semi-domestic ducks, geese and swans are susceptible to and carriers of disease and parasites of free-ranging wild ducks, geese, and other birds;..."

...the AAWV encourages local authorities and state and federal agencies to cooperate to limit the population of waterfowl on urban water areas to prevent disease outbreaks in semi-domestic as well as free ranging ducks, geese and swans and discourages the practice of relocating nuisance or excess urban ducks, geese and swans to other parks or wildlife areas as a means of local population control."

1.4 SUMMARY OF PROPOSED ACTION

The proposed action is for WS to continue to implement an adaptive IWDM program that responds to requests for goose damage management to protect property, agricultural resources, natural resources, human health and human safety in Mississippi. Requests for assistance may occur anywhere and anytime within the state. An IWDM approach would be implemented which would allow the use of legal techniques and methods, used singly or in combination, to meet requester needs for reducing conflicts with Canada geese (see Appendix B). Cooperators requesting assistance would be provided with information regarding the use of effective non-lethal and lethal techniques. Non-lethal methods recommended and used by WS may include resource management, physical exclusion, relocation, and deterrents (see Appendix B). Lethal methods recommended and used by WS may include nest destruction, egg addling, live capture and euthanasia, and/or shooting (see Appendix B). In many situations, the implementation of non-lethal methods such as manipulation of habitat, application of repellents, and installation of fencing, flagging, and exclusion devices would be conducted by the requestor. Canada goose damage management assistance would be conducted by WS in Mississippi, when requested, on private and public property, facilities, and residential buildings where a need exists and pursuant to a Cooperative Service Agreement.

The proposed program conducted by WS in Mississippi would continue to be conducted pursuant to applicable laws and regulations authorizing take of Canada geese and their nest and eggs, developed through partnerships among WS, the USFWS, and the MDWFP, and as requested by and through coordination with requesters of assistance. All management actions would comply with appropriate federal, state, and local laws.

1.5 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

1.5.1 WS' Programmatic FEIS

WS prepared a FEIS that addresses the potential impacts of WS' programmatic activities on the quality of the human environment through the scoping and analyses of issues and alternatives (USDA 1997). Information in WS' programmatic FEIS has been incorporated by reference into this EA.

1.5.2 USFWS Resident Canada Goose Management FEIS

The USFWS has issued a FEIS addressing the need for and potential environmental impacts associated with goose damage management activities entitled "*Resident Canada Goose Management*" (USFWS 2005a). This EA is tiered to the FEIS with pertinent and current information available in the FEIS incorporated by reference into this document. The FEIS also contains detailed analyses of the issues and methods used to manage Canada goose damage. A Record of Decision (ROD) and Final Rule were published by the USFWS on August 10, 2006 (Federal Register Vol. 71, No. 154: 45964- 45993). On June 27, 2007, WS issued a ROD and adopted the USFWS FEIS (Federal Register Vol. 72, No. 123: 35217). Information in USFWS (2005a) has been incorporated by reference into this EA.

1.6 DECISIONS TO BE MADE

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

- Should WS implement a resident Canada goose damage management program in Mississippi?
- If not, how should WS fulfill its responsibilities for managing damage and conflicts associated with resident Canada geese in Mississippi?
- Might the proposed WS' program have significant impacts requiring preparation of an Environmental Impact Statement (EIS)?

1.7 SCOPE OF THIS EA

1.7.1 Actions Analyzed

This EA evaluates resident Canada goose damage management by WS to protect human safety, property, natural resources, and agriculture on private and public lands statewide, whenever such management is requested of the WS' program.

1.7.2 Native American Lands and Tribes

The WS program in Mississippi currently has an MOU with the Mississippi Band of Choctaw Indians to assist in planning and coordinating any wildlife damage management conducted on property they own or manage. This MOU does not directly refer to goose damage management; however, a request for assistance to manage damage caused by geese is possible. All goose damage management activities conducted on tribal lands will be pursuant to tribal laws and regulations.

1.7.3 Period for which this EA is Valid

This EA will remain valid until WS determines that new needs for action, changed conditions or new alternatives that have different environmental effects must be analyzed. At that time, this analysis and document will be reviewed and supplemented pursuant to NEPA. This EA will be reviewed each year to ensure that it is complete and still appropriate to the scope of WS' goose damage management activities.

1.7.4 Site Specificity

This EA analyzes the potential impacts of WS' goose damage management activities and addresses activities on all lands in Mississippi covered under a MOU, a Cooperative Service Agreement, or another comparable service agreement. All activities will be conducted in cooperation with the appropriate public land management agencies. This EA also addresses the impacts of resident Canada goose damage management activities on areas where additional agreements may be signed in the future. Because the proposed action is to reduce damage and because the program's goals and directives are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional goose damage management efforts could occur. Thus, this EA anticipates this potential expansion and analyzes the impacts of such efforts as part of the program.

Planning for the management of resident Canada goose damage must be viewed as being conceptually similar to federal or other agency actions whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they will occur are unknown but could be anywhere in a defined geographic area. Examples of such agencies and programs include fire departments, police departments, emergency clean-up organizations, and insurance companies. Although some of the sites where Canada goose damage will occur can be predicted, all specific locations or times where such damage will occur in any given year cannot be predicted. This EA emphasizes major issues as they relate to specific areas whenever possible, however, many issues apply wherever goose damage and resulting management occurs, and are treated as such. The standard WS' Decision Model (Slate et al. 1992) would be the site-specific procedure for individual actions conducted by WS in Mississippi (see Chapter 3 for a description of the Decision Model and its application).

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

1.7.5 Public Involvement and Notification

Issues related to the goose damage management program were initially developed by WS. Issues were defined and preliminary alternatives were identified for the EA based on the issues and alternatives addressed in WS' programmatic FEIS. As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS NEPA implementing regulations, this document is being noticed to the public through legal notices published in local media, through direct mailings to parties that have requested to be notified or have been identified to have an interest in the reduction of threats and damage caused by geese in Mississippi, and by posting the EA on the APHIS website at http://www.aphis.usda.gov/wildlife_damage/nepa.shtml.

WS will provide for 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. New issues or alternatives raised after publication of public notices will be fully considered to determine whether the EA should be revisited and, if appropriate, revised prior to issuance of a final Decision. New issues or alternatives identified from the public involvement process will be fully considered prior to WS reaching a Decision.

1.8 AUTHORITY AND COMPLIANCE

1.8.1 Authority of Federal and State Agencies in Resident Canada Goose Damage Management in Mississippi

See Chapter 1 of WS' programmatic FEIS (USDA 1997) for a complete discussion of federal laws pertaining to WS.

1.8.1.1 WS' Legislative Authority

The primary statutory authorities for the WS' program are the Act of March 2, 1931 (46 Stat. 1468; 7 USC 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 USC 426c). WS' mission is to provide leadership in managing damage to agricultural resources, natural resources, property, and to reduce threats to human safety caused by wildlife when requested.

1.8.1.2 U.S. Fish and Wildlife Service

The USFWS is responsible for managing and regulating take of bird species that are listed as migratory under the MBTA and those that are listed as threatened or endangered under the ESA. Under the permitting application process, the USFWS requires applicants to describe, prior non-lethal damage management, techniques that have been used.

The USFWS authority for action is based on the MBTA of 1918 (as amended), which implements treaties with the United States, Great Britain (for Canada), the United Mexican States, Japan, and the Soviet Union.

1.8.1.3 Mississippi Department of Wildlife, Fisheries, and Parks

The Mississippi Department of Wildlife, Fisheries, and Parks authority in wildlife management is given within the Mississippi Code Annotated Section 49-1-1 et seq., the official regulations of the Commission of Wildlife, Fisheries and Parks and applicable federal laws. This legislation covers general provisions; licenses, permits and stamps; wildlife; fish; and wild animals.

1.8.1.4 Mississippi Department of Agriculture and Commerce (MDAC)

The Pesticide Program of MDAC enforces state laws pertaining to the use and application of pesticides. Under the Mississippi Pesticide Application Act (Sections 69-23-101 through 69-23-133) 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 Mississippi Pesticide Law (Section 69-23-1 through 69-23-27) the program licenses restricted use pesticide dealers and registers all pesticides for sale and distribution in the state of Mississippi. Currently, only alpha chloralose is registered with MDAC for management of Canada geese in Mississippi.

1.8.2 Compliance with Other Federal Laws

Several other federal laws authorize, regulate, or otherwise affect WS' damage management activities. WS complies with these laws, and consults and cooperates with other agencies as appropriate.

1.8.2.1 National Environmental Policy Act

The NEPA was signed into law on January 1, 1970. NEPA requires federal agencies to incorporate environmental planning into federal agency actions and decision-making processes. The two primary objectives of NEPA are: 1) agencies must have available and fully consider detailed information regarding environmental effects of federal actions and 2) agencies must make information regarding environmental effects available to interested persons and agencies before decisions are made and before actions are taken.

This EA will assist WS and cooperating agencies in determining whether potential environmental impacts caused by a proposed action might be significant, requiring the preparation of an EIS. The development of this EA documents the incorporation of environmental planning into the actions and decision-making process to ensure compliance with NEPA requirement for the proposed action in Mississippi. When WS' direct management assistance is requested by another federal agency, NEPA compliance is the responsibility of the requesting federal agency. However, WS could agree to complete NEPA documentation at the request of the requesting federal agency.

1.8.2.2 Endangered Species Act

It is federal policy, under the ESA, that all federal agencies shall seek to conserve threatened and endangered species and shall utilize their authorities in furtherance of the purposes of the Act (Sec.2(c)). WS conducts Section 7 consultations with the USFWS to ensure that "*any action authorized, funded or carried out by such an agency . . . is not likely to jeopardize the continued existence of any endangered or threatened species . . . Each agency shall use the best scientific and commercial data available*" (Sec.7(a)(2)). WS obtained a Biological Opinion (BO) from the USFWS describing potential effects on threatened and endangered (T&E) species and prescribing reasonable and prudent measures for avoiding jeopardy on WS' programmatic activities (USDA 1997, Appendix F).

1.8.2.3 Migratory Bird Treaty Act of 1918, as amended

The MBTA (USC 703711: 40 Stat. 755) provides USFWS regulatory authority to protect families of bird species that migrate outside the United States. The law prohibits the "*take*" of these species by any entity,

unless permitted by USFWS; people can obtain permits to take migratory birds under this law that are causing damage to resources.

WS provides on-site assessments for persons experiencing migratory bird damage to obtain information on which to base damage management recommendations. Damage management recommendations could be in the form of technical assistance or operational assistance. In severe cases of migratory bird damage, WS provides recommendations to the USFWS for the issuance of depredation permits to private entities or other agencies. The ultimate responsibility for issuing such permits rests with the USFWS.

WS will obtain MBTA permits covering goose damage management activities that involve the taking of species for which such permits are required in accordance with the MBTA and USFWS regulations, or will operate as a named agent on MBTA permits obtained by cooperators.

The Migratory Bird Treaty Reform Act of 2004 was passed to clarify the original intent of the MBTA, the conservation and protection of migratory birds native to North America, and directed USFWS to establish a list of non-native bird species found in the United States. Species on this list will not be afforded MBTA protection. Certain bird species in North America are not protected under the MBTA because neither the species nor their Family group was listed in the MBTA. All actions conducted in this EA will be in compliance with the regulations of the MBTA, as amended.

1.8.2.4 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The U.S. Environmental Protection Agency (EPA) is responsible for implementing and enforcing FIFRA. All chemical methods integrated into the WS' program in Mississippi are registered with and regulated by the EPA and Mississippi Department of Agriculture and Commerce, and used by WS in compliance with labeling procedures and requirements. No toxicants are currently used or registered for use in managing goose damage. There are several repellents that are registered for use in reducing goose damage to turf in Mississippi. Currently, ReJeX-iT^{TM} (methyl anthranilate), AG-36^{TM} and FlightControl^{TM} (Antraquinone) are registered as repellents in Mississippi.

1.8.2.5 Investigational New Animal Drug

The Food and Drug Administration (FDA) grants permission to use investigational new animal drugs [21 Code of Federal Regulations (CFR), Part 511]. The sedative drug alpha-chloralose is registered with the Food and Drug Administration to capture waterfowl, coots, and pigeons. The use of alpha-chloralose by WS was authorized by the FDA through approval under the Investigational New Animal Drug which allows use of the drug as a non-lethal form of capture. Alpha-chloralose as a method for resolving bird damage and threats to human safety are discussed in Appendix B of the EA.

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

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

Each of the Canada goose damage management methods described in Appendix B that might be used operationally by WS do not cause major ground disturbance, do not cause any physical destruction or damage to property, do not cause any alterations of property, wildlife habitat, or landscapes, and do not involve the sale, lease, or transfer of ownership of any property. In general, such methods also do not have the potential to introduce visual, atmospheric, or audible elements to areas in which they are used that could result in effects on the character or use of historic properties. Therefore, the methods that would be used by WS under the proposed action are not generally the types of activities that would have the potential to

affect historic properties. If an individual activity with the potential to affect historic resources is planned under an alternative selected as a result of a decision on this EA, then site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

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

1.8.2.7 Coastal Zone Management Act of 1972, as amended (16 USC 1451-1464, Chapter 33; P.L. 92-583, October 27, 1972; 86 Stat. 1280).

This law established a voluntary national program within the Department of Commerce to encourage coastal states to develop and implement coastal zone management plans. Funds were authorized for cost-sharing grants to states to develop their programs. Subsequent to federal approval of their plans, grants would be awarded for implementation purposes. In order to be eligible for federal approval, each state's plan was required to define boundaries of the coastal zone, 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 actions be conducted in a manner consistent with the federally approved plan. The standard for determining consistency varied depending on whether the federal action involved a permit, license, financial assistance, or a federally authorized activity. As appropriate, a consistency determination would be conducted by WS to assure management actions would be consistent with the State's Coastal Zone Management Program.

1.8.2.8 Executive Order 12898 - Environmental Justice

Executive Order 12898, promotes the fair treatment of people of all races, income levels and cultures with respect to the development, implementation and enforcement of environmental laws, regulations and policies. Environmental justice is the pursuit of equal justice and protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. Environmental Justice is a priority within APHIS and WS. Executive Order 12898 requires federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of federal programs, policies and activities on minority and low-income persons or populations. APHIS implements Executive Order 12898 principally through its compliance with NEPA. All WS' activities are evaluated for their impact on the human environment and compliance with Executive Order 12898.

WS personnel use only legal, effective, and environmentally safe wildlife damage management methods, tools, and approaches. All chemicals used by WS are regulated by the EPA through FIFRA, the Mississippi Department of Agriculture, by MOUs with land managing agencies, and by WS' Directives. Based on a thorough Risk Assessment, APHIS concluded that when the WS' program uses chemicals according to label directions, they are selective to target individuals or populations, and such use has negligible impacts on the environment (USDA 1997, Appendix P). The WS' operational program properly disposes of any excess solid or hazardous waste. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations. In contrast, the proposed action may benefit minority or low-income populations by reducing damage such as threats to public health and safety. Additionally, the donation of processed goose meat products at no cost to food shelf operations within Mississippi would be a benefit to low income families or populations.

1.8.2.9 Executive Order 13045 - Protection of Children from Environmental Risks

Children may suffer disproportionately from environmental health and safety risks, including the development of their physical and mental status. Because WS makes it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children, WS has considered the impacts that this proposed action might have on children. The proposed Canada goose damage management program would occur by using only legally available and approved methods where it is highly unlikely that children would be adversely affected. For these reasons, WS concludes that it would not create an environmental health or safety risk to children from implementing this proposed action. Additionally, since the proposed Canada goose damage management program is directed at reducing accumulations of feces, waterfowl aggression, and denuding of landscaped vegetation at schools, public parks, playgrounds, private properties and other locations where children are sometimes present, it is expected that health and safety risks to children associated with geese would be reduced.

1.8.2.10 Executive Order 13186 - Migratory Birds

Executive Order 13186 requires each Federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations, is directed to develop and implement, a MOU with the USFWS that shall promote the conservation of migratory bird populations. WS has developed a draft MOU with the USFWS as required by this Order and is currently waiting for USFWS approval. WS will abide by the MOU once it is finalized and signed by both parties.

1.8.2.11 Native American Graves and Repatriation Act of 1990

The Native American Graves Protection and Repatriation Act requires federal agencies to notify the Secretary of the Department that manages the federal lands upon the discovery of Native American cultural items on federal or tribal lands. Federal projects would discontinue work until a reasonable effort has been made to protect the items and the proper authority has been notified.

1.8.2.12 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 birds that may cause safety and health concerns at workplaces.

CHAPTER 2: AFFECTED ENVIRONMENT AND ISSUES

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

Issues are concerns of the public and/or professional community about potential environmental problems that might occur from a proposed action. Such issues must be considered in the NEPA decision process. Issues relating to the reduction of wildlife damage were raised during the scoping process for WS' programmatic FEIS (USDA 1997) and were considered in the preparation of this EA. These issues are fully evaluated within WS' FEIS which analyzed specific data relevant to the WS' program. Further issues related to goose damage management were addressed in the USFWS Canada goose management FEIS (USFWS 2005a).

2.1 AFFECTED ENVIRONMENT

The areas of the proposed action include, but are not limited to, property on or adjacent to airports, golf courses, athletic fields, recreational areas, swimming beaches, parks, corporate complexes, subdivisions, businesses, industrial parks, schools, agricultural areas, wetlands, restoration sites, and cemeteries. The proposed action may be conducted on properties held in private, local, state or federal ownership. Goose damage management would be conducted when requested by a landowner or manager and only on properties where a cooperative service agreement, work plan or other comparable document is in place.

2.1.1 Environmental Status Quo

As defined by NEPA implementing regulations, the "*human environment* shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment" (40 CFR 1508.14). Therefore, when a federal agency analyzes its potential impacts on the "human environment," it is reasonable for that agency to compare not only the effects of the federal action, but also the potential impacts that occur or will occur in the absence of the federal action by a non-federal entity. This concept is applicable to situations involving federal assistance to reduce damage associated with wildlife species.

Wildlife species, such as most native species are protected under state or federal law. When a non-federal entity (*i.e*., agricultural agencies, health agencies, municipalities, counties, private companies, individuals, or any other non-federal entity) has obtain the appropriate federal and/or state permit and takes a management action, the action is not subject to NEPA compliance due to the lack of federal involvement[5] in the action. Under such circumstances, the environmental *baseline* or *status quo* must be viewed as an environment that includes those resources *as they are managed or impacted by non-federal entities in the absence of the federal action being proposed*. Therefore, in those situations in which a non-federal entity has decided that a management action directed towards a state or federally protected wildlife species will occur and even the particular methods that will be used, WS' involvement in the action will not affect the *environmental status quo* if the requestor would have conducted the action in the absence of WS' involvement since most methods for resolving damage are available to both WS and to other entities. WS' decision-making ability is restricted to one of two alternatives - either taking the action using the specific methods as decided upon by the non-federal entity, or taking no action at which point the non-federal entity will take the action anyway. Under these circumstances, WS would have virtually no ability to affect the *environmental status quo.*

Therefore, based on the discussion above, it is clear that in those situations where a non-federal entity has obtained the appropriate permit or authority, and has already made the decision to remove or otherwise manage Canada geese to stop damage with or without WS' assistance, WS' participation in carrying out the action will not affect the *environmental status quo*. In some situations, however, certain aspects of the human environment may actually benefit more from WS' involvement than from a decision not to assist. For example, if a

[5] If a federal permit is required to conduct damage management activities, the issuing federal agency would be responsible for compliance with NEPA for issuing the permit.

cooperator believes WS has greater expertise to selectively remove a target species than a non-WS entity; WS' management activities may have less of an impact on target and non-target species than if the non-federal entity conducted the action alone. Thus, in those situations, WS' involvement may actually have a *beneficial* effect on the human environment when compared to the *environmental status quo* in the absence of such involvement.

2.2 ISSUES ADDRESSED IN THE ANALYSIS OF ALTERNATIVES

Issues relevant to the management of damage and reducing threats to human safety caused by geese have been identified through WS' programmatic FEIS as areas of concern based the alternatives, including the proposed action, requiring consideration in this EA. In addition, issues were also identified and addressed in the USFWS Canada goose management FEIS. The issues as related to the possible implementation of the alternatives, including the proposed action, are discussed in detail in Chapter 4. The issues analyzed in detail in the EA are summarized below:

2.2.1 Effects on Canada Goose Populations

A common issue when addressing damage caused by wildlife are the potential impacts of management actions on the population of a species. Methods used to resolve damage or threats to human safety can involve altering the behavior of target species and may require the use of lethal methods when appropriate. Under the proposed action, WS would incorporate non-lethal and lethal methods described in Appendix B in an integrated approach in which all or a combination of methods may be employed to resolve a request for assistance. WS would recommend both non-lethal and lethal methods to interested individuals, as governed by federal, state, and local laws and regulations. Non-lethal methods can disperse or otherwise make an area unattractive to target species causing damage thereby, reducing the presence of those species at the site and potentially the immediate area around the site where non-lethal methods are employed.

Lethal methods available for use under this alternative are described in Appendix B. Lethal methods would be employed to remove an individual or those individuals responsible for causing damage or threats to human safety. The use of lethal methods would therefore result in local population reductions in the area where damage or threats were occurring. The number of target species removed from the population using lethal methods under this alternative would be dependent on the number of requests for assistance received, the number of individuals involved with the associated damage or threat, and the efficacy of methods employed.

WS' proposed action incorporates an adaptive IWDM approach to resolve damage and reduce threats to human safety by targeting individual geese or groups of geese using non-lethal and lethal methods after applying the WS' Decision Model (Slate et al. 1992) to identify possible techniques. Lethal methods may be used to reinforce non-lethal methods to reduce damage to a level that is more acceptable to the requester. The effects on the Canada goose population in Mississippi from implementation of the identified alternatives, including the proposed action, are analyzed in Chapter 4.

2.2.2 Effectiveness of Damage Management Methods

The effectiveness of any damage management program could be defined in terms of losses or risks potentially reduced or prevented, how accurately practioners diagnosis the problem, the species responsible for the damage, and how actions are implemented to correct or mitigate risks or damages. To determine that effectiveness, WS must be able to complete management actions expeditiously to minimize harm to non-target animals and the environment, while at the same time, using methods as humanely as possible within the limitations of current technology, funding, and workforce. The most effective approach to resolving any damage problem is to use an adaptive integrated approach which may call for the use of several management methods simultaneously or sequentially (USDA 1997, Courchamp et al. 2003).

The purpose behind integrated management is to implement methods in the most effective manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment[6]. Efficacy is based on the types of methods employed, the application of the method, restrictions on the use of the

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

method(s), the skill of the personnel using the method and, for WS' personnel, the guidance provided by WS' Directives and policies.

The goal of the WS' program is to reduce damage, risks, and conflicts with wildlife as requested. WS recognizes that localized population reduction could be short-term and that new individuals may immigrate, be released at the site, or be born to animals remaining at the site (Courchamp et al. 2003). The ability of an animal population to sustain a certain level of removal and to eventually return to pre-management levels, however, does not mean individual management actions are unsuccessful, but that periodic management may be necessary. Even though a reduction in local populations may not last, timed properly, the management result can last long enough for the protected resources to reach a size or level of maturity where risk of damage is lessened.

2.2.3 Affects on Aesthetic Values

Aesthetics is the philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetic values are subjective, and depend on what an observer regards as beautiful. These values are personal and vary between individuals.

Generally, wildlife is regarded as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987), and the mere knowledge that wildlife exists is a positive benefit for many people. However, wildlife also may be responsible for adverse affects to people. Wildlife activities sometimes result in economic losses to agriculture and property damage. Wildlife collisions with aircrafts and automobiles, aggressive waterfowl behavior, and wild animals that may harbor diseases transmissible to humans also jeopardize human safety (Conover 2001).

Wildlife populations provide a range of social and economic benefits (Decker and Goff 1987). These include direct benefits related to consumptive and non-consumptive use (e.g., wildlife related recreation, observation, harvest, sale), indirect benefits derived from vicarious wildlife related experiences (e.g., reading, television viewing), and the personal enjoyment of knowing wildlife exists and is a part of the stability of natural ecosystems (e.g., ecological, existence, bequest values) (Bishop 1987). Indirect benefits come in two forms: bequest and pure existence (Decker and Goff 1987). Bequest is providing for future generations and pure existence is the knowledge that the animals exist (Decker and Goff 1987). Positive values of wildlife would also include having an abundance of wildlife to view. However, the same wildlife populations that are generally appreciated may also create conflicts with land uses and human health and safety. In certain settings, some species of wildlife can be regarded as a nuisance. Large numbers of waterfowl can reduce the aesthetic appearance and enjoyment of some activities and locations because of an excessive accumulation of feces, through aggression associated with human injury, denuding vegetation, removing vegetation that leads to erosion of stream banks, and disrupting vehicle traffic. Aesthetics include those values people place on waterfowl, knowledge of their existence and roles in local ecosystems, ability to enjoy and use properties for their intended purpose without an excessive feces accumulation, and ability to enjoy the natural and landscaped vegetation of an area.

Public reaction varies among people and social groups because of the numerous philosophical, aesthetic, personal attitudes, values, and opinions concerning the reduction of conflicts/problems between humans and wildlife. Population management methods (egg destruction, capture and relocation, capture and euthanize, and shooting) may provide relief from damage in certain situations where non-lethal methods were ineffective or impractical. Many people directly affected by damage to property and threats to human safety caused by geese choose to remove birds from their property when the WAC has been exceeded. Some people believe that geese should be captured and relocated to another area to alleviate damage or threats to human safety. Some people directly affected by the damage from geese sometimes oppose removal of the birds regardless of the amount of damage. Individuals not directly affected by the harm or damage may be supportive, neutral, or totally opposed to removal of Canada geese from specific locations or sites. Some of the people totally opposed to damage management want WS to teach tolerance for goose damage and threats to human health and safety, and those geese should never be removed from their local ecosystem. Some of the people who oppose removal of geese do so because of human affectionate bonds with individual birds. These human affectionate bonds are similar to attitudes of a pet owner and result in aesthetic enjoyment of the particular species.

Some wildlife habituates easily and lives in close proximity to humans. Some people in these situations feed wildlife and/or otherwise develop emotional attitudes toward the animals that result in aesthetic enjoyment. In addition, some people consider individual wild birds as "pets", or exhibit affection toward these animals. Examples would be people who visit a city park to feed waterfowl and homeowners who have bird feeders or bird houses. Many people do not develop emotional bonds with individual species, but experience aesthetic enjoyment from observing them.

Some property owners that have populations of waterfowl above their identified WAC are concerned about the negative aesthetic appearance of feces and property damage to landscaping and turf. Managers of golf courses, swimming beaches and athletic fields are particularly concerned because negative aesthetics can result in reduced public use.

The WS program in Mississippi only conducts wildlife damage management at the request of the affected property owner or resource manager. If WS received requests from an individual or official for Canada goose damage management, WS would address the issues/concerns and consideration would be made to explain the reasons why the individual damage management actions would be necessary. Management actions would be carried out in a caring, humane, and professional manner.

2.2.4 Humaneness and Animal Welfare Concerns of Methods used by WS

Humaneness, in part, is a person's perception of harm or pain inflicted on an animal. People may perceive the humaneness of each action differently. For example, one may view a certain action as a demeaning method that initially harms the animal and the environment of which it coexist. On the parallel, one may view the same action as resolution that best alleviates the problem.

Research indicates that the public may be willing to accept lethal wildlife management methods if they are humane (i.e., minimize pain and suffering of the target animal) (Kellert 1993, Schwartz et al. 1997). The issue of humaneness and animal welfare, as it relates to the killing or capturing of wildlife is an important and complex concept. Wildlife 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*" (Schmidt 1989). Suffering is described as a "*. . . highly unpleasant emotional response usually associated with pain and distress*", however, suffering "*. . . can occur without pain . . .* ," and "*. . . pain can occur without suffering . . .*" (American Veterinary Medical Association (AVMA) 1987). Because suffering carries with it the implication of a time frame, suffering is considered to be minimized where death is immediate (CDFG 1991).

Defining pain as a component in humaneness of WS' methods is a greater challenge than that of suffering. Pain occurs in animals. Altered physiology and behavior can be indicators of pain, and the causes that elicit pain responses in humans would "*. . . probably be causes for pain in other animals . . .*" (AVMA 1987). Pain experienced by individual animals probably ranges from little or no pain to significant pain (CDFG 1991). One challenge with coping with this issue is how to achieve the least amount of animal suffering within the constraints of current technology and resources. Additionally, "*. . . neither medical or veterinary curricula explicitly address suffering or its relief*" (AVMA 1987, CDFG 1999).

WS has improved the selectivity and humaneness of management techniques through research and development. 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 waterfowl damage management methods are used.

WS' personnel in Mississippi are experienced and professional in their use of management methods. Management methods are applied as humanely as possible under the constraints of current technology, workforce and funding. Mitigation measures and standard operating procedures used to maximize humaneness are listed in Chapter 3.

2.2.5 Effects on Non-target Wildlife Species Populations, Including Threatened and Endangered Species

The issue of non-target species effects, including effects on T&E species arises from the use of non-lethal and lethal methods identified in the alternatives. The use of non-lethal and lethal methods has the potential to inadvertently disperse, capture or kill non-target wildlife. WS' minimization measures and SOPs are designed to reduce the effects on non-target species' populations and are discussed in Chapter 3. To reduce the risks of adverse affects to non-target wildlife, WS would select damage management methods that are as target-selective as possible or apply such methods in ways to reduce the likelihood of capturing non-target species. Before initiating management activities, WS would select locations which are extensively used by geese.

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 Section 7 consultations with the USFWS to ensure compliance with the ESA and to ensure that "*any action authorized, funded or carried out by such an agency...is not likely to jeopardize the continued existence of any endangered or threatened species…Each agency shall use the best scientific and commercial data available*" [Sec. 7(a)(2)].

Special efforts are made to avoid jeopardizing threatened and endangered species through biological evaluations of the potential effects and the establishment of special restrictions or minimization measures. WS has consulted with the USFWS under Section 7 of the ESA concerning potential impacts of methods available for use by WS on threatened and endangered species. The USFWS issued a BO on WS' programmatic activities in 1992 (USDA 1997, Appendix F).

2.3 ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE

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

WS has the discretion to determine the geographic scope of their NEPA analyses (Kleppe v Sierra Club, 427 U.S. 390, 414 (1976), CEQ 1508.25). Ordinarily, according to APHIS procedures implementing the NEPA, individual wildlife damage management actions may be categorically excluded (7 CFR 372.5(c), 60 Fed. Reg. 6000-6003, 1995). The intent in developing this EA is to determine if the proposed action would potentially have significant individual and cumulative impacts on the quality of the human environment that would warrant the preparation of an EIS or a finding of no significant impact (FONSI). This EA addresses impacts for managing damage and threats to human safety caused by Canada geese in Mississippi to analyze individual and cumulative impacts to provide thorough analyses.

In terms of considering cumulative effects, one EA analyzing impacts for the entire State of Mississippi will provide a more comprehensive and less redundant analysis than multiple EA covering smaller areas. If a determination is made through this EA that the proposed action would have a significant impact on the quality of the human environment, then an EIS would be prepared.

2.3.2 Effects on Human Health from Consumption of Canada Geese

The entity selecting the capture/euthanize (and donation for charitable consumption) program would be responsible for all costs associated with legal and appropriate donation of geese for human consumption. In Mississippi, captured geese which would be donated for human (charitable) consumption by WS would typically be euthanized and processed by a poultry processing facility, and then transported legally to the food bank. In some cases, WS would euthanize captured geese utilizing methods such as CO_2, which is recognized as an acceptable and humane euthanasia method by the AVMA (Beaver et al. 2000). Poultry processing facilities utilized for this process would be in compliance with existing USDA regulations pertaining to the processing and handling of fowl (turkeys, chickens, and waterfowl). There are no Mississippi regulations that provide further guidance in the processing and distribution of Canada goose carcasses for consumption by people (charitable donation).

2.3.3 Cost Effectiveness of Control Methods

The CEQ does not require a formal, monetized cost benefit analysis to comply with NEPA. Consideration of this issue is not essential to making a reasoned choice among the alternative being considered. However, the methods determined to be most effective to reduce damage and threats to human safety caused by geese and prove to be the most cost effective will receive the greatest application. Additionally, management operations may be constrained by cooperator funding and/or objectives and needs.

2.3.4 A Loss Threshold should be Established before Allowing Lethal Methods

One issue identified through WS' implementation of NEPA is a concern that a threshold of loss should be establish before employing lethal methods to resolve damage and that wildlife damage should be a cost of doing business. Some damage and economic loss can be tolerated by cooperators until the damage reaches a threshold where damage becomes an economic burden. The appropriate level of allowed tolerance or threshold before employing lethal methods would differ among cooperators and damage situations. Establishing a threshold would be difficult or inappropriate to apply to human health and safety situations.

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 plaintiffs' motion for preliminary injunction. In part, the court found that a forest supervisor needs only show that damage from wildlife is threatened, to establish a need for wildlife damage management (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 wildlife damage management actions.

2.3.5 Wildlife Damage Management should not occur at Taxpayer Expense

An issue identified through the development of WS' programmatic FEIS (USDA 1997) 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 WS' activities is derived from federal appropriations and through cooperative funding. Activities conducted in Mississippi for the management of damage and threats to human safety from Canada geese will be primarily funded by cooperators

CHAPTER 3: ALTERNATIVES INCLUDING THE PROPOSED ACTION

Alternatives were developed for consideration using WS' Decision Model (Slate et al. 1992) as described in Chapter 2 (pages 20-35), Appendix J (Methods of Control), Appendix N (Examples of WS Decision Model), and Appendix P (Risk Assessment of Wildlife Damage Control Methods Used by USDA, WS' Program) of WS' programmatic FEIS (USDA 1997).

Chapter 3 contains a discussion of the program alternatives, including those that will receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences), alternatives considered but not analyzed in detail, with rationale, and mitigation measures and SOPs for wildlife damage management techniques. Pertinent portions of the affected environment will be included in this chapter in the discussion of issues used to develop mitigation measures. Evaluation of the affected environments will be addressed in more detail in Chapter 4.

3.1 DESCRIPTION OF THE ALTERNATIVES

The No Action alternative is a procedural NEPA requirement (40 CFR 1502), is a viable and reasonable alternative that could be selected, and serves as a baseline for comparison with the other alternatives. The No Action alternative, as defined here, is consistent with the CEQ definition (CEQ 1981).

3.1.1 Alternative 1: Integrated Wildlife Damage Management (Proposed Action/No Action)

The proposed action is for the WS to continue to implement an Integrated Waterfowl Damage Management program that responds to requests for assistance to manage goose damage to protect property, agricultural resources, natural resources, human health, and human safety in Mississippi. Requests for assistance may occur anywhere and anytime throughout the state. An IWDM approach would be implemented which would allow the use of legal techniques and methods, used singly or in combination, to meet requestor needs for reducing conflicts with Canada geese. Cooperators requesting assistance would be provided with information regarding the use of effective non-lethal and lethal techniques. Non-lethal methods recommended and used by WS may include resource management, physical exclusion, relocation, and deterrents. Lethal methods recommended and used by WS may include nest and egg treatment/destruction, live capture and transportation to an approved poultry processing facility, live capture and euthanasia, and/or shooting. In many situations, the implementation of non-lethal methods such as habitat alteration, repellents, and exclusion type barriers would be the responsibility of the requestor to implement. Canada goose damage management by WS would be conducted in Mississippi, when requested, on private and public property, facilities, and housing where a need exists and pursuant to a Cooperative Service Agreement or other comparable document.

The proposed program conducted by WS in Mississippi would continue to be conducted pursuant to applicable laws and regulations authorizing take of waterfowl and their nest and eggs, developed through partnerships among WS, the USFWS, and the MDWFP, and as requested by and through coordination with requesters. All management actions would comply with appropriate federal, state, and local laws.

3.1.1.1 Integrated Wildlife Damage Management

The philosophy behind IWDM is to implement the best combination of effective management methods in a cost-effective[7] manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment. IWDM may incorporate cultural practices (i.e., no feeding policies), habitat modification (i.e., exclusion), animal behavior modification (i.e., scaring), and removal of individual disrupting animals (i.e., relocation), local population reduction, or any combination of these, depending on the circumstances of the specific damage problem. WS considers the biology and behavior of the damaging species and other factors using the WS Decision Model (Slate et al 1992). The recommended strategy(ies) may include any combination of preventive and corrective actions that could be implemented by the requester, WS, or other agency personnel, as appropriate. Two strategies are available:

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

Preventive Damage Management

Preventive damage management is applying wildlife damage management strategies before damage occurs, based on historical problems and data. All non-lethal methodologies, whether applied by WS or resource owners, are employed to prevent damage from occurring and therefore, fall under this heading. When requested, WS' personnel provide information and conduct demonstrations, or take action to prevent additional losses from recurring. An example would be a cooperator installing and maintaining a fence and/or overhead wire grid system to reduce access of geese to a retention pond or scaring geese away from active runways.

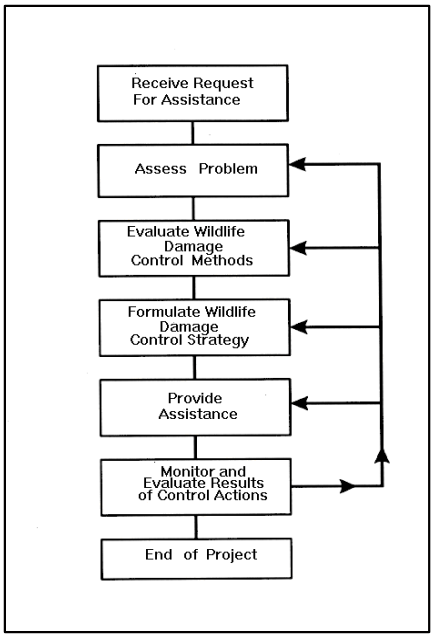
Corrective Damage Management

Corrective damage management is applying wildlife damage management to stop or reduce current losses. As requested and appropriate, WS' personnel provide information and conduct demonstrations, or take action to prevent additional losses from recurring. An example would be the removal of geese during the summer molt using round-up techniques or the oiling of eggs during the nesting season. Often, this involves the lethal removal of individual animals.

3.1.1.2 WS' Decision Making

WS' personnel use a thought process for evaluating and responding to damage complaints that is depicted by the WS Decision Model described by Slate et al. (1992) (Figure 2). WS' personnel are frequently contacted after requesters have tried or considered non-lethal methods and found them to be impractical, too costly, or inadequate for reducing damage to an acceptable level. WS' personnel assess the problem; evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic and social considerations. Following this evaluation, the methods deemed to be practical for the situation are developed into a management strategy. After the management strategy has been implemented, monitoring is conducted and evaluation continues to assess the effectiveness of the strategy. If the strategy is effective, the need for further management is ended. In terms of the WS Decision Model (Slate et al. 1992), most damage management efforts consist of continuous feedback between receiving the request and monitoring the results of the damage management strategy. The Decision Model is not necessarily a documented process, but is a mental problem-solving process common to most professions.

Figure 2 - WS' Decision Model



3.1.1.3 The IWDM Strategies that WS Employs

Technical Assistance Recommendations

Technical assistance is information, demonstrations, and advice on available and appropriate wildlife damage management methods. Technical assistance may require substantial effort by WS' personnel in the decision making process, but the implementation of damage management actions is the responsibility of the requester. In some cases, WS provides supplies or materials that are of limited availability for non-WS entities to use. Technical assistance may be provided following a personal or telephone consultation, or during an on-site visit with the requester. Generally, several management strategies are described to the requester for short and long-term solutions to damage problems, these strategies are based on the level of risk, need, and the practicality of their application.

Under APHIS' NEPA Implementing Regulations and specific guidance for the WS' program, WS' technical assistance is categorically excluded from the need to prepare an EA or EIS. However, it is discussed in this EA because it is an important component of the IWDM approach to resolving wildlife damage problems.

Direct Damage Management Assistance

Direct damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone, and when a Cooperative Service Agreement or other comparable document provides for WS' direct damage management. The initial investigation defines the nature, history, extent of the problem, species or property directly and indirectly damaged, species responsible for the damage, and methods that would be available to resolve the problem. Professional skills of WS' personnel are often required to effectively resolve problems, especially if restricted use pesticides are necessary, or if the problem is complex. Direct damage management provided by WS in Mississippi is provided on a cost-reimbursable agreement basis.

Educational Efforts

Education is an important element of WS' program 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 sustaining damage, lectures and demonstrations are provided to producers, homeowners, state and county agents, and other interested groups. WS frequently cooperates with other agencies in education and public information efforts. Additionally, technical papers are presented at professional meetings and conferences so that WS personnel, other wildlife professionals, and the public are periodically updated on recent developments in damage management technology, laws, regulations, and agency policies.

Research and Development

The National Wildlife Research Center (NWRC) functions as the research arm of WS by providing scientific information and development of methods for wildlife damage management that are effective and environmentally responsible. NWRC scientists work closely with wildlife managers, researchers, field specialists and others to develop and evaluate wildlife damage management techniques. NWRC research was instrumental in the development of methyl anthranilate, a goose repellent. In addition, NWRC is currently testing new experimental drugs that inhibit bird reproduction. NWRC scientists have authored hundreds of scientific publications and reports, and are respected world-wide for their expertise in wildlife damage management.

3.1.1.4 Community Based Decision Making

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

Local decision makers decide which methods should be used to solve wildlife-related conflicts. These decision makers include community leaders, private property owners/managers, and public property owners/managers.

Community decision makers

The decision maker for the local community with a homeowner or civic association would be the President or the Board's appointee. The President and Board are popularly elected residents of the local community who oversee the interests and business of the local community. This person 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. If no homeowner or civic association represents the affected resource then WS will provide technical assistance to the self or locally appointed decision maker. Identifying the decision maker for local business communities is more complex because the lease may not indicate whether the business must manage wildlife damage themselves, or seek approval to manage wildlife from the property owner or manager, or from a governing Board. WS would provide technical assistance and make recommendations for damage reduction to the local community or local business community decision maker(s). Direct control would be provided by WS only if requested by the local community decision maker, funding is provided, and if the requested direct control was compatible with WS' recommendations.

Private property decision makers

The decision maker for private property is usually the property owner. WS would provide technical assistance and recommendations to this person. Direct control would be provided by WS if requested, funding provided, and the requested direct control was in line with WS recommendations.

Public property decision makers

The decision maker for local, state, or federal property would be the official responsible for or authorized to manage the public land to meet interests, goals and legal mandates for the property. WS would provide technical assistance to this person and recommendations to reduce damage. Direct control would be provided by WS if requested, funding provided, and the requested direct control was in line with WS recommendations.

3.1.1.5 Methods Available for Use or Recommended by WS

Appendix B contains detailed descriptions of goose damage management methodologies.

Non-lethal Methods

Many non-lethal methods are available to prevent or manage goose damage in Mississippi. Many non-lethal methods are also available to private entities for use to manage goose damage. WS' may recommend or employ the following non-lethal methods to exclude, disperse, and/or harass geese from problem areas:

Animal behavior modification refers to tactics that alter the behavior of wildlife to reduce damages. Some but not all of these tactics include:

- Exclusion (fencing/overhead wires)
- Propane cannons (to scare geese)
- Pyrotechnics (to scare geese)
- Distress calls and sound producing devices (to scare geese)
- Visual repellents and scaring tactics
- Lasers (to scare geese)
- Dogs (to scare geese)

Nest destruction of the target species before eggs or young are in the nest.

Live traps are various types of traps designed to live-capture Canada geese. Some examples are corral traps, panel nets, rocket nets, and hand nets. Some of these devices are more effective during the summer molting season.

Alpha-chloralose is used as an immobilizing agent, which is a central nervous system depressant used to capture waterfowl. It is generally used in recreational and residential areas, such as swimming pools, shoreline residential areas, golf courses, or resorts where geese are habituated to being hand-fed. Alpha-chloralose is typically delivered in small quantities to target gees inside bait which poses minimal hazards to pets and humans (i.e., single bread or corn baits are fed directly to the target birds).

Methyl Anthranilate (MA) (artificial grape flavoring food additive) has been shown to be an effective repellent for many bird species, including Canada geese. It can be applied to turf or surface water or as a fog to repel birds from small areas.

Anthraquinone is a chemical bird repellent that could be used to reduce feeding activity on airfields and other turf applications. Anthraquinone is a non-lethal repellent and works by causing a negative response to feeding in the treated area (Avery et al. 1997).

Lethal Methods

Shooting is the selective removal of target species by shooting with an air rifle, shotgun, or rifle. Shooting a few individuals from a larger flock can reinforce birds' fear of harassment techniques.

Sport hunting is sometimes recommended when target species can be legally hunted.

Egg treatment/destruction is the practice of ceasing the development of the egg prior to hatching (egg oiling, chilling, shaking, puncturing); physically breaking eggs; or directly removing eggs from a nest and destroying them (Christens et al. 1995).

Carbon dioxide (CO_2) gas is an AVMA approved euthanasia method (Beaver et al. 2001) which is sometimes used to euthanize birds which are captured in live traps or by chemical immobilization and when relocation is not a feasible option. Live animals are placed in a container or chamber into which CO_2 gas is released. The animals quickly expire after inhaling the gas.

Capture and Euthanize is the most efficient way to reduce the size of resident Canada goose population is to increase mortality among adult geese. Geese that are captured and euthanized would be buried, incinerated, or processed for charitable donation as required by the depredation permit issued by the USFWS Migratory Bird Permit Office.

3.1.1.6 Examples of Goose Damage Management Projects

Nest/Egg Treatments

Nest/egg treatment has been recommended as part of the Mississippi WS technical assistance program. Nest treatments include visiting the site during the nesting season of targeted species and removing/destroying the nest/eggs. Nest/egg treatment projects are most commonly conducted in public recreation areas, golf courses, and industrial facilities. The typical egg treatment method that is recommended by Mississippi WS is oiling. Oiling involves marking each egg in the nest, and spreading a few drops of vegetable oil on the entire surface of the egg. The oiled eggs are returned to the nest until the completion of the project when they are removed and disposed of in accordance with state and federal laws as required by permits issued from the USFWS Migratory Bird Permit Office (Christens et al. 1995).

Although this technique has not been used operationally by Mississippi WS it has been used by cooperators within Mississippi. If this method is used in the future, the Mississippi WS program will adhere to the following protocol: 1) visiting the nests every 7-10 days for a 6-8 week period (last week of March to middle of May); and 2) WS will treat only those eggs that are less than 14 days old.

Dog Harassment

Dog harassment of Canada geese has not been directly used by the Mississippi WS program, but is a common practice recommended through WS' technical assistance to private individuals who have the ability to use dogs. Dog harassment is most effective in areas with no water bodies or with single, small (less than 2 acres) water bodies. This technique requires an ongoing program augmented with other goose control techniques. Dog harassment projects are most commonly conducted in public recreation areas, golf courses, and industrial facilities. The procedure includes using dogs such as border collies or Labradors to encourage waterfowl to leave an area. Dog harassment usually occurs after the nesting season but before post-nuptual molt and then again after the molt and into the fall. Mississippi WS recommends that the cooperator visit each site three days a week. Dog harassment is recommended and would only be conducted by WS in areas where egg treatment has been done in order to reduce the possibility of young being present during harassment. Mississippi WS also emphasizes dog harassment activities during the resident Canada goose hunting season.

Waterfowl Round-ups

Canada goose round-ups by Mississippi WS have included using panel nets or drive traps to capture resident Canada geese during post-nuptial molt. In Mississippi, this capturing method is generally used between the last two weeks in June and the first two weeks in July. Once the birds are in the traps they are humanely caught and transferred to waterfowl crates. MDWFP does not recommend the relocation of Canada geese (S. Baker, MDWFP, pers. comm. 2006), therefore all geese captured using this method are euthanized using appropriate methods and the carcasses disposed of through donation, incineratin, or burial.

Habitat Management

Reducing the attractiveness or accessibility to a site that is receiving damage from Canada geese is often suggested to Mississippi residents. This can be an easy and cost effective method for landowners to manage this species (Cooper 1998). Grass length, steep sided banks, and structures placed at the edge of water are all methods that can reduce the attractiveness and accessibility of a site.

Public Education

Educating the public on methods to reduce the attractiveness of locations to resident Canada geese can be an effective method in reducing nuisance goose behavior. This includes informing the public on the problems associated with feeding geese, and having community involvement and enforcement of wildlife feeding regulations.

3.1.2 Alternative 2: Technical Assistance Only

This alternative would not allow for WS' operational Canada goose damage management in Mississippi. WS would only provide technical assistance and make recommendations when requested. Producers, property owners, governmental personnel, or others could conduct goose damage management using any legal lethal or non-lethal method that is available to them. Currently, alpha-chloralose is only available for use by WS employees. Therefore, use of this chemical by private individuals would be illegal and unavailable for use. Appendix B describes a number of methods that could be employed by private individuals or other agencies after receiving technical assistance advice under this alternative.

3.1.3 Alternative 3: Non-lethal Canada Goose Damage Management Only by WS

This alternative would require WS to use or recommend non-lethal methods only to resolve Canada goose damage problems. Persons receiving technical assistance could still employ lethal methods that were available to them. Currently, alpha-chloralose is only available for use by WS' employees. Therefore, use of this chemical by private individuals would be illegal. Appendix B describes a number of non-lethal methods available for use by WS under this alternative.

3.1.4 Alternative 4: No WS' Program

This alternative would eliminate WS' involvement in Canada goose damage management in Mississippi. WS would not provide direct operational or technical assistance to anyone requesting assistance. Those persons experiencing goose damage could conduct goose damage management without WS' input using those methods legally available. Information on goose damage management methods may or may not be available to producers and property owners from other entities. Alpha-chloralose is only available for use by WS employees. Therefore, use of this chemical by private individuals would be illegal and unavailable for use.

3.2 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

3.2.1 Non-lethal Methods Implemented Before Lethal Methods

This alternative would require that all non-lethal methods or techniques described in Alternative 1 and Appendix B be applied to all requests for assistance to reduce damage and threats to safety from geese. If the use of all non-lethal methods fails 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. Verification of the methods used would be the responsibility of WS. No standard exists to determine requester diligence in applying these methods, nor are there any standards to determine how many non-lethal applications are necessary before the initiation of lethal methods. Thus, only the presence or absence of non-lethal methods can be evaluated. WS' proposed action described in section 3.1.1 is similar to a non-lethal before lethal alternative because WS considers the use of non-lethal methods before lethal methods (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.

3.2.2 Trap and Relocate

This alternative would allow the live capture of geese using non-lethal techniques. Captured animals would be translocated to other areas where they would be released back into the wild or free living state. Relocation of wildlife is often viewed as inhumane and biologically unsound management, especially when the wildlife species being relocated are considered a human health and safety threat. The MDWFP discourages relocating geese in Mississippi. Consequently, WS will not relocate any geese captured during control operations back into the wild. If certain segments of the public demand relocation, it will be up to the group(s) to acquire the appropriate permits and/or locate a landowner with appropriate habitat for relocation.

3.2.3 Use of Lethal Methods Only

This alternative would require the use of lethal methods only to reduce threats and damage associated with geese. All live captured geese would be euthanized using appropriate methods. As stated in section 3.1.1, non-lethal can be effective in preventing damage in certain confined instances. Under WS Directive 2.101, WS must consider the use of non-lethal methods before lethal methods. In those situations where damage could be alleviated using non-lethal methods, those methods would be employed or recommended as determined by WS' Decision Model (see Appendix E). Therefore, this alternative was not considered in detail.

3.3 MITIGATION AND STANDARD OPERATING PROCEDURES

Mitigation measures are any features of an action that serve to prevent, reduce, or compensate for impacts that otherwise might result from that action. The current WS' program, nationwide and in Mississippi, uses many such mitigation measures and these are discussed in detail in Chapter 5 of WS' programmatic FEIS (USDA 1997). Some key mitigating measures pertinent to the proposed action and alternatives that are incorporated into WS' standard operating procedures include:

- The WS Decision Model would be used to identify effective goose damage management strategies and their impacts (Slate et al. 1992).

- Non-target animals captured in traps are released unless it is determined by a WS' employee that the animal will not survive and/or that the animal can not be released safely.
- Reasonable and prudent measures or alternatives would be identified through consultation with the USFWS and are implemented to avoid impacts to T&E species.
- All WS' personnel who use restricted-use chemicals are trained and certified by WS' personnel or others who are experts in the safe and effective use of these substances or are supervised by such qualified persons.
- Management actions are directed toward specific individual animals posing a threat to human health and safety, agricultural damage, property damage, and damage to natural resources. Control actions would only be directed towards those Canada geese identified as causing damage in Mississippi.
- Although hazards to the public from control devices and activities used for goose damage management are low according to a formal risk assessment of WS' programmatic activities (USDA 1997, Appendix P), hazards to the public and their pets are even further reduced by the fact that control activities are primarily conducted during low human activity periods and by trained wildlife damage management specialists.

3.4 MITIGATION MEASURES SPECIFIC TO THE ISSUES

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

3.4.1 Effects on Canada Goose Populations

- Canada goose damage management is directed to resolve goose damage problems by taking action against individual problem birds, or local populations or groups, not by attempting to eradicate or reduce Canada goose populations in the entire area or region.
- To ensure that methods of live-capturing Canada geese result in minimal pain, which could be measured as physical injury (e.g., bleeding, broken wing), captured birds would be watered and fed as necessary, not overcrowded for transportation, and placed in shaded areas to reduce overheating.
- WS' take is monitored by comparing numbers of birds killed with overall populations or trends in populations.

3.4.2 Effectiveness of Damage Management Methods

- The appropriateness and effectiveness of methods and techniques will be applied based on WS' Decision Model using site specific inputs.

3.4.3 Effects on Aesthetic Values

- Management actions are directed toward specific individual animals posing a threat to human health and safety, agricultural damage, property damage, and damage to natural resources. Control actions would only be directed towards Canada geese in Mississippi.

3.4.4 Humaneness and Animal Welfare Concerns of Methods used by WS

- WS' personnel will be well trained in the latest and most humane devices/methods for removing problem wildlife.
- WS' personnel attempt to dispatch captured target animals, slated for lethal removal, as quickly and humanely as possible.
- The NWRC is continually conducting research, with the goal, to improve the selectivity and humaneness of wildlife damage management devices used by WS' personnel in the field.

3.4.5 Effects on Non-target Wildlife Species Populations, Including Threatened and Endangered Species

- WS' personnel are trained and experienced to select the most appropriate method for taking problem animals and excluding non-target wildlife.

- Observations are made to determine if non-target or T&E species would be at significant risk from goose damage management activities.
- WS has consulted with the USFWS regarding potential impacts of damage management methods on T&E species. WS abides by reasonable and prudent alternatives (RPA) and/or reasonable and prudent measures (RPM) established as a result of that consultation. For the full context of the Biological Opinion see Appendix F of WS' programmatic FEIS (USDA 1997).
- As appropriate, further consultation on species not covered by or included in that formal consultation process will be initiated with the USFWS and WS will abide by any RPA, RPM, and terms and conditions that result from that process to avoid jeopardizing any listed species.

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. This chapter analyzes the environmental consequences of each alternative in relation to the issues identified for detailed analysis. This chapter analyzes the environmental consequences of each alternative in comparison to determine the extent of actual or potential impacts. Therefore, the proposed action alternative serves as the baseline for the analysis and the comparison of expected impacts among the alternatives. The analysis also takes into consideration WS' mandates, directives, and the procedures used in the WS' decision process (USDA 1997).

4.1 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL

As described in section 2.1.1, in those situations where an entity has already made the decision to remove or otherwise manage geese and to stop damage with or without WS' assistance, WS' participation in carrying out the action will not affect the *environmental status quo*. In some situations, WS' involvement may actually have a *beneficial* effect on the human environment when compared to the *environmental status quo* in the absence of such involvement due to WS' expertise in managing damage and threats caused by wildlife.

Table 6 provides a comparison of the alternatives in relationship to the potential issues identified in Chapter 2.

4.1.1 Effects on Canada Goose Populations

The analysis for magnitude of impact on Canada goose populations generally follows the process described in Chapter 4 of WS' programmatic FEIS (USDA 1997). Magnitude is described in the FEIS as *"…a measure of the number of animals killed in relation to their abundance*." Magnitude may 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 data when available. Generally, WS only conducts damage management on species whose population densities are high and usually only after they have caused damage.

A common issue is whether damage management actions will adversely affect the viability of target species' population. WS maintains ongoing contact with USFWS and the MDWFP and submits annual migratory bird activity reports of activities to both agencies. The USFWS monitors the total take of geese from all sources and factors in survival rates from predation, disease, and other mortality data. Ongoing contact with USFWS and the MDWFP assures local, state and regional knowledge of wildlife population trends are considered. While local populations of Canada geese may be reduced, compliance with applicable state and federal laws and regulations authorizing take of geese and their nest and eggs, will ensure that the regional and statewide population will not be adversely affected.

4.1.1.1 Alternative 1: Integrated Wildlife Damage Management Program (Proposed Action/No Action)

Resident Canada Geese

As described in Section 1.3, the population of resident Canada geese in Mississippi was estimated to be approximately 28,500 geese in 2006. Cumulative impacts of the proposed action on resident Canada geese are based upon the anticipated WS' take, hunter harvest, and authorized take by other (non-WS) entities (farmers, municipalities, homeowners associations, airports). The potential take of resident Canada geese by WS is expected to have no negative cumulative impact on the statewide or flyway resident Canada goose population.

From 2003-2006, WS has lethally removed a total of 2,018 resident Canada geese (Table 4). Based upon past requests for WS' assistance and an anticipated increase in future requests for services, WS anticipates that no more than 4% (currently 1,140 birds) of the resident Canada goose population would likely be killed by WS in Mississippi annually under the proposed action . During the 2006 Canada goose hunting season, the harvest of Canada geese in Mississippi was estimated at 10,026 geese (USFWS 2007). Based

upon information from the MDWFP, most geese harvested by hunters are likely resident birds since a minimal number of migratory geese pass through the state (S. Baker, MDWFP, pers. comm. 2005). Since a minimal number of migratory geese pass through the state according the MDWFP, WS' take of geese during damage management activities will be considered resident geese for analysis purposes. Nearly 96% of the geese taken by WS since fiscal year 2003 were live captured using corral traps. Since the use of corral traps to capture geese requires adult geese to be flightless, which occurs during the period of times when geese are considered resident (June-July) in Mississippi, all of the geese live-captured by corral traps are considered resident. The use of other methods may occur throughout the year but are primarily employed during those months when geese are considered resident in Mississippi. Though take of migratory geese may occur during damage management activities, the take will not reach a magnitude that would negatively impact those geese considered migratory.

In Mississippi, Canada geese are classified as a protected game bird species, and are regulated by Mississippi state law. Waterfowl hunting seasons in Mississippi are regulated by the MDWFP and USFWS as described in Section 1.3.1.3.1. To manage damage associated with protected bird species, depredation permits are issued by the USFWS. Resident Canada geese fall under the jurisdiction of the USFWS. Agencies such as WS are required to obtain migratory bird permits with specified limits on the take of Canada geese, their nests and eggs. Some facilities such as airports may be authorized to take migratory birds on an as needed basis and have no limits associated with their take. Table 5 shows the number of permits issued by the USFWS that refer specifically to the take of Canada geese.

Table 5. Number of Resident Canada Goose Depredation Permits and Take issued by the USFWS for Mississippi (C. Simonton, USFWS, pers. comm. 2006).

Year	Number of depredation permits issued*	Number of geese authorized for take	Number of geese taken	Number of goose egg addling permits	Limit on goose egg addling permits	Number of goose eggs taken	Number of goose nest take permits	Limit on goose nest take permits	Number of goose nests taken
2000	0	0	0	0	0	0	0	0	0
2001	1	15	0	3	Unlimited	21	3	Unlimited	0
2002	4	585	6	4	3 = Unlimited, 1 = 250 eggs	396	4	3 = Unlimited, 1 = 250 nests	0
2003	6	696	390	6	5 = Unlimited, 1 = 250 eggs	421	6	5 = Unlimited, 1 = 250 nests	0
2004	4	1115	44	5	4 = Unlimited, 1 = 250 eggs	582	5	4 = Unlimited, 1 = 250 nests	0
2005	4	1,165	628	5	0= Unlimited, 1 = 250	29	5	4 = Unlimited, 1 = 250 nests	0
2006	4	1,085	0	7	6 = Unlimited, 1 = 250 eggs	0	7	6= Unlimited, 1 = 250 nests	0

*** Table does not include data from permits that are listed as authorizing migratory bird permit take on an as needed basis, such as those issued to some airports.**

Using the 2006 hunter harvest (using the assumption that all birds taken by hunters are resident geese), USFWS permitted take, WS' anticipated lethal take of no more than 4% of the State's resident Canada goose population per year, and an increasing population trend, the magnitude of WS' impacts on the resident Canada goose population is considered to be relatively low (approximately one third of the estimated resident goose population). Furthermore, this cumulative take would contribute positively to the

state and Mississippi Flyway Council's resident goose population management objective of reduction from the current level to approximately 20,000 geese in Mississippi.

While local populations of resident Canada geese deemed above the WAC by the property owner or local community may be reduced, applicable state and federal laws and regulations authorizing take of Canada geese and their nest and eggs, including the USFWS and MDWFP permitting processes, would ensure that the statewide population would not be reduced below the state and Mississippi Flyway goal of 20,000 resident Canada geese (USFWS 2005a).

Migratory Canada geese

Cumulative impacts of the proposed action on migratory Canada geese are based upon the anticipated WS' take, hunter harvest, and authorized take by other (non-WS) entities. The number of migratory geese taken by WS in Mississippi is believed to be relatively low annually (less than 20 birds) and is directly related to protection of aviation. The majority of WS' lethal Canada goose damage management activities have taken place during the months when migratory geese are not present in Mississippi (April-September). Most if not all of WS' Canada goose damage management activities are targeted towards the resident Canada goose population. Based upon past requests for WS' assistance and an anticipated increase in future requests for services, WS anticipates that no more than 100 migratory Canada geese would be killed by WS annually under the proposed action. During the 2004 Canada goose hunting season, the harvest of Canada geese in Mississippi was estimated at 8,707 geese (USFWS 2005b). Based upon information from MDWFP (S. Baker, MDWFP, pers. comm. 2005) most geese harvested by hunters are likely resident birds since a minimal number of migratory geese pass through the state. The majority of management that may result in the take of migratory Canada geese in Mississippi relates to the protection of human health and safety at airports. Canada goose management at these facilities is conducted throughout the year whenever the threat arises, and although non-lethal means are used to reduce threats from Canada geese, lethal control is sometimes employed. During FY 2004, FY 2005, and FY 2006, a total of 7 Canada geese were lethally removed during the time when migratory geese may occupy the state (October-March). During this same period, non-lethal management methods were used to disperse or harass 104 Canada geese at airports. As the Mississippi WS program expands to work with more airports, the chance to lethally take migrant Canada geese may increase, but minimal lethal control combined with extensive non-lethal measures should minimize the lethal take of migrant geese. Additionally, although it is possibly that geese taken between October-March are migratory Canada geese, it is more likely that these birds are resident individuals.

While local populations of migratory Canada geese deemed above the WAC by the landowner or local community may be reduced, applicable state and federal laws and regulations authorizing take of Canada geese, including the USFWS and the MDWFP permitting processes, under which management actions would be implemented would ensure that the statewide and flyway population would not be reduced below state and Mississippi Flyway population goals and objectives. Therefore, WS has determined that WS' Canada goose damage management program activities in Mississippi will have no cumulative adverse affects on the populations of migratory Canada geese in Mississippi or the Mississippi Flyway.

4.1.1.2 Alternative 2: Technical Assistance Only

Canada goose populations in Mississippi would not be directly impacted by a program implementing a technical assistance program. However, persons experiencing damage or threats from geese 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 for use to resolve goose damage in Mississippi. Methods and techniques recommended would be based on WS' Decision Model using information provided from the requestor or from a site visit. Requestors may implement WS' recommendations or take no action. However, those requesting assistance are likely those that would implement damage abatement methods in the absence of WS' recommendations. Therefore, the impacts on goose populations in Mississippi from a WS' technical assistance program would not be greater than the *environmental status quo* (see section 2.1.1).

For the same reasons shown in the population effects analysis in Section 4.1.1.1, it is unlikely that goose populations would be adversely impacted by implementation of this alternative. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal use of chemicals which could lead to real but unknown effects on Canada goose populations (White et al. 1989, USDA 1997, USFWS 2001, FDA 2003). Effects and hypothetical risks of illegal killing of Canada geese under this alternative would probably be about the same as those under Alternative 3.

4.1.1.3 Alternative 3: Non-lethal Canada Goose Damage Management Only By WS

Under this alternative, WS would not employ lethal methods to manage damage caused by geese. Although WS' lethal take of Canada geese would not occur, it is likely that, without WS conducting some level of lethal goose damage management activities for these species, private Canada goose damage management efforts would increase, leading to potentially similar or even greater effects on target species populations than those of the current program alternative. For the same reasons shown in the population effects analysis in section 4.1.1.1, it is unlikely that target Canada goose populations would be adversely impacted by implementation of this alternative. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal use of other chemicals which could lead to real but unknown effects on both target and non-target waterfowl populations (White et al. 1989, USDA 1997, USFWS 2001, FDA 2003). Effects and hypothetical risks of illegal killing of waterfowl under this alternative would probably be less than Alternative 4.

4.1.1.4 Alternative 4: No WS' Program

This alternative precludes any and all activities by WS to protect human health and safety, protect agricultural resources, alleviate damage to property, and protect natural resources from impacts caused by geese in Mississippi. WS would not provide operational or technical assistance. WS would not respond to requests for assistance and would direct all inquiries to appropriate federal, state, and/or local agencies or private business. This alternative would not deny other federal, state, and local agencies, including private entities from conducting management activities directed at alleviating damage and threats associated with geese in Mississippi. Many of the methods listed in Appendix B would be available for use by other agencies and private entities, unless otherwise noted in the Appendix, to manage damage and threats associated with geese.

Under this alternative, WS would have no impact on Canada goose populations in Mississippi. Private efforts to reduce or prevent damage and conflicts could increase, which could result in effects on target species populations to an unknown degree. Effects on target species under this alternative could be the same, less, or more than those of the proposed action depending on the level of effort expended by private persons. For the same reasons shown in the population effects analysis in Section 4.1.1.1 it is unlikely that target waterfowl populations would be adversely impacted by implementation of this alternative. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal killing of Canada geese and therefore could lead to real but unknown effects on target and non-target waterfowl populations (White et al. 1989, USDA 1997, USFWS 2001, FDA 2003).

4.1.2 Effectiveness of Damage Management Methods

4.1.2.1 Alternative 1: Integrated Wildlife Damage Management Program (Proposed Action/No Action)

This alternative would be more effective than any of the other alternatives in reducing or minimizing damage caused by Canada geese. Population limiting techniques (e.g., hunting, capture and euthanize, shooting, and nest/egg destruction) may have long-term effects and can slow population growth or even reduce the size of a waterfowl population (Cooper and Keefe 1997). This alternative would give WS the option to implement lethal management in response to human health and safety concerns and damage to property and other resources. This alternative would enhance WS' effectiveness and ability to address a broader range of damage problems. Repopulation of sites where lethal management methods were used would undoubtedly take place as long as suitable habitat exists in that area. However, the use of lethal

management would reduce the number of damaging geese thereby enhancing the effectiveness of non-lethal methods (Smith et al. 1999). Kilpatrick and Walter (1999) reported that when an urban wildlife population above the WAC is reduced through lethal means, many residents subsequently experience reduced damage.

This alternative would likely reduce the potential for bird-aircraft collisions at airports and increase human safety. This has been demonstrated by Cooper (1991) who reported the removal of geese posing or likely to pose a hazard to air safety at airports considerably reduced the population of local geese, decreased the number of goose flights through airport operations airspace, and significantly reduced goose-aircraft collisions at Minneapolis-St. Paul International Airport. In addition, Dolbeer et al. (1993) demonstrated that an integrated approach (including removal of offending birds) reduced bird hazards at airports and substantially reduced bird collisions with aircraft by as much as 89%.

This alternative would be more effective than Alternatives 2 or 3, which rely primarily on frightening or displacing waterfowl from one location to another.

4.1.2.2 Alternative 2: Technical Assistance Only

With WS' technical assistance but no direct management, entities requesting waterfowl damage management would either take no action, which means conflicts and damage would likely continue or increase in each situation as bird numbers are maintained or increased, or implement WS' recommendations for non-lethal and lethal control methods. Methods of frightening or discouraging geese have been effective at specific sites. In most instances however, these methods have simply shifted the problem elsewhere (Conover 1984, Aguilera et al. 1991, Swift 1998). Of the non-lethal techniques commonly used by the public to reduce conflicts with waterfowl (e.g., feeding ban, habitat modification, live swan, methyl anthranilate, fencing, harassment with dogs, people or vehicles), only fencing was reported to have been highly effective (Cooper and Keefe 1997). Habitat modifications, while potentially effective, are poorly accepted, not widely employed, and many include reducing water levels in wetlands and are not biologically sound. Long-term solutions usually require some form of local population reduction to stabilize or reduce waterfowl population size (Smith et al. 1999). Population reduction would be limited to applicable state and federal laws and regulations authorizing take of geese, including legal hunting and take pursuant to depredation permits. However, individuals or entities that implement lethal management may not have the experience necessary to efficiently and effectively conduct the actions.

4.1.2.3 Alternative 3: Non-Lethal Canada Goose Damage Management Only By WS

Given the behavior of geese, very few non-lethal techniques have proven effective in adequately addressing damage and threats associated with geese (Cooper and Keefe 1997, Smith et al. 1999). Harassment and dispersal techniques would be limited to audio and visual cues that invoke a flight response. Non-lethal methods often have a high rate of habituation after multiple applications. To lessen habituation, non-lethal harassment and dispersal techniques require application only when geese are present which can lead to elevated costs from increased monitoring of vulnerable resources.

Exclusionary devices can be effective in preventing access to resources in certain circumstances. The primary exclusionary methods are fencing and netting. Exclusion is most effective when applied to small areas to protect high value resources. However, exclusionary methods are neither feasible nor effective for protecting human safety, agriculture, or native wildlife species from geese across large areas. The proposed action, using an integrated damage management approach, incorporates the use on non-lethal methods when addressing requests for assistance. In those instances where non-lethal methods would effectively resolve damage from geese those methods would be used or recommended under the proposed action.

The success or failure of the use of non-lethal methods can be quite variable. Methods of frightening or discouraging geese have been effective at specific sites. In most instances however, these methods have simply shifted the problem elsewhere (Conover 1984, Aguilera et al. 1991, Swift 1998). However, if WS is providing direct operational assistance in dispersing geese, coordination with local authorities, who may

assist in monitoring the birds' movements, is generally conducted to assure they do not reestablish in other undesirable locations. Of the non-lethal techniques commonly used by the public to reduce conflicts with waterfowl (e.g., feeding ban, habitat modification, live swan, methyl anthranilate, fencing, harassment with dogs, people or vehicles), only fencing was reported to have been highly effective (Cooper and Keefe 1997). Habitat modifications, while potentially effective, are poorly accepted, not widely employed, and many include reducing water levels in wetlands and are not biologically sound. Long-term solutions usually require some form of local population reduction to stabilize or reduce waterfowl population size (Smith et al. 1999). Overall impacts would be similar to Alternative 2.

4.1.2.4 Alternative 4: No WS' Program

With no WS' assistance, private individuals and government officials would either take no action, which means the Canada goose damage and conflicts would likely continue or increase in each situation as Canada goose numbers are maintained or increased, or individuals will implement their own non-lethal and lethal control methods. Impacts would be variable and dependent upon the actions taken by non-WS personnel.

4.1.3 Effects on Aesthetic Values

4.1.3.1 Effects on Human Affectionate-Bonds with Individual Birds and On Aesthetics

4.1.3.1.1 Alternative 1: Integrated Wildlife Damage Management Program (Proposed Action/No Action)

Under the proposed action, when requested, WS would employ methods that would result in the dispersal, exclusion, or removal of individuals or small groups of geese to resolve damage and threats associated with geese in Mississippi. In some instances where geese are dispersed or removed, the ability of interested persons to observe and enjoy geese will likely temporarily decline. The goose populations in those areas will likely increase upon cessation of damage management activities.

Even the use of exclusionary devices can lead to dispersal of wildlife if the resource being damaged was acting as an attractant. Thus, once the attractant has been removed or made unavailable, wildlife will likely disperse to other areas where resources are more vulnerable.

The use of lethal methods would result in temporary declines in local populations resulting from the removal of geese to resolve requests for assistance. WS' goal under the proposed action is to respond to requests for assistance and to manage those geese responsible for the resulting damage. Therefore, the ability to view and enjoy geese in Mississippi will still remain if a reasonable effort is made to locate geese outside the area in which damage management activities occurred.

People who have developed affectionate bonds with individual birds may feel sadness and anger if those particular birds were removed. WS is aware of such concerns and takes this into consideration to mitigate those affects. WS might sometimes be able to mitigate such concerns by leaving certain birds which might be identified by interested individuals.

Some people have expressed opposition to the killing of any birds during goose damage management activities. Under the current program, some lethal control of birds would continue and those persons would continue to oppose those methods. However, many persons who voice opposition have no direct connection or opportunity to view or enjoy the particular birds that would be killed by WS' lethal control activities. Lethal control actions would generally be restricted to local sites and to small percentages of overall Canada goose populations. Therefore, the species subjected to limited lethal control actions would remain common and abundant and would therefore continue to remain available for viewing by persons with that interest.

Lethal removal of Canada geese from airports should not affect the public's enjoyment of the aesthetics of the environment since airport properties are closed to the public. The ability to view and

interact with Canada geese at those sites is usually either restricted to viewing from a location outside boundary fences, or is forbidden.

4.1.3.1.2 Alternative 2: Technical Assistance Only

Under this alternative, the affects on the aesthetic values of geese in Mississippi would be similar to those addressed in the proposed action. Those persons requesting assistance from WS have often reached a damage-level that has exceeded the economic threshold of that individual and therefore, the social acceptance level of geese has reached a level where assistance is required. Based on recommendations by WS using the Decision Model, methods are likely to be employed by the requestor based on those recommendations that will result in the dispersal and/or removal of those individuals of the goose population responsible for damage or threaten safety.

The impacts on aesthetics from a technical assistance program would only be lower then the proposed action if those individuals experiencing damage are not as diligent in employing those methods as WS would be if conducting an operational program. If those experiencing damage abandoned the use of those methods then geese would likely remain in the area and available for viewing and enjoying from those interested in doing so. However, since employing methods under this alternative or the proposed action would result in only a temporary reduction in the viewing opportunities of geese, the impact of this alternative is likely to be low.

4.1.3.1.3 Alternative 3: Non-lethal Canada Goose Damage Management Only By WS

Under this alternative, WS would not conduct any lethal damage management activities but would still conduct harassment of Canada geese that were causing damage. Some people who oppose lethal control of wildlife by the government but are tolerant of government involvement in non-lethal wildlife damage management would favor this alternative. Persons who have developed affectionate bonds with individual birds would not be affected by the death of individual birds under this alternative, but might oppose dispersal or translocation of certain birds. As discussed in this subsection under Alternative 1, WS might sometimes be able to mitigate such concerns by leaving certain waterfowl which might be identified by interested individuals. In addition, the abundant populations of geese in urban-suburban environments would enable people to continue to view them and to establish affectionate bonds with individual birds. Although WS would not perform any lethal activities under this alternative, other private entities would likely conduct goose damage management activities similar to those that would no longer be conducted by WS, and the effects would then be similar to the proposed action alternative.

4.1.3.1.4 Alternative 4: No WS' Program

Under the no program alternative, WS' actions would have no impact on the aesthetic value of geese in Mississippi. Methods for managing damage or threats associated with geese could still be employed or recommended by other agencies, entities, or the public. Under this alternative, WS would not conduct any lethal removal of Canada geese nor would the program conduct any harassment or dispersal of birds. Persons who have developed affectionate bonds with individual birds would not be affected by WS' activities under this alternative. However, other private entities would likely conduct waterfowl damage management activities similar to those that would no longer be conducted by WS, and the effects would then be similar to the proposed action alternative.

4.1.3.2 Effects on Aesthetic Values of Property Damaged by Canada Geese

4.1.3.2.1 Alternative 1: Integrated Wildlife Damage Management Program (Proposed Action/No Action)

Under this alternative, operational assistance in reducing goose conflicts, in which feces from the birds accumulate, would improve aesthetic values of affected properties. In addition, individuals whose aesthetic enjoyment of other birds and the environment is diminished by the presence of Canada geese

and goose feces will be positively affected by programs which result in reductions in the presence of Canada geese.

The dispersal of Canada geese by harassment and barriers can sometimes result in the birds causing the same or similar problems at the new location. If WS is providing direct operational assistance in dispersing such birds, coordination with local authorities, who may assist in monitoring the birds' movements, may be conducted to assure they do not reestablish in other undesirable locations.

4.1.3.2.2 Alternative 2: Technical Assistance Only

Under this alternative, the lack of operational assistance in reducing Canada goose problems could result in an increase of potential adverse affects on aesthetic values. However, potential adverse affects would likely be less than those for Alternative 4, since WS would be providing technical assistance.

The dispersal of Canada geese by harassment and barriers can sometimes result in the birds causing the same or similar problems at a new location. If WS has only provided technical assistance to local residents or municipal authorities, coordination with local authorities to monitor the birds' movements to determine if birds become established in other undesirable locations may not be conducted, therefore increasing the potential of adverse effects to nearby property owners.

4.1.3.2.3 Alternative 3: Non-Lethal Canada Goose Damage Management Only By WS

Under this alternative, WS would be restricted to non-lethal methods only. Assuming property owners would choose to allow and pay for the implementation of these non-lethal methods, this alternative could result in Canada geese relocating to other sites where they would likely create or worsen similar problems for other property owners. Thus, this alternative would likely result in more property owners experiencing adverse effects on the aesthetic values of their properties than the proposed action alternative.

The dispersal of Canada geese by harassment and barriers can sometimes result in the birds causing the same or similar problems at a new location. If WS is providing direct operational assistance in dispersing such birds, coordination with local authorities, who may assist in monitoring the birds' movements, may be conducted to determine if they become established in other undesirable locations.

4.1.3.2.4 Alternative 4: No WS' Program

Under this alternative, the lack of any operational or technical assistance in reducing Canada geese problems would mean aesthetic values of some affected properties would continue to be adversely affected if the property owners were not able to reduce goose damage in some other way. In many cases, this type of aesthetic "damage" would worsen because property owners would not be able to resolve their problems and goose damage would continue to increase.

The dispersal of geese by harassment and barriers can sometimes result in the birds causing the same or similar problems at the new location. Coordination with local authorities to monitor goose movements, to determine if birds become established in other undesirable locations, might not be conducted, therefore increasing the potential of adverse effects to nearby property owners.

4.1.4 Humaneness and Animal Welfare Concerns of Methods Used by WS

4.1.4.1 Alternative 1: Integrated Wildlife Damage Management Program (Proposed Action/No Action)

As discussed in section 2.2.4, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal. People may perceive the humaneness of an action differently. The challenge in

coping with this issue is how to achieve the least amount of animal suffering within the constraints imposed by current technology and funding.

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 most effective way to address damage and threats caused by wildlife in a humane manner, WS is 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 is to use methods as humanely as possible to effectively resolve requests for assistance to reduce damage and threats to human safety. WS continues to evaluate methods and activities to minimize the pain and suffering of methods addressed when attempting to resolve requests for assistance.

As mentioned previously, 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 is generally considered by most members of the public as "humane". Yet, without proper care, live-captured wildlife in a cage trap can be treated inhumanely if not attended to appropriately. Therefore, WS' mission is to effectively address requests for assistance using methods in the most humane way possible that minimizes the stress and pain of the animal.

Under this alternative, methods viewed by some persons as inhumane would be used by WS. There would likely be concern among stakeholders, in situations where geese are captured and euthanized or captured and processed for human consumption, that the birds should be killed quickly. Many stakeholders would want geese captured in a way that results in no pain or a minimization of pain, which they could measure as physical injury (e.g., bleeding, broken wing). Captured birds would be made as comfortable as possible by watering the birds as necessary, not overcrowding the birds if they are put in holding crates for transportation, and seeking shade for caged birds as necessary. There would likely also be concern among stakeholders, in situations where geese are captured and processed for human consumption, that the birds should be killed quickly. Birds would be processed for human consumption in state licensed poultry processing facilities in accordance with all pertinent regulations.

There may be concern among stakeholders that birds sedated with alpha-chloralose should not be allowed to drown, even if the birds are to be euthanized. In situations where geese are being captured alive by use of alpha-chloralose, nets, or by hand, the birds would be euthanized by methods approved by the AVMA (Beaver et al. 2001). Most people would view AVMA approved methods of euthanizing animals as humane.

If geese are shot, stakeholders would likely want quick clean kills of shot birds. Some persons would view shooting as inhumane. Some people could also be concerned about eggs being oiled, punctured, chilled, or addled. A minority of stakeholders would likely want no geese captured, harassed, or killed because they consider putting birds in crates as inhumane, and the killing of birds as inhumane regardless of the method used.

Some people have concerns over the potential for separation of Canada geese family groups through management actions. This could occur through harassment (e.g., pyrotechnics, dogs) and lethal control methods. However, it is not uncommon for family units to experience change. Bellrose (1980) cites several sources which list annual mortality rates of juvenile waterfowl ranging from 7 to 19% during the hatching to fledgling stage. Biologists believe that juvenile birds have a good likelihood of survival without adult birds once the juvenile reaches fledgling stage, which occurs by July for most juvenile birds in Mississippi. Therefore, molting juvenile geese that escape capture would most likely survive to adulthood (Mississippi Flyway Council Technical Section 1996). Separated adults form new pair bonds and readily breed with new mates (Moser et al. 1991).

4.1.4.2 Alternative 2: Technical Assistance Only

The issues of humaneness of methods under this alternative are likely to be perceived to be similar to humaneness issues discussed under the proposed action. This perceived similarity is derived from WS' recommendation of methods that some consider inhumane. WS would not directly be involved with damage management activities under this alternative. However, the recommendation of the use of methods would likely result in the requestor employing those methods. Therefore, by recommending methods and thus a requestor employing those methods the issue of humaneness would be similar to the proposed action.

WS would instruct and demonstrate the proper use and placement of methodologies to increase effectiveness in capturing target geese and to ensure methods are used in such a way as to minimize pain and suffering. However, the efficacy of methods employed by a cooperator would be based on the skill and knowledge of the requestor in resolving the threat to safety or damage situation despite WS' demonstration. Therefore, a lack of understanding of the behavior of geese or improperly identifying the damage caused by geese 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 are likely to be regarded as greater than those discussed in the proposed action.

4.1.4.3 Alternative 3: Non-lethal Canada Goose Damage Management Only by WS

Under this alternative, lethal methods viewed as inhumane by some persons would not be used by WS. However, it is expected that many requesters of goose damage management assistance would likely implement lethal methods that would not be available from WS. Overall, Canada goose damage management under this alternative would likely be similar to the proposed action alternative.

4.1.4.4 Alternative 4: No WS' Program

Under this alternative, methods viewed as inhumane by some persons would not be used by WS. However, these methods could be used by non-WS entities and, similar to the proposed action alternative, would be viewed by some persons as inhumane. Overall, Canada goose damage management under this alternative would likely be similar to the proposed action alternative.

4.1.5 Effects on Non-target Wildlife Species Populations, Including Threatened and Endangered Species

4.1.5.1 Alternative 1: Integrated Wildlife Damage Management Program (Proposed Action/No Action)

WS' personnel are experienced and trained in wildlife identification and 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 uses the most selective methods for the target species, employs the use of attractants that are specific to target species, and determines placement of methods to avoid exposure to non-targets. Despite WS' best efforts to minimize non-target take during program activities, the potential for non-target take 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 affects on non-targets primarily through exclusionary, harassment, and dispersal. Any exclusionary device erected to prevent access of target species also potentially excludes species that are not the primary reason the exclusion was erected therefore; non-target species excluded from areas may potentially be adversely impacted if the area excluded is large enough. The use of auditory and visual dispersal methods used to reduce damage or threats caused by target species are also likely to disperse non-targets in the immediate area the methods are employed. Therefore, non-targets may be dispersed from an area while employing non-lethal dispersal techniques. However, like target species, the potential impacts on non-target species are expected to be temporary with target and non-target species often returning after the cessation of dispersal methods.

WS' standard operating procedures include measures intended to mitigate or reduce the effects on non-target species populations and are presented in Chapter 3. WS has not killed any non-target wildlife

species while conducting Canada goose damage management activities in Mississippi and does not anticipate this number to substantially increase. While every precaution is taken to safeguard against taking non-target birds, changes in local flight patterns and other unanticipated events can result in the incidental take of unintended species. These occurrences are rare and should not affect the overall populations of any species under the current program.

Direct impacts on non-target species occur when WS' program personnel inadvertently kill, injure, or harass animals that are not target species. In general, these impacts result from the use of methods that are not completely selective for target species. Non-target migratory bird species and other wildlife species are usually not affected by WS' management methods, except for the occasional scaring from harassment devices. In these cases, migratory birds and other affected wildlife may temporarily leave the immediate vicinity of scaring, but would most likely return after conclusion of the action.

Shooting is virtually 100% selective for the target species; therefore no adverse impacts are anticipated from use of this method. Any non-target species captured in a live trap would be released unharmed on site, if deemed the non-target would likely survive. Non-lethal chemical products that might be used or recommended by WS would include repellents such as methyl or di-methyl anthranilate (artificial grape flavoring used in foods and soft drinks sold for human consumption), which has been used as an area repellent, anthraquinone, and the tranquilizer drug alpha-chloralose. Such chemicals have undergone rigorous testing and research to prove safety, effectiveness, and low environmental risks before they would be registered by EPA or FDA. Any operational use of chemical repellents would be in accordance with labeling requirements under FIFRA and State pesticide laws and regulations which are established to avoid unreasonable adverse effects on the environment. Following labeling requirements and use restrictions are a built-in mitigation measure that would assure that use of registered chemical products would avoid significant adverse effects on wildlife populations. Based on a thorough Risk Assessment, APHIS concluded that, when chemical methods are used by WS in accordance with label directions, they are highly selective to target individuals or populations, and such use has negligible effects on the environment (USDA 1997).

Special efforts are made to avoid jeopardizing threatened and endangered species through biological evaluations of the potential effects and the establishment of special restrictions or mitigation measures. WS has obtained the list of federally listed threatened and endangered species for the state of Mississippi (see Appendix C). WS has consulted with the USFWS under Section 7 of the ESA concerning potential impacts of methods employed during management of damage caused by geese on threatened and endangered species and has obtained a Biological Opinion. For the full context of the Biological Opinion, see Appendix F of WS' programmatic FEIS (USDA 1997, Appendix F).

The USFWS determined that the management activities being utilized for Canada goose damage management activities are not likely to adversely affect those listed species. In addition, WS has determined that the use of goose damage management methods will have no effect on those T&E species not included in the 1992 BO or their critical habitats. Furthermore, WS has determined that the use alpha-chloralose and lasers will have no effect on any listed threaten and endangered species or their critical habitats. Therefore, WS has determined that the proposed goose damage management program will not likely adversely affect any federally listed T&E species addressed in the 1992 BO issued by the USFWS and will have no effect on those species listed since completion of the BO, including the use of lasers and alpha-chloralose.

WS has obtained and reviewed the list of listed threatened and endangered species listed by the MDWFP and has determined that the proposed Canada goose damage management program will not adversely affect any of the species listed in Mississippi.

4.1.5.2 Alternative 2: Technical Assistance Only

Under a technical assistance alternative, WS would recommend methods legally available for use in Mississippi for the management of damage and human health threats caused by Canada geese to those requesting assistance. Recommendations would be based on WS' Decision Model using information

provided by the person requesting assistance or through site visits. Methods recommended could include non-lethal and lethal methods as deemed appropriate by WS' personnel addressing the requestor using the WS' Decision Model and as applicable by law. Impacts to non-target and threatened and endangered species would not directly result from WS' technical assistance program. However, those experiencing damage from geese may 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 the methods. Those persons implementing lethal methods based on WS' recommendation are likely to use lethal methods in the absence of WS' recommendation.

It is possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal killing of geese, which could lead to unknown effects on local non-target species populations, including some T&E species (White et al. 1989, USDA 1997, USFWS 2001, FDA 2003).

4.1.5.3 Alternative 3: Non-lethal Canada Goose Damage Management Only By WS

Under this alternative, WS' take of non-target animals would hypothetically be less than that of the proposed action because no lethal control actions would be taken by WS. However, non-target take would not differ substantially from the proposed/current program because the current program has taken no non-target animals. On the other hand, people whose Canada goose damage problems were not effectively resolved by non-lethal control methods would likely resort to other means of lethal control such as use of shooting by private persons or even illegal use of chemical toxicants. This could result in less experienced persons implementing control methods and could lead to greater take of non-target wildlife than the proposed action. For example, shooting by persons not proficient at bird identification could lead to killing of non-target birds. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal killing of geese which could lead to unknown effects on local non-target species populations, including T&E species (White et al. 1989, USDA 1997, USFWS 2001, FDA 2003).

4.1.5.4 Alternative 4: No WS' Program

There would be no impact on non-target or T&E species by WS' activities from this alternative. However, private efforts to reduce or prevent depredations could increase, which could result in less experienced persons implementing control methods and could lead to greater take of non-target wildlife than under the proposed action. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal killing of geese which could impact local non-target species populations, including some T&E species (White et al. 1989, USDA 1997, USFWS 2001, FDA 2003).

4.2 CUMULATIVE IMPACTS

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

Under Alternatives 1, 2 and 3, WS would address damage associated with Canada geese in a number of situations throughout the State. WS' program would be the primary federal program with goose damage management responsibilities; however, some state and local government agencies may conduct damage management activities in Mississippi or authorize the take of geese by other entities. Take of geese could also occur under guidelines evaluated in the USFWS resident Canada goose management FEIS (USFWS 2005a). Through ongoing coordination with state and federal agencies, WS is aware of such activities and may provide technical assistance in such efforts. WS does not normally conduct direct damage management activities concurrently with such agencies in the same area, but may conduct Canada goose damage management activities at adjacent sites within the same time frame. In addition, commercial pest control companies may conduct goose damage management activities in the same area. The potential cumulative impacts analyzed below could occur either as a result of WS' damage management program activities over time, or as a result of the aggregate effects of those activities combined with the activities of other agencies and individuals.

Cumulative Impacts on Wildlife Populations

Evaluation of WS' activities relative to target species indicated that program activities will likely have no cumulative adverse effects on goose populations in Mississippi when targeting those geese responsible for the 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 are not limited to:

- Natural mortality of geese
- Harvest of geese during the regulated harvest season
- Human-induced mortality of geese through private damage management activities
- 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 Canada goose 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. WS' actions taken to minimize or eliminate damage are constrained as to scope, duration and intensity, for the purpose of minimizing or avoiding impacts to the environment. WS evaluates damage occurring, including other affected elements and the dynamics of the damaging species; determines appropriate strategies to minimize effects on environmental elements; applies damage management actions; and subsequently monitors and adjusts/ceases damage management actions (Slate et al. 1992). This process allows WS to take into consideration other influences in the environment, such as those listed above, in order to avoid cumulative adverse impacts on target species. Further discussion of cumulative impacts on goose populations are discussed in section 4.1.1.

Potential effects on non-target species from conducting goose damage management arise from the use of non-lethal and lethal methods to alleviate or prevent those damages. The use of both non-lethal and lethal methods during activities to reduce or prevent damage caused by geese has the potential to exclude, disperse, capture, or take non-target wildlife. Non-lethal methods can also exclude, disperse, and/or harass non-target wildlife as a secondary event during the primary use of those methods on target wildlife. However, non-lethal methods are often temporary and do not involve the take of non-target wildlife species. When using exclusion devices, both target and non-target wildlife can be prevented from accessing the resource which may have differing values depending on the species of wildlife. Since exclusion does not involve lethal take, cumulative impacts from the use of exclusionary methods will not cumulative impact non-target species. Exclusionary methods are often expensive and require constant maintenance to ensure effectiveness. Therefore, the use of exclusionary devices will be somewhat limited to small, high-value resources and not used to the extent that non-targets are excluded from large areas that would cumulatively impact populations from the inability to access a resource, such as potential food sources or nesting sites. The use of visual and auditory harassment and dispersion methods are generally temporary with non-target species returning after the cessation of those activities. Dispersal and harassment does not involve the take of non-target species and similar to exclusionary methods are not used to the extent or constant level that would prevent non-targets from accessing critical resources that would threaten survival of a population.

The use of lethal methods or those methods used to live-capture target species followed by euthanasia also have the potential to impact non-target wildlife through the take or capture of non-target species. Capture methods used are often methods that are set to confine target wildlife after being triggered. Capture methods are employed in such a manner as to minimize the threat to non-target species by placement in those areas frequently used by target wildlife, using baits or lures that are as species specific as possible, and modification of individual methods to exclude non-targets from capture. Most methods described in Appendix B are methods that are employed to confine wildlife that are subsequently euthanized using humane methods. WS' SOPs are intended to ensure take of non-target wildlife is minimal during the use of methods to capture target wildlife.

The use of firearms, immobilizing chemicals, and euthanasia chemicals are essentially selective for target species since identification of an individual is made prior to the application of the method. Therefore, the use of those methods will not impact non-target species.

The methods described in Appendix B all have a high level of selectivity and can be employed using WS' SOPs and minimization measures to ensure impacts to non-targets are minimal. Therefore, take under the proposed action of

non-targets will not cumulatively impact non-target species. WS' activities under the proposed action or any of the alternatives will not encourage or facilitate the take of non-target species by other entities. Cumulative impacts will be minimal on non-targets from any of the alternatives discussed.

Canada goose damage management methods used or recommended by WS' program in Mississippi will likely have no cumulative adverse effects on target and non-target wildlife populations. WS' limited lethal take of target geese is anticipated to have minimal impacts on Canada goose populations in Mississippi, the region, and in the United States. When control actions are implemented by WS, the potential lethal take of non-target wildlife species is expected to be minimal to non-existent.

Cumulative Impact Potential from Chemical Components

Chemical methods available for use under the proposed action are immobilizing and euthanizing drugs described in Appendix B. Immobilizing drugs are administered to target individuals using methods that ensure the identification of the target animal. Treated baits are administered through hand-baiting for target individuals and designed to provide a single dose to the targeted individual to ensure sedation and avoid overdose. Immobilizing drugs temporarily sedate an animal to minimize stress of handling and reduce the risks to human safety. Immobilized animals may also be euthanized using a euthanizing method described in Appendix B. WS' personnel are required to attend training courses and be certified in the use of immobilizing drugs to ensure proper care and handling occurs, to ensure the proper doses are administered, and to ensure human safety. The use of treated baits would occur primarily through targeting by hand baiting of individual animals.

Direct application of chemical methods to target species will ensure cumulative impacts do no occur to human safety and to other wildlife. All chemical methods will be track and recorded to ensure proper accounting of used and unused chemicals occurs. All chemicals will be stored and transported according the WS, Department of Transportation, FDA, and Drug Enforcement Agency regulations. The amount of chemicals used or stored by WS will be minimal to ensure human safety. Based on this information, WS' use of chemical methods, as part of the proposed action, will not have cumulative impacts on human safety. Non-lethal chemicals may be used or recommended by the WS' program in Mississippi. Characteristics of these chemicals and use patterns indicate that no significant cumulative impacts related to environmental fate are expected from their use in WS' damage management programs in Mississippi.

Cumulative Impact Potential from Non-chemical Components

All non-chemical methods described in Appendix B are used within a limited time frame, are not residual, and do not possess properties capable of inducing cumulative adverse impacts on human health and safety. All non-chemical methods are used after careful consideration of the safety of those employing methods and to the public. All capture methods are employed in areas where human activity is minimal and warnings signs are placed in conspicuous areas, when appropriate, to ensure the safety of the public. Capture methods also require direct contact to trigger ensuring that those methods, when left undisturbed will have no effect on human safety. All methods are agreed upon by the requesting entities which are made aware of the safety issues of those methods when entering into a cooperative service agreement with WS. WS' SOPs and minimization measures also ensure the safety of the public from those methods used to capture or take wildlife. A formal risk assessment conducted by APHIS determined that WS' non-chemical methods, when used as intended, poses a low risk to human safety. The use of firearms, though hazards do exist, is employed to ensure the safety of employees and the public. Based on WS' use of non-chemical methods, those methods will not cumulatively impact human safety.

Non-chemical methods used or recommended by the WS program may include exclusion through use of various barriers, habitat modification of structures or vegetation, live trapping and translocation or euthanasia of birds, nest and egg destruction, harassment of birds or bird flocks, and shooting. When control actions are implemented by WS the potential adverse effects of these control methods are expected to be minimal to non-existent.

Humaneness of Methods Employed

WS continues to seek new methods and ways to improve current technology to improve 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. Because WS continues to develop and implement more humane methods as technology advances, and also makes this information available to non-WS entities, no cumulative adverse affects from WS' activities are expected in relation to this element of the human environment.

Effects on the Aesthetic Value of Targeted Species

Those who enjoy viewing wildlife may experience a temporary reduction in being able to view wildlife at some sites where WS' program activities are implemented. However, other individuals of the same species would likely continue to be present in the affected area, and would also likely be available for viewing and enjoyment at adjacent locations.

Some people experience a decrease in aesthetic enjoyment of wildlife because they feel that overabundant species are objectionable and interfere with their enjoyment of wildlife in general. Continued increases in numbers of individuals or the continued presence of an overabundant species may lead to further degradation of some people's enjoyment of any wildlife. WS' actions could positively affect the aesthetic enjoyment of wildlife for those people that are being adversely affected by the target species identified in this EA. Overall, cumulative impacts on the aesthetic value of geese will not be diminished by WS' activities to manage damage. Geese will remain abundant in areas where damage is not occurring. The ability to enjoy geese will continue to be available for those interested in those activities.

4.3 ADDITIONAL ANALYSIS OF POTENTIAL CUMULATIVE IMPACTS

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

4.3.1 Irreversible and Irretrievable Commitments of Resources

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

4.3.2 Effects on Sites or Resources Protected under the National Historic Preservation Act

WS' Canada goose damage management actions are not undertakings that could adversely affect historic resources (See Section 1.8.2.6).

4.4 SUMMARY

No significant cumulative environmental impacts are expected from any of the 4 alternatives. Under the proposed action, the lethal removal of Canada geese by WS would not have a significant impact on overall goose populations in Mississippi, but some local reductions may occur. No risk to public safety is expected when WS' activities are provided and accepted by requesting individuals in Alternatives 1, 2, and 3, since only trained and experienced wildlife biologists/specialists would conduct and recommend damage management activities. There is a slight increased risk to public safety when persons who reject WS' assistance and recommendations in Alternatives 1, 2 and 3 and conduct their own activities, and when no WS' assistance is provided in Alternative 4. In all 4 Alternatives, however, it would not be to the point that the impacts would be significant. Although some persons will likely be opposed to WS' participation in Canada goose damage management activities on public and private lands within the state of Mississippi, the analysis in this EA indicates that WS' adaptive IWDM program will not result in significant cumulative adverse impacts on the quality of the human environment. Table 6 summarizes the expected impacts of each of the alternatives on each of the issues.

Table 6. Summary of the Expected Impacts of Each of the Alternatives on Each of the Issues Related to Canada Goose Damage Management by WS in Mississippi.

Issues	*Alternative 1 Integrated Wildlife Damage Management Program (Proposed Action/No Action)*	*Alternative 2 Technical Assistance Only*	*Alternative 3 Non-lethal Canada Goose Damage Management Only by WS*	*Alternative 4 No WS' Program*
Effects on Canada Goose Populations	Low effect - reductions in local Canada goose numbers; would not adversely affect state and flyway populations.	Low effect – No effect by WS; reductions in local Canada goose numbers by non-WS personnel likely; would not adversely affect state and flyway populations.	Low effect – No effect by WS; reductions in local Canada goose numbers by non-WS personnel likely; would not adversely affect state and flyway populations.	Low effect – No effect by WS; reductions in local Canada goose numbers by non-WS personnel likely; would not adversely affect state and flyway populations.
Effectiveness of Wildlife Damage Management Methods	The proposed action has the greatest potential of successfully reducing Canada goose conflicts and damage	Impacts could be similar or less than the proposed action dependent upon action taken by non-WS personnel.	Impacts could be similar or less than the proposed action dependent upon action taken by non-WS personnel.	Impacts could be similar or less than the proposed action dependent upon action taken by non-WS personnel.
Effects on Human Affectionate-Bonds With Individual Birds and On Aesthetics	Low to moderate effect at local levels; Some local populations may be reduced; WS Canada goose damage management activities do not adversely affect overall regional or state Canada goose populations.	Low to moderate effect. No effect by WS; local Canada goose numbers in damage situations would remain high or possibly increase unless non-WS personnel successfully implement lethal methods; no adverse affect on overall regional and state Canada goose populations.	Low to moderate effect. Local Canada goose numbers in damage situations would remain high or possibly increase when non-lethal methods are ineffective unless non-WS personnel successfully implement lethal methods; no adverse affect on overall regional and state Canada goose populations.	Low to moderate effect. No effect by WS; local Canada goose numbers in damage situations would remain high or possibly increase unless non-WS personnel successfully implement lethal methods; no adverse affect on overall regional and state Canada goose populations.

Effects On Aesthetic Values of Property Damaged by Canada Geese	Low effect – Canada goose damage problems most likely to be resolved without creating or moving problems elsewhere.	Moderate to High effect – No effect by WS; Canada geese may move to other sites which can create aesthetic damage problems at new sites.	Moderate to High effect – Canada geese may move to other sites which can create aesthetic damage problems at new sites. Less likely than Alt. 2 and 4.	High – No effect by WS; nuisance Canada goose problems less likely to be resolved without WS involvement. Canada geese may move to other sites which can create aesthetic damage problems at new sites
Humaneness and Animal Welfare Concerns of Methods Used by WS	Low to moderate effect - methods viewed by some people as inhumane would be used by WS	No effect by WS. Impacts by non-WS personnel would be variable.	Lower effect than Alt. 1 since only non-lethal methods would be used by WS	No effect by WS. Impacts by non-WS personnel would be variable.
Effects on Non-target Wildlife Species Populations, Including T&E Species	Low effect - methods used by WS would be highly selective with very little risk to non-target species.	No effect by WS. Impacts by non-WS personnel would be variable.	Low effect - methods used by WS would be highly selective with very little risk to non-target species.	No effect by WS. Impacts by non-WS personnel would be variable.

5.0 CHAPTER 5: LIST OF PREPARERS AND PERSONS CONSULTED

5.1 LIST OF PREPARERS

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APPENDIX A

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APPENDIX B

Canada Goose Damage Management Methods Available for Use or Recommended by WS in Mississippi

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

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

A variety of methods are potentially available to the WS program in Mississippi relative to the management or reduction of damage from Canada geese. Various federal, state, and local statutes and regulations and WS' directives govern WS' use of damage management tools and substances. WS develops and recommends or implements IWDM strategies based on resource management, physical exclusion and wildlife management approaches. Within each approach there may be available a number of specific methods or tactics. The following methods and materials are recommended or used in technical assistance and direct damage management efforts of the WS program in Mississippi.

RESOURCE MANAGEMENT

Resource management includes a variety of practices that may be used by resource owners to reduce the potential for wildlife damage. Implementation of these practices is appropriate when the potential for damage can be reduced without significantly increasing a resource owner's costs or diminishing his/her ability to manage resources pursuant to goals. Resource management recommendations are made through WS technical assistance efforts.

Habitat Alteration: Habitat alteration can be the planting of vegetation unpalatable to wildlife or altering the physical habitat (Conover and Kania 1991, Conover 1992). Conover (1991) found that even hungry Canada geese refused to eat some ground covers such as common periwinkle (*Vinca minor*), English ivy (*Hedera helix*) and Japanese pachysandra (*Pachysandra terminalis*). Planting less preferred plants or grasses to discourage geese from a specific area could work more effectively if good alternative feeding sites are nearby (Conover 1985). However, the manipulation of turf grass varieties in urban/suburban, heavy use situations such as parks, athletic fields and golf courses is often not feasible. Varieties of turf grass that grow well and can withstand regular mowing and regular/heavy human use include: Kentucky blue grass, red fescue, perennial bent grass, perennial rye grass and white clover. All of these grasses are appealing to most waterfowl. The turf grass varieties that are not appealing to geese such as tall fescue, orchard grass and timothy do not withstand regular mowing and/or regular/heavy human use.

Fences, hedges, shrubs, boulders, and other structures can be placed at shorelines to impede waterfowl movements. Restricting a bird's ability to move between water and land will deter them from an area, especially during molts (Gosser et al. 1997). However, people are often reluctant to make appropriate landscape modifications to discourage waterfowl activity (Breault and McKelvey 1991, Conover and Kania 1991). Unfortunately, both humans and geese appear to find lawn areas near water attractive (Addison and Amernic 1983), and conflicts between humans and geese will likely continue wherever this interface occurs.

Removal of water bodies would likely reduce the attractiveness of an area to geese. Urban/suburban geese tend to feed near bodies of water with a distant view over short grass (Conover and Kania 1991). Draining/removal of water bodies are considered unreasonable and aesthetically unacceptable. The draining of wetlands is strictly regulated by the U.S. Army Corps of Engineers and the Department of Environmental Protection.

Lure Crops: Lure crops are food resources planted to attract wildlife away from more valuable resources (e.g., crops). This method is largely ineffective for urban geese since food (turf) resources are readily available. For lure crops to be effective, the ability to keep birds from surrounding fields would be necessary, and the number of alternative feeding sites must be minimal (Fairaizl and Pfeifer 1988). Additionally, lure crops reduce damage for only a short time (Fairaizl and Pfeifer 1988) and damage by geese is generally continuous. The resource owner is limited in implementing this method contingent upon ownership of, or otherwise ability to manage the property. Unless the original goose-human conflict is resolved, creation of additional goose habitat could increase future conflicts.

Lure crops may be planted on some land held in private ownership, such as conservation clubs, throughout Mississippi. These plantings may provide some additional food or act as an attractant for geese. However, it is highly unlikely they contribute to conflicts with geese or act as significant attractants.

Modify Human Behavior: Artificial feeding of geese by people attracts and sustains more birds in an area than could be supported by natural food supplies. This unnatural food source exacerbates damage by geese. The elimination of feeding of geese is a primary recommendation made by WS, and many local municipalities and homeowners associations have adopted policies and ordinances prohibiting it. Some parks have posted signs, and there have been efforts made to educate the public on the negative aspects of feeding geese. However, sometimes people do not comply, and the policies are poorly enforced in some areas.

Alternatively, some entities do not prohibit the feeding of geese because the goose population in the location has not exceeded the WAC. It is unlikely that the feeding of Canada geese in these locations would significantly contribute to conflicts with waterfowl in other communities or locations.

Alter Aircraft Flight Patterns: In cases where the presence of Canada geese at airports results in threats to human safety, and when such problems cannot be resolved by other means, the alteration of aircraft flight patterns or schedules may be recommended. However, altering operations at airports to decrease the potential for hazards is not feasible unless an emergency situation exists. Otherwise, the expense of interrupted flights and the limitations of existing facilities make this practice prohibitive.

Removal of Domestic Waterfowl: Flocks of urban waterfowl are known to act as decoys and attract other migrating waterfowl (Crisley et al. 1968, Woronecki 1992, AAWV undated). Avery (1994) reported that birds learn to locate food resources by watching the behavior of other birds. The removal of geese from water bodies removes birds that act as decoys in attracting other waterfowl. Geese could also carry diseases which threaten wild populations. Property or resource owners may be reluctant to remove some or all decoy birds because of the enjoyment of their presence.

PHYSICAL EXCLUSION AND DETERRENTS

Physical exclusion and deterrents restrict the access of wildlife to resources and/or alters behavior of target animals to reduce damage. These methods provide a means of appropriate and effective prevention of goose damage in many situations. When threatened and endangered species exist on a site, certain methods will not be incorporated in management plans. Exclusions/scare devices will not be used in areas that are frequented by the wood stork, bald eagle, red cockaded woodpecker, and other threatened and endangered species.

Electric Fence: The application of electrified fencing is generally limited to rural settings, due to the possibility/likelihood of electricity interacting with people and pets. Limits of this application arise where there are multiple landowners along the wetland, pond, or lake, and the size of the field and its proximity to bodies of water used by geese. Perceptions from Minnesota on the effectiveness of electric fences were high (Cooper and Keefe 1997). While electric fencing may be effective in repelling geese in some urban settings, its use is often prohibited

in many municipalities for human safety reasons. Problems that typically reduce the effectiveness of electric fences include; vegetation on fence, flight capable geese, fencing knocked down by other animals (e.g., white-tailed deer and dogs), and poor power.

Barrier Fence: The construction or placement of physical barriers has limited application for geese. Barriers can be temporary or permanent structures. Lawn furniture/ornaments, vehicles, boats, snow fencing, plastic hazard fencing, metal wire fencing, and multiple strand fencing have all been used to limit the movement of Canada geese. The application of this method is limited to areas that can be completely enclosed and do not allow waterfowl to land inside enclosures. Similar to most abatement techniques, this method has been most effective when dealing with small numbers of breeding geese and their flightless young along wetlands and/or waterways. Unfortunately, there have been situations where barrier fencing designed to inhibit goose nesting has entrapped young and resulted in starvation (Cooper 1998). The preference for geese to walk or swim, rather than fly, during this time period contributes to the success of barrier fences. Birds that are capable of full or partial flight render this method useless, except for enclosed areas small enough to prevent landing.

Surface Coverings: Waterfowl may be excluded from ponds using overhead wire grids (Fairaizl 1992, Lowney 1993). Overhead wire grids have been demonstrated to be most applicable on ponds $\leq$ two acres, but wire grids may be considered aesthetically unappealing to some people. Wire grids render a pond unusable for boating, swimming, fishing, and other recreational activities. Installation costs are about $1,000 per surface acre for materials. The expense of maintaining wire grids may be burdensome for some people.

Balls approximately five inches in diameter can be used to cover the surface of a pond. A "ball blanket" renders a pond unusable for boating, swimming, fishing, and other recreational activities. This method is very expensive, costing about $131,000 per surface acre of water.

Visual Deterrents: Reflective tape has been used successfully to repel some birds from crops when spaced at three to five meter intervals (Bruggers et al. 1986, Dolbeer et al. 1986). Mylar flagging has been reported effective at reducing migrant Canada goose damage to crops (Heinrich and Craven 1990). Flagging is impractical in many locations and has met with some local resistance due to the negative aesthetic appearance presented on the properties where it is used. Other studies have shown reflective tape ineffective (Bruggers et al. 1986, Dolbeer et al. 1986, Tobin et al. 1988, Conover and Dolbeer 1989). While sometimes effective for short periods of time, reflective tape has proven mostly ineffective in deterring resident geese.

Mute Swans: Mute swans are ineffective at preventing Canada geese from using or nesting on ponds (Conover and Kania 1994). Additionally, swans can be aggressive towards humans (Conover and Kania 1994, Chasko 1986) and may have undesirable effects on native aquatic vegetation (Chasko 1986). Executive Order 13112, states that federal agencies shall encourage states, local governments, and private citizens to prevent the introduction of exotic species into the environment. The use of mute swans as a Canada goose damage management technique is ineffective, and not recommended.

Dogs: Dogs can be effective at harassing waterfowl and keeping them off turf and beaches (Conover and Chasko 1985, Castelli and Sleggs 2000). Around water, this technique appears most effective when the body of water to be patrolled is less than two acres in size (Swift 1998). Although dogs can be effective in keeping waterfowl off individual properties, they do not contribute to a solution for the larger problem of overabundant goose populations (Castelli and Sleggs 2000). Swift (1998) and numerous individuals in New Jersey have reported that when harassment with dogs ceases, the number of geese returns to pre-treatment numbers. WS has recommended and encouraged the use of dogs where appropriate.

Repellents: To use chemical repellents for goose damage management in Mississippi, State regulations governing use of restricted chemicals must be followed.

Methyl Anthranilate (MA) (artificial grape flavoring used in foods and soft drinks for human consumption) could be used or recommended by WS as a waterfowl repellent. Methyl Anthranilate is a registered repellent for waterfowl and is marketed under the trade names ReJeX-iT and Bird Shield. The material has been shown to be nontoxic to

bees (LD_{50} > 25 micrograms/bee[8]), nontoxic to rats in an inhalation study (LC_{50} > 2.8 mg/L[9]), and of relatively low toxicity to fish and other invertebrates. Methyl anthranilate is naturally occurring in concord grapes and in the blossoms of several species of flowers and is used as a food additive and perfume ingredient (Dolbeer et al. 1992). It has been listed as "Generally Recognized as Safe" by the FDA (Dolbeer et al. 1992).

Methyl anthranilate has been shown to be a promising repellent for many bird species (Dolbeer et al. 1993). It is registered for applications to turf or to surface water areas used by unwanted birds. Cummings et al. (1995) reported that MA repelled Canada geese from grazing turf for four days. However, Belant et al. (1996) found it ineffective as a grazing repellent when applied at 22.6 and 67.8 kg/ha which is the label rate and triple the label rate, respectively. MA is water soluble therefore, moderate to heavy rain or daily watering and/or mowing render MA ineffective.

Water surface and turf applications of MA are generally considered expensive. For example, the least intensive application rate required by label directions is 20 lbs. of product (8 lbs. active ingredient) per acre of surface water at a cost of about $64/lb., with re-treatment required every 3-4 weeks. The cost of treating turf areas would be similar on a per acre basis. Also, MA completely degrades in about 3 days when applied to water, which indicates the repellent effect is short-lived.

Another potentially more cost-effective method of MA application is by use of a fog-producing machine (Vogt 1997). The fog drifts over the area to be treated and is irritating to the birds while being non-irritating to any humans that might be exposed. Fogging applications must generally be repeated 3-5 times after the initial treatment before the birds abandon a treatment. Applied at a rate of about 0.25 l/acre of water surface, the cost is considerably less than when using the turf or water treatment methods.

Other Repellents. Research continues on other avian feeding repellents. A 50% anthraquinone product (FlightControl) shows promise for waterfowl (Dolbeer et al. 1998). Like MA, anthraquinone has low toxicity to birds and mammals. Activated charcoal has also been evaluated for use in deterring waterfowl damage, but it requires frequent re-application to effectively reduce waterfowl damage (Mason and Clark 1994). Further, laboratory and field trials are needed to refine minimum repellent levels and to enhance retention of treated vegetation (Sinnott 1998). Askham (1997) found that by only treating the initial 100 ft of turf from the waters edge across the entire waterline can deter use of the entire damaged area. This can reduce the high costs associated with the use of chemical deterrents.

Hazing: Hazing reduces losses in those instances when the affected geese move to a more acceptable area. Achieving that end has become more difficult as the local goose population has increased. Birds hazed from one area where they are causing damage, frequently move to another area where they cause damage (Brough 1969, Conover 1984, Summers 1985, Swift 1998). Smith et al. (1999) noted that others have reported similar results, stating: "biologists are finding that some techniques (e.g., habitat modifications or scare devices) that were effective for low to moderate population levels tend to fail as flock sizes increase and waterfowl become more accustomed to human activity". Whiteford (2003) used a combination of noise harassment, dogs, nest displacement, and visual harassment to chase geese from an urban park during the nesting season. Birds responded by dispersing and continued harassment with alarm calls prevented recolonization of the site during the nesting season. Generally speaking, birds tend to habituate to hazing techniques (Zucchi and Bergman 1975, Summers 1985, Aubin 1990). In some locations and circumstances, hazing is a useful component of a goose damage management program.

Scarecrows: The use of scarecrows has had mixed results. Effigies depicting alligators, humans, floating swans and dead geese have been employed, with limited success for short time periods in small areas. An integrated approach (swan and predator effigies, distress calls and non-lethal chemical repellents) was found to be ineffective at scaring or repelling nuisance waterfowl (Conover and Chasko 1985). While Heinrich and Craven (1990) reported that using scarecrows reduced migrant Canada goose use of agricultural fields in rural areas, their effectiveness in scaring geese from suburban/urban areas is severely limited because geese are not afraid of humans as a result of nearly constant contact with people. In general, scarecrows are most effective when they are moved frequently,

[8] An LD_{50} is the dosage in milligrams of material per kilogram of body weight, or, in this case in micrograms per individual bee, required to cause death in 50% of a test population of a species.

[9] An LC_{50} is the dosage in milligrams of material per liter of air required to cause death in 50% of a test population of a species through inhalation.

alternated with other methods, and are well maintained. However, scarecrows tend to lose effectiveness over time and become less effective as goose populations increase (Smith et al. 1999).

Distress Calls: Aguilera et al. (1991) found distress calls ineffective in causing migratory and resident geese to abandon a pond. Although, Mott and Timbrook (1988) reported distress calls as effective at repelling resident geese 100 meters from the distress unit, the birds would return shortly after the calls stopped. The repellency effect was enhanced when pyrotechnics were used with the distress calls. In some situations, the level of volume required for this method to be effective in urban/suburban areas would be prohibited by local noise ordinances. A similar device, which electronically generates sound, has proven ineffective at repelling migrant waterfowl (Heinrich and Craven 1990).

Lasers and Lights: The use of lasers as non-lethal avian damage control tools, have recently been evaluated for a number of species (Blackwell et al. 2002); research on this potential tool has been conducted in a replicated format only for double-crested cormorants (Glahn et al. 2000). Lasers were found to be only moderately effective for harassing geese, with significant reduction in night roosting, but little to no reduction in diurnal activity at the site pre- and post-use (Sherman 2003). The integrated use of lasers as part of goose damage management programs by WS in Mississippi may increase program effectiveness, and would be incorporated as appropriate. Wide scale public use of lasers is not typically recommended at this time, pending additional research (on effectiveness and impacts) on its use as a goose damage management tool. In some situations (neighborhoods, schools, hospitals), use of lasers may enhance integrated control programs since they are silent and do not fire a projectile.

Similarly to the use of lasers, application of spotlights to haze geese from night roosts has proven to be a moderately effective method. The benefits are similar to lasers with the potential to use in highly urban or residential areas without disturbing the pubic. It is a method that can be incorporated with other methods in integrated management plans (VerCauteren et al. 2003).

Pyrotechnics: Pyrotechnics (screamer shells, bird bombs, and 12-gauge cracker shells) have been used to repel many species of birds (Booth 1994). Aguilera et al. (1991) found 15mm screamer shells effective at reducing resident and migrant Canada geese use of areas of Colorado. However, Mott and Timbrook (1988) and Aguilera et al. (1991) doubted the efficacy of harassment and believed that moving the geese simply redistributed the problem to other locations.

Fairaizl (1992) and Conomy et al. (1998) found the effectiveness of pyrotechnics highly variable among different flocks of waterfowl. Some flocks in urban areas required continuous harassment throughout the day with frequent discharges of pyrotechnics. The waterfowl usually returned within hours. A minority of resident Canada goose flocks in Virginia showed no response to pyrotechnics (Fairaizl 1992). Some flocks of Canada geese in Virginia have shown quick response to pyrotechnics during winter months suggesting migrant geese made up some or all of the flock (Fairaizl 1992). Shultz et al. (1988) reported fidelity of resident Canada geese to feeding and loafing areas is strong, even when heavy hunting pressure is ongoing. Mott and Timbrook (1988) concluded that the efficacy of harassment with pyrotechnics is partially dependent on availability of alternative loafing and feeding areas. Although one of the more effective methods of frightening geese away, more often than not pyrotechniques simply move geese to other areas. There are also safety and legal implications regarding their use. Discharge of pyrotechnics is inappropriate and prohibited in some urban/suburban areas. Pyrotechnic projectiles can start fires, ricochet off buildings, pose traffic hazards, and trigger dogs to bark incessantly, annoy and possibly injure people.

Use of pyrotechnics in certain municipalities would be constrained by local firearm discharge and noise ordinances.

Propane Cannons: Propane cannons produce a noise that is intended to represent a firearm discharge. Cannons are attached to a propane tank and regulated to discharge at certain intervals. Propane cannons are generally inappropriate for urban/suburban areas due to the repeated loud explosions, which many people would consider a serious and unacceptable nuisance and potential health threat (hearing damage). Although a propane cannon can be an effective dispersal tool for migrant waterfowl in agricultural settings, resident waterfowl in urban areas are more tolerant of noise and habituate to propane cannons relatively quickly.

POPULATION MANAGEMENT

Potential methods of managing the local goose population include capture and relocation, contraception, egg destruction, hunting, shooting, and capture and euthanize. The advantages of lethal damage management by WS are that it would be applied directly to those identified as causing the damage or threat, its effects are obvious and immediate, and it carries no risk that the birds will return or move and create conflicts elsewhere. The primary disadvantage is that it is sometimes more socially controversial than other techniques. The use of lethal methods to reduce goose damage can be very effective at alleviating damage and the most economical approach to reducing damage when compared to non-lethal methods (Cooper and Keefe 1997). Additionally, capture and removal of waterfowl is the most cost efficient lethal method to reduce damage, except for hunting (Cooper and Keefe 1997). Moreover, the use of lethal methods has longer effectiveness than non-lethal methods because it would likely take months to years before the original local population level of waterfowl returned. Lethal methods would also reduce conflicts among resource owners whereas non-lethal actions only move the waterfowl among resource owners (i.e., spread the damage) (Cooper and Keefe 1997, Smith et al. 1999), and possibly leave resource owners with the fewest financial means burdened with the geese and the damage.

Capture and Relocation: Geese are live captured through the use of non-chemical (panel nets, rocket nets, drive traps, net guns, dip nets, by hand, etc.) or chemical (alpha-choloralose) methods. Upon capture, birds could be transferred to waterfowl crates for relocation to suitable habitat away from the capture site. To discourage the return of geese to capture sites the primary wing feathers of relocated geese are typically clipped. Geese with clipped wings are able to fly after their next molting.

Smith (1996) reported that groups of juvenile geese relocated from urban to rural settings can effectively eliminate these geese from urban areas, retain them at the release site, include them in the sport harvest, and expose them to higher natural mortality. Smith (1996) also reported that multiple survival models indicated that survival estimates of relocated juveniles were half of those of urban captured and released birds.

Ultimately, the relocation of resident geese from metropolitan communities can assist in the reduction of overabundant populations (Cooper and Keefe 1997), and has been accepted by the general public as a method of reducing goose populations to socially acceptable levels (Fairaizl 1992, Powell et. al. 2003). In areas where interest in hunting is high, the potential exists for moving nuisance birds to more rural areas to supplement huntable populations. In addition, the removal of geese posing or likely to pose a hazard to air safety at airports has been demonstrated to reduce the population of local geese and decrease the number of flights through the airport operations airspace; and resulted in increased air safety at the Minneapolis-St. Paul International Airport (Cooper 1991).

Relocation of resident geese has the potential to spread disease into populations of other and/or migrating waterfowl. As stated in the USFWS resident Canada goose management FEIS (2005a), the American Association of Wildlife Veterinarians (undated) "…discourages the practice of relocating nuisance or excess urban ducks, geese and swans to other parks or wildlife areas as a means of local population control." Currently in Mississippi, relocation of Canada geese is not considered an option. MDWFP discourages the practice and the Mississippi WS program currently lethally removes all captured birds. If relocation policies of the MDWFP are adjusted to allow for the relocation of captured geese, WS would coordinate efforts with the MDWFP to locate suitable habitat and willing property owners.

Sterilization: Although, Canada geese have been successfully sterilized to prevent production of young, this method is only effective if the female does not form a bond with a different male. In addition, vasectomies can only prevent the production of the mated pair. The ability to identify breeding pairs for isolation and to capture a male bird for vasectomization becomes increasingly difficult as the number of birds increase (Converse and Kennelly 1994). Geese have a long life span once they survive their first year (Cramp and Simmons 1977, Allan et al. 1995); leg-band recovery data indicate that some waterfowl live longer than 20 years. The sterilization of resident geese would not reduce the damage caused by the overabundance of the goose population since the population would remain relatively stable. Keefe (1996) estimated sterilization of a Canada goose to cost over $100 per bird.

Nicarbazin (NCZ): OvoControl–G™ is an EPA registered reproductive inhibitor containing NCZ that can be used to reduce Canada goose egg production and viability. NCZ is registered for use at site specific locations in highly

populated urban areas. The user of this chemical product must adhere to all EPA use restrictions. VerCauteren et al. (2000) examined the use of NCZ to reduce Canada goose egg production and viability, and found that NCZ did experimentally reduce egg viability, but that there were difficulties in delivery methods and acceptance of treated feed. NCZ is not currently registered for use in Mississippi. If NCZ becomes available for use in Mississippi, WS will evaluate the use as part of an integrated damage management strategy and will supplement the EA pursuant to NEPA as appropriate.

Egg Destruction/Reproduction Control: Egg addling, oiling, freezing, egg replacement, or puncturing can be effective in reducing recruitment into the local population (Christens et al. 1995, Cummings et al. 1997). Throughout the goose nesting season, eggs may be treated or destroyed to eliminate reproduction on the site, which may slow the growth of the local population and increase the effects of harassment activities. Geese typically lay one egg every 1-2 days for a total of 4-8 eggs/nest; the incubation period for goose eggs is approximately 28 days.

While egg removal/destruction can reduce production of young, merely destroying an egg does not reduce a population as quickly as removing immature or breeding adults (Cooper and Keefe 1997). Approximately five eggs must be removed to have the effect of stopping one adult from joining the breeding population (Rockwell et al. 1997, Schmutz et al. 1997). Keefe (1996) estimated egg destruction to cost $40 for the equivalent of removing one adult goose from the population. To equal the effect of removing an adult bird from a population, all eggs produced by that bird during its entire lifetime must be removed (Smith et al. 1999). Furthermore, egg removal efforts must be nearly complete in order to prevent recruitment from a small number of surviving nests that would offset control efforts (Smith et al. 1999). Cooper and Keefe (1997), Rockwell et al. (1997), and Schmutz et al. (1997) reported that egg destruction is only fractionally effective in attaining population reduction objectives, and that nest/egg destruction is not an efficient or cost-effective damage management or population reduction approach.

The Atlantic Flyway Resident Canada Goose Management Plan (Atlantic Flyway Council 1999), states that to effectively reduce resident goose populations, an increase in adult and immature mortality rates, combined with reproductive control, is necessary. Reproductive control alone can not reduce the population in an acceptable time; treatment of 95% of all eggs each year would result in only a 25% reduction over 10 years (Allan et al. 1995). In contrast, reducing annual survival of resident Canada geese by just 10% would reduce a predicted growth rate of more than 15%/year to a stable population, assuming moderate recruitment (Atlantic Flyway Council 1999). In addition, nest destruction is estimated to cost significantly more than other forms of population management (Cooper and Keefe 1997). Egg destruction, while a valuable tool, has fallen short as a single method for reducing local waterfowl populations. Many nests cannot be found by resource managers in typical urban-suburban settings due to the difficulties in gaining access to search the hundreds of private properties where nests may occur. In addition, waterfowl which have eggs oiled in successive years may learn to nest away from the water making it more difficult to find nests.

VerCauteren et al. (2000) and VerCauteren and Marks (2004) examined the use of Nicarbazin (NCZ) to reduce Canada goose egg production and viability, and found that NCZ did experimentally reduce egg viability, but that there were difficulties in delivery methods and acceptance of treated feed. Additional research and field trials to document the extent to which NCZ is effective and practical as an operational population management tool are needed before this material is available to wildlife managers in field applications. Other methods that reduce hatch rate have been developed and tested recently. Hill and Craven (2003) found that conjugated linoleic acid when used in controlled experiments significantly reduced hatch rate dependant on dosage, but suggest there are application obstacles related to widespread application in the field.

Capture with Alpha-Chloralose: Alpha-Chloralose (AC) is a central nervous system depressant used as an immobilizing agent to capture and remove pigeons, waterfowl and other birds. It is labor intensive and in some cases, may not be cost effective (Wright 1973, Feare et al. 1981). Alpha-chloralose is typically delivered as well contained bait in small quantities with minimal hazards to pets and humans; single bread or corn baits are fed directly to the target birds. WS personnel are present at the site of application during baiting to retrieve the immobilized birds. Unconsumed baits are removed from the site following each treatment. Alpha-chloralose was eliminated from more detailed analysis in WS' programmatic FEIS (USDA 1997) based on critical element screening; therefore, environmental fate properties of this compound were not rigorously assessed. However, the solubility and mobility are believed to be moderate and environmental persistence is believed to be low. Bioaccumulation in plants and animal tissue is believed to be low. The compound is slowly metabolized, with

recovery occurring a few hours after administration (Schafer 1991). The dose used for immobilization is designed to be about two to 30 times lower than the LD_{50}. Mammalian data indicate higher LD_{50} values than birds. Toxicity to aquatic organisms is unknown (Woronecki et al. 1990), but the compound is generally not soluble in water and, therefore, should remain unavailable to aquatic organisms. Factors supporting the determination of this low potential included the lack of exposure to pets, non-target species and the public, and the low toxicity of the active ingredient. Other supporting rationale for this determination included relatively low total annual use and a limited number of potential exposure pathways. The agent is currently approved for use by WS as an Investigative New Animal Drug by the FDA, rather than as a pesticide.

Alpha-Chloralose may be used only by WS personnel to live capture waterfowl. Pursuant to FDA restrictions, waterfowl captured with AC for subsequent euthanasia must be killed and buried or incinerated, or be held alive for at least 30 days, at which time the birds may be killed and processed for human consumption.

Toxicants: All pesticides are regulated by the EPA. There are currently no toxicants registered with the EPA for use on waterfowl and therefore none would be used by WS.

Hunting: WS sometimes recommends that resource owners consider legal hunting as an option for reducing waterfowl damage. Although legal hunting is impractical and/or prohibited in many urban-suburban areas, it can be used to reduce some populations of resident geese. Legal hunting also reinforces harassment programs (Kadlec 1968). Zielske et al. (1993) believed legal hunting would not reduce resident Canada geese populations where there is limited interest in legally hunting resident geese. However, hunting has had a major impact on the distribution of geese in the Minneapolis-St. Paul Metro Area of Minnesota (Cooper and Keefe 1997). They reported goose densities during the summer in hunted areas of the Metro Area (which comprised only 23% of the area) were significantly lower (three times lower) than densities in unhunted areas. Similarly, Conover and Kania (1991) reported that Canada geese were more likely to cause damage in areas that waterfowl hunting was prohibited. Even in urban/suburban areas (e.g., golf courses and green spaces) there may be locations where controlled hunting would be effective in reducing goose damage. In Mississippi, Canada geese are legally harvested during 2 seasons: the regular season and early September season. These seasons and annual harvests are described in Table 1 and Table 2 respectively.

Shooting: Shooting geese can be highly effective in removing birds from specific areas and in supplementing harassment. Shooting is the practice of selectively removing target birds. Shooting a few individuals from a larger flock can reinforce birds' fear of harassment techniques. Shooting is used to reduce Canada goose problems when lethal methods are determined to be appropriate. The birds are killed as quickly and humanely as possible. In Mississippi, shooting geese pursuant to a depredation permit is conducted primarily by farmers, airport personnel, municipal and county park personnel, and others.

Capture and Euthanize: The most efficient way to reduce the size of resident waterfowl population is to increase mortality among adult geese. Nationwide, hunting is the major cause of waterfowl mortality, but waterfowl may seldom be available to hunters in an urban-suburban environment (Conover and Chasko 1985, Smith et al. 1999). For purposes of lethal control, waterfowl are usually captured with panel nets, rocket nets, drive traps, net guns, dip nets, and/or by hand. Panel nets as described by Costanzo et al. (1995) are lightweight, portable panels (approximate size 4' x 10') that are used to herd and surround waterfowl into a moveable catch pen. This method is equally efficient on hard (pavement) and soft (field) surfaces, and can be employed in such a way as to reduce stress on captured birds (place the catch pen in a shaded area) and control other impacts (place far from roadways). Rocket netting involves the setting of bait in an area that would be completely contained within the dimensions of a manually propelled net. The launching of the rocket net occurs too quickly for the birds to escape. Rocket netting may take place anytime during the year. Using a net gun to capture waterfowl can be conducted anytime during the year by firing a net from a shoulder mounted gun. Canada geese that are captured and euthanized would be buried, incinerated, or processed for charitable donation.

APPENDIX C

Federal and State Threatened and Endangered Species in Mississippi

U.S. Fish & Wildlife Service

Mississippi

39 Federally Protected Species

E = Endangered Species and T = Threatened Species

mammals

E -- Bat, Gray (*Myotis grisescens*)
E -- Bat, Indiana (*Myotis sodalis*)
T -- Bear, Louisiana Black (*Ursus americanus luteolus*)
E -- Manatee, West Indian (*Trichechus manatus*)

birds

E -- Crane, Mississippi Sandhill (*Grus canadensis pulla*)
T -- Eagle, Bald (*Haliaeetus leucocephalus*) —proposed for delisting
E -- Pelican, Brown (*Pelecanus occidentalis*)
T -- Plover, Piping (*Charadrius melodus*)
E -- Tern, Least - interior population (*Sterna antillarum*)
E -- Woodpecker, Red-cockaded (*Picoides borealis*)

reptiles and amphibians

E -- Frog, Mississippi (Dusky)Gopher (*Rana sevosa*)
T -- Sea Turtle, Green (*Chelonia mydas*)
E -- Sea Turtle, Hawksbill (*Eretmochelys imbricata*)
E -- Sea Turtle, Kemp's Ridley (=Atlantic) (*Lepidochelys kempii*)
E -- Sea Turtle, Leatherback (*Dermochelys coriacea*)
T -- Sea Turtle, Loggerhead (*Caretta caretta*)
T -- Snake, Eastern Indigo (*Drymarchon corais couperi*)
E --Turtle, Alabama Red-bellied (*Pseudemys alabamensis*)
T -- Turtle, Ringed Map (=sawback) (*Graptemys oculifera*)
T -- Turtle, Yellow-blotched Map (=sawback) (*Graptemys flavimaculatata*)
T -- Tortoise, Gopher (*Gopherus polyphemus*)

fish

T -- Darter, Bayou (*Etheostoma rubrum*)
T -- Sturgeon, Gulf (*Acipenser oxyrinchus desotoi*)
E -- Sturgeon, Pallid (*Sscaphirhynchus albus*)

mussels

E -- Clubshell, Black (*Pleurobema curtum*)
E -- Clubshell, Ovate (*Pleurobema perovatum*)
E -- Clubshell, Southern (*Pleurobema decisum*)
E -- Combshell, Southern (*Epioblasma penita*)
T -- Heelsplitter, Inflated (*Potamilus inflatus*)
T -- Moccasinshell, Alabama (*Medionidus acutissimus*)
T -- Mucket, Orange-nacre (*Lampsilis perovalis*)
E -- Pigtoe, flat (*Pleurobema marshalli*)
E -- Pigtoe, heavy (*Pleurobema taitianum*)
E -- Pocketbook, Fat (*Potamilus (=Proptera) caprax)*
E -- Stirrupshell (Quadrula stapes)

plants

E -- American Chaffseed (*Schwalbea americana)*
E -- Louisiana Quillwort (*Isoetes louisianensis*)
T -- Price's Potato-bean (*Apios priceana*)
E -- Pondberry (*Lindera melissifolia*)

Note: List does not include the 5 endangered whales that may occasionally be found in Mississippi coastal waters.

Extirpated Species - Once lived in Mississippi but not any more; are found elsewhere: Red Wolf, Florida Panther, Alabama Sturgeon, American Burying Beetle, Bachman's Warbler, and Ivory-billed Woodpecker.
Extinct Species - Gone forever from Mississippi and the world: Carolina Parakeet and Passenger Pigeon.
Recovered Species - Removed from the Endangered Species List: Peregrine Falcon, August 1995.
Protected Species - Due to similarity of appearance to federally listed species - American Alligator and American Black Bear.

ENDANGERED SPECIES OF MISSISSIPPI

MISSISSIPPI NATURAL HERITAGE PROGRAM

- 2003 -

SPECIES NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS
ANIMALS				
BIVALVIA				
ACTINONAIAS LIGAMENTINA	MUCKET	G5	S1	
CYCLONAIAS TUBERCULATA	PURPLE WARTYBACK	G5	S1	
ELLIPTIO ARCTATA	DELICATE SPIKE	G3G4	S1	
ELLIPTIO DILATATA	SPIKE	G5	S1	
EPIOBLASMA BREVIDENS	CUMBERLANDIAN COMBSHELL	G1	S1	(LE,XN)
EPIOBLASMA PENITA	SOUTHERN COMBSHELL	G1	S1	LE
EPIOBLASMA TRIQUETRA	SNUFFBOX	G3	S1	
LAMPSILIS PEROVALIS	ORANGE-NACRE MUCKET	G2	S1	LT
LEXINGTONIA DOLABELLOIDES	SLABSIDE PEARLYMUSSEL	G2	S1	C
MEDIONIDUS ACUTISSIMUS	ALABAMA MOCCASINSHELL	G1	S1	LT
PLETHOBASUS CYPHYUS	SHEEPNOSE	G3	S1	
PLEUROBEMA CURTUM	BLACK CLUBSHELL	G1	SH	LE
PLEUROBEMA DECISUM	SOUTHERN CLUBSHELL	G1G2	S1S2	LE
PLEUROBEMA MARSHALLI	FLAT PIGTOE	GH	SH	LE
PLEUROBEMA PEROVATUM	OVATE CLUBSHELL	G1	S1	LE
PLEUROBEMA RUBRUM	PYRAMID PIGTOE	G2	S1	
PLEUROBEMA TAITIANUM	HEAVY PIGTOE	G1	SH	LE
POTAMILUS CAPAX	FAT POCKETBOOK	G1	S1	LE
POTAMILUS INFLATUS	INFLATED HEELSPLITTER	G1	SH	LT
PTYCHOBRANCHUS FASCIOLARIS	KIDNEYSHELL	G4G5	S1	
QUADRULA CYLINDRICA CYLINDRICA	RABBITSFOOT	G3T3	S1	
QUADRULA METANEVRA	MONKEYFACE	G4	SH	
QUADRULA STAPES	STIRRUPSHELL	GH	SH	LE
MALACOSTRACA				
FALLICAMBARUS GORDONI	CAMP SHELBY BURROWING CRAWFISH	G1	S1	C
INSECTA				
NICROPHORUS AMERICANUS	AMERICAN BURYING BEETLE	G2G3	SX	LE
OSTEICHTHYES				
ACIPENSER OXYRINCHUS DESOTOI	GULF STURGEON	G3T2	S1	LT
ALOSA ALABAMAE	ALABAMA SHAD	G3	S1	C
CRYSTALLARIA ASPRELLA	CRYSTAL DARTER	G3	S1	
ETHEOSTOMA BLENNIOIDES	GREENSIDE DARTER	G5	SH	
ETHEOSTOMA RUBRUM	BAYOU DARTER	G1	S1	LT
FUNDULUS JENKINSI	SALTMARSH TOPMINNOW	G2	S3	C
NOTROPIS BOOPS	BIGEYE SHINER	G5	S1	
NOTROPIS CHALYBAEUS	IRONCOLOR SHINER	G4	S2	
NOTURUS EXILIS	SLENDER MADTOM	G5	S1	
NOTURUS MUNITUS	FRECKLEBELLY MADTOM	G3	S2	
NOTURUS STIGMOSUS	NORTHERN MADTOM	G3	S1	
PERCINA AURORA	PEARL DARTER	G1	S1	C
PERCINA PHOXOCEPHALA	SLENDERHEAD DARTER	G5	S1	
PHENACOBIUS MIRABILIS	SUCKERMOUTH MINNOW	G5	S1	
PHOXINUS ERYTHROGASTER	SOUTHERN REDBELLY DACE	G5	S2	
SCAPHIRHYNCHUS ALBUS	PALLID STURGEON	G1	S1	LE
SCAPHIRHYNCHUS SUTTKUSI	ALABAMA STURGEON	G1	S1	LE

AMPHIBIA

AMBYSTOMA TIGRINUM	TIGER SALAMANDER	G5	S1	(PS)
AMPHIUMA PHOLETER	ONE-TOED AMPHIUMA	G3	S1	
ANEIDES AENEUS	GREEN SALAMANDER	G3G4	S1	
CRYPTOBRANCHUS ALLEGANIENSIS	HELLBENDER	G3G4	S1	(PS)
EURYCEA LUCIFUGA	CAVE SALAMANDER	G5	S1	
GYRINOPHILUS PORPHYRITICUS	SPRING SALAMANDER	G5	S1	
RANA SEVOSA	DARK GOPHER FROG	G1	S1	LE

REPTILIA

CARETTA CARETTA	LOGGERHEAD; CABEZON	G3	S1B,SZN	LT
CHELONIA MYDAS	GREEN TURTLE	G3	SZN	(LE,LT)
DERMOCHELYS CORIACEA	LEATHERBACK; TINGLAR	G2	SZN	LE
DRYMARCHON CORAIS COUPERI	EASTERN INDIGO SNAKE	G3	S1	LT
ERETMOCHELYS IMBRICATA	HAWKSBILL; CAREY	G3	SZN	LE
FARANCIA ERYTROGRAMMA	RAINBOW SNAKE	G5	S2	
GOPHERUS POLYPHEMUS	GOPHER TORTOISE	G3	S2	(PS:LT)
GRAPTEMYS FLAVIMACULATA	YELLOW-BLOTCHED MAP TURTLE	G2	S2	LT
GRAPTEMYS NIGRINODA	BLACK-KNOBBED MAP TURTLE	G3	S2	
GRAPTEMYS OCULIFERA	RINGED MAP TURTLE	G2	S2	LT
HETERODON SIMUS	SOUTHERN HOGNOSE SNAKE	G2	SH	
LEPIDOCHELYS KEMPII	KEMP'S OR ATLANTIC RIDLEY	G1	S1N	LE
PITUOPHIS MELANOLEUCUS LODINGI	BLACK PINE SNAKE	G4T3	S2	C
PSEUDEMYS ALABAMENSIS	ALABAMA REDBELLY TURTLE	G1	SR	LE

AVES

CAMPEPHILUS PRINCIPALIS	IVORY-BILLED WOODPECKER	GH	SX	LE
CHARADRIUS ALEXANDRINUS TENUIROSTRIS	SOUTHEASTERN SNOWY PLOVER	G4T3Q	S2B,SZN	
CHARADRIUS MELODUS	PIPING PLOVER	G3	SZN	(LE,LT)
FALCO PEREGRINUS	PEREGRINE FALCON	G4	SZN	(PS:LE)
GRUS CANADENSIS PULLA	MISSISSIPPI SANDHILL CRANE	G5T1	S1	LE
HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	G4	S1B,S2N	(PS:LT,PDL)
MYCTERIA AMERICANA	WOOD STORK	G4	S1N	(PS:LE)
PELECANUS OCCIDENTALIS	BROWN PELICAN	G4	S1N	(PS:LE)
PICOIDES BOREALIS	RED-COCKADED WOODPECKER	G3	S1	LE
STERNA ANTILLARUM ATHALASSOS	INTERIOR LEAST TERN	G4T2Q	S3?B	(PS:LE)
THRYOMANES BEWICKII	BEWICK'S WREN	G5	S2S3B,SZN	
VERMIVORA BACHMANII	BACHMAN'S WARBLER	GH	SXB	LE

MAMMALIA

MYOTIS GRISESCENS	GRAY MYOTIS	G3	SAN	LE
MYOTIS SODALIS	INDIANA OR SOCIAL MYOTIS	G2	SAN	LE
PUMA CONCOLOR CORYI	FLORIDA PANTHER	G5T1	SH	LE
TRICHECHUS MANATUS	MANATEE	G2	SZ	LE
URSUS AMERICANUS	BLACK BEAR	G5	S1	(PS)
URSUS AMERICANUS LUTEOLUS	LOUISIANA BLACK BEAR	G5T2	S1	LT

PLANTS

ISOETOPSIDA

ˇ ISOETES LOUISIANENSIS	LOUISIANA QUILLWORT	G3	S2	LE

DICOTYLEDONEAE

ˇ APIOS PRICEANA	PRICE'S POTATO BEAN	G2	S1	LT
ˇ LINDERA MELISSIFOLIA	PONDBERRY	G2	S2	LE
ˇ SCHWALBEA AMERICANA	CHAFFSEED	G2	SH	LE

ˇ Note: Listed plants are only protected federally, no state protection is provided.

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