ENVIRONMENTAL ASSESSMENT

An Integrated Wildlife Damage Management Approach
for the Management of White-tailed Deer Damage
in the State of Michigan as Conducted by USDA-Wildlife Services

Prepared By:
UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
WILDLIFE SERVICES

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ACRONYMS

ADC	Animal Damage Control
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
CFR	Code of Federal Regulations
EA	Environmental Assessment
EIS	Environmental Impact Statement
EJ	Environmental Justice
ESA	Endangered Species Act
FY	Fiscal Year
IWDM	Integrated Wildlife Damage Management
MIS	Management Information System
MOU	Memorandum of Understanding
MDNR	Michigan Department of Natural Resources
NEPA	National Environmental Policy Act
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
USC	United States Code
USDA	U.S. Department of Agriculture
USDI	U.S. Department of Interior
USFWS	U.S. Fish and Wildlife Service
WS	Wildlife Services

1.0 CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

Within Michigan and across the United States, wildlife habitat has been substantially changed as human populations expand and land is used for human needs. These human uses and needs often compete with wildlife thereby increasing the potential for conflicting human/wildlife interactions. In addition, segments of the public desire protection for all wildlife; this protection can create localized conflicts between human and wildlife activities. The *Animal Damage Control Programmatic Final Environmental Impact Statement* (EIS) summarizes the relationship in American culture of wildlife values and wildlife damage in this way (United States Department of Agriculture (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.*"

Wildlife damage management is the science of reducing damage or other problems caused by wildlife and is recognized as an integral part of wildlife management (The Wildlife Society 1992). Wildlife Services (WS) uses an Integrated Wildlife Damage Management (IWDM) approach, known as Integrated Pest Management (WS Directive 2.1051), in which a combination of methods may be used or recommended to reduce wildlife damage. IWDM is described in Chapter 1:1-7 of USDA (1997). These methods may include alteration of cultural practices and habitat and behavioral modification to prevent or reduce damage. The reduction of wildlife damage may require that the local populations of offending animal(s) be reduced through lethal means.

This environmental assessment (EA) documents the analysis of the potential environmental effects of a proposed Michigan WS integrated white-tailed deer (*Odocoileus virginians*) damage management program to alleviate damage to agriculture, property, natural resources, and human health and safety. This analysis relies mainly on existing data contained in published documents (Appendix A), including the *Animal Damage Control Program Final Environmental Impact Statement* (USDA 1997) to which this EA is tiered. USDA (1997) may be obtained by contacting the USDA,

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

Animal and Plant Health Inspection Service (APHIS), WS Operational Support Staff at 4700 River Road, Unit 87, Riverdale, MD 20737-1234.

WS is the federal agency directed by law and federally authorized to protect American resources from damage associated with wildlife (Animal Damage Control Act of March 2, 1931, as amended 46 Stat. 1486; 7 USC. 426-426c and the Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988, Public law 100-102, Dec. 27, 1987. Stat. 1329-1331 (7 USC 426C)). To fulfill this Congressional direction, WS activities are conducted to prevent or reduce wildlife damage caused to agricultural, industrial and natural resources, property, and threats to public health and safety on private and public lands in cooperation with federal, state and local agencies, private organizations, and individuals. Therefore, wildlife damage management is not based on punishing offending animals but as one means of reducing damage and is used as part of the WS Decision Model (Slate et al. 1992). The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated. The need for action is derived from the specific threats to resources or the public. WS's vision is to improve the coexistence of people and wildlife, and its mission is to provide Federal leadership in managing problems caused by wildlife.

Normally, according to the APHIS procedures implementing the National Environmental Policy Act (NEPA), individual wildlife damage management actions may be categorically excluded (7 CFR 372.5(c), 60 Fed. Reg. 6,000- 6,003, (1995)). WS has decided in this case to prepare this EA to facilitate planning, interagency coordination, and the streamlining of program management, and to clearly communicate with the public the analysis of individual and cumulative impacts. In addition, this EA has been prepared to evaluate and determine if there are any potentially significant or cumulative impacts from the proposed and planned damage management program. All WS wildlife damage management that would take place in Michigan would be undertaken according to relevant laws, regulations, policies, orders and procedures, including the Endangered Species Act (ESA). WS will obtain all necessary permits from the Michigan Department of Natural Resources. Notice of the availability of this document will be made available consistent with the agency's NEPA procedures.

WS is a cooperatively funded, service-oriented program from which other governmental agencies and entities may request assistance. Before any WS wildlife damage management is conducted, Cooperative Agreements, Agreements for Control or other comparable documents are in place. As requested, WS cooperates with land and wildlife management agencies to reduce wildlife damage effectively and efficiently according to applicable federal, State and local laws and Memorandums of Understanding (MOUs) between WS and other agencies. WS's mission, developed through its strategic planning process, is: 1) *"to provide leadership in wildlife damage management in the protection of America's agricultural, industrial and natural resources, and 2) to safeguard public health and safety."* WS's 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 1999a)

1.1 PROPOSED ACTION

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

1.2 PURPOSE

The purpose of white-tailed deer damage management in Michigan is primarily directed to the alleviation of deer damage to agricultural resources, damage to urban/suburban landscaping, damage to property and human safety from deer-vehicle and deer-aircraft collisions, and concerns about the spread of disease. Under the Proposed Action, deer damage management could be conducted on private, federal, state, tribal, county, and municipal lands in the state of Michigan upon request for WS assistance.

1.2.1 BACKGROUND AND NEED FOR ACTION

1.2.1.1 Deer Damage to Agriculture

Conover et al. 1997 estimates that deer cause $100 million in damage to agricultural productivity annually. Deer are most often cited as being the source of the wildlife damage (Conover and Decker 1991); 67% of all farmers reported problems with deer (Conover 1994). In Michigan, Campa et al. (1997) studied deer-agricultural crop damage and characterized significant economic loss as a harvest loss valued above $20 per acre. This study surveyed alfalfa (n=157), grain corn (n=246), soybean (n=106), and table bean (n=29) farmers in the Lower Peninsula and found that 20% of the alfalfa, 25% of the grain corn, 30% of the soybean, and 55% of the table bean farmers had substantial losses.

1.2.1.2 Deer-Vehicle Collisions

Deer-vehicle collisions are a serious concern nationwide because of losses to property and the potential for human injury and death (Conover 1997, Conover et al. 1995, Romin and Bissonette 1996). Conover et al. (1995) estimated that 1.5 million deer-vehicle collisions occur annually in the United States. In addition, Conover et al. (1995) estimated that the average cost to repair the vehicle after a collision with a deer was $1,500. The total damage to vehicles in the United States each year from deer-vehicle collisions is estimated to be greater than $1 billion (Conover et al. 1995). Additionally, deer-vehicle collisions in the United States result in 40,000 injuries and 300 human fatalities annually (Terry Messmer, pers. commu.). In Michigan, there were 67,669 deer-vehicle collisions reported to state police in 1999; more than a 50 percent increase from the 42,868 deer-vehicle collisions reported in 1988 (Michigan State Police 1988,1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999).

1.2.1.3 Damage to Urban Areas, Landscaping and Natural Resources

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

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

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

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

1.2.1.4 Deer Damage to Timber Productivity

Herbivory on small trees constitutes the main source of deer damage to the timber industry (Conover 1997). Deer browsing may either kill trees or stunt their growth, which increases the number of years it takes trees to reach commercial size and results in a loss in productivity (Conover 1997). In the eastern deciduous

forests of the United States, many tree species grown for sawtimber are also highly palatable to deer (Marquis and Brenneman 1981). Marquis (1981) estimated that annual timber losses from deer in the 6.5 million-ha Allegheny hardwood forest in Pennsylvania amounted to >$56/ha or $367 million per year (Conover et al. 1995).

In the mixed, conifer-hardwood forests of Michigan, hemlock (*Tsuga Canadensis*), white cedar (*Thuja occidentalis*), and yellow birch (*Betula lutea*) are generally considered preferred or second-choice deer browse (Stoeckeler et al. 1957). When deer are abundant, the impact of deer on hemlock regeneration is intensified by deer yarding in hemlock stands during the winter (Blouch 1986). Under these conditions, hemlock seedlings visible above the snow line were browsed heavily and seldom survived to produce a sapling (Mladenoff and Stearns 1993).

The second most abundant forest type in Michigan is the aspen-birch (*Populus* spp. – *Betula* spp.) type which covers approximately 7.9 million ha. Research has shown that heavy browsing (browsing on >50% of twigs) by deer and elk can impact the density, structure, composition, and nutritional quality of some bigtooth (*Populus grandidentata*) and quaking (*P. tremuloides*) aspen stands (Campa et al. 1993, Raymer 1996). During the 1980's, browsing intensities in some stands within the Pigeon River Country State Forest were >50% and, therefore, may have caused changes in stand characteristics and plant composition within those stands (Raymer 2000). Overbrowsing has also been observed to reduce the density of bigtooth and quaking aspen in clearcuts >13 years old and caused a 50% reduction in the merchantable volume in 15-17 year old clearcuts (Raymer 2000).

1.2.1.5 Threats to Human Health and Safety from Disease Transmission

Currently, the most common disease involving deer is Lyme disease, caused by the spirochete *Borrelia burgdorferi* and transmitted to humans by the deer tick (*Ixodes dammini* in the eastern U.S.) (Conover 1997). Initial symptoms of Lyme disease include a flu-like illness with headache, fever, muscle or joint pain, neck stiffness, swollen glands, jaw discomfort, and inflammation of the eye membranes (McLean 1994). If left untreated during its early stages, Lyme disease may lead to serious and persistent health problems including arthritis, carditis, and various neurologic symptoms (Gage et al. 1995).

Research has shown a correlation between infected ticks, deer numbers, and Lyme disease cases (Deblinger et al. 1993, Magnarelli et al. 1984). Deer are an important reservoir for Lyme disease and are the primary host for the adult deer tick (Conover 1997). As many as 500 adult ticks may parasitize a single deer (Piesman et al. 1979, Anderson and Magnarelli 1980, Main et al. 1981, Schulze et al. 1984). Wilson et al. (1985, 1988) and Anderson et al. (1987) found that

islands with deer contained active populations of *I. Dammini* and *B. burgdorferi*-infected ticks, whereas islands without deer did not.

1.2.1.6 Threats to Livestock Health and Safety from Disease Transmission

Bovine Tuberculosis

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

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

Since 1994, the state of Michigan has recognized a problem with bovine tuberculosis in wild white-tailed deer from a twelve county area in northeastern Lower Michigan. A total of 87,877 free-ranging deer have been tested and 397 have been found to be positive for M. bovis. In addition to testing deer, the Michigan Department of Agriculture and the USDA Veterinary Services have been testing cattle for tuberculosis. As of January 30, 2002 whole herd tests were conducted on 728,251 head of cattle. In the High Risk Area, only 17 beef and 2 dairy herds have been found with bovine TB (Stine 2002).

The USDA Cooperative State-Federal Tuberculosis Eradication Program, which began in 1917, is chiefly responsible for the near-eradication of the disease from the nation's livestock population. Under the previous USDA rules governing state bovine TB status, at the end of fiscal year 1998-99, 45 states were in "Accredited Free" status and four states were in "Modified Accredited" status. Under the new USDA rules governing state bovine TB status, Michigan's status

was changed to “Modified Accredited” to reflect the presence of the disease in livestock. In order to regain its “Accredited Free” status, the State must have 0% TB prevalence in cattle, bison, and goat herds and no TB in the past three years from the time the last infected herd was depopulated or from the time of surveillance indicating no risk of TB spreading.

The *M. bovis* bacteria strain isolated from infected deer and cattle in Michigan has so far been susceptible to common antibiotics. Although *M.* bovis has been diagnosed in humans, at this time, there are no active human cases of *M. bovis* infection due to exposure to free-ranging white-tailed deer in Michigan. The period of time that tuberculosis has existed in the deer populations in northeastern Michigan is unknown but it is likely the disease has been present in the free-ranging deer populations since the late 1950’s. Since human occupational and recreational activities involving deer have been occurring at least that long, it appears that the risk of tuberculosis in humans from this situation is low for most individuals.

1.2.1.7 Deer Damage at Airports and Airbases

Airports provide ideal conditions for deer and other wildlife due to the large grassy areas adjacent to brushy, forested habitat used as noise barriers. Airport habitats harbor excellent feeding and bedding sites for deer and they are usually protected from hunting and many other human disturbances.

White-tailed deer are a commonly encountered problem at airfields in Michigan, causing considerable hazards to the safe operation of aircraft at those facilities. Michigan has a total of 240 public use airports (Mi. Dept. of Trans. 1993). Collisions between deer and aircraft can cause major damage to the aircraft, and potentially cause injury and loss of human life. Serious consequences are also possible if pilots lose control of the aircraft while attempting to avert a collision with deer.

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

Deer/aircraft strikes can result in loss of human life, injury to passengers or people on the ground, damage or malfunction of aircraft, aircraft navigational aids, or airport facilities. Mammals colliding with aircraft during the most vulnerable phases of flight, takeoff or landing, can cause the aircraft to crash or sustain physical damage (U.S. Dept. of Agri.). In Michigan, there have been many deer/airplane strikes and numerous near misses. Michigan airports have

reported 43 deer/airplane collisions since 1987, and 29 collisions (67%) occurred after 1995 (WS unpublished report 2001). Mammals are characteristically unpredictable in their initial response to approaching aircraft. Deer may wander onto runway surfaces and be startled into the path of oncoming aircraft, and at night, freeze when caught in beams of light causing a strike. The majority of deer strikes occur at night and in the fall during the breeding season (Dolbeer et al. 1995).

1.3 ACTIVITIES BY WS TO ALLEVIATE DEER DAMAGE IN MICHIGAN

Wildlife Services in Michigan has been involved in a number of activities to help reduce the negative impacts of overabundant deer herds.

In February 1998, WS entered into an agreement with the Michigan Department of Agriculture to depopulate a privately owned ranch of captive cervids, namely white-tailed deer. These deer were tested and found positive with *M. bovis*. Sharpshooting, aerial gunning, and trained dogs were all techniques used to depopulate this ranch of 325 deer.

The [redacted], Michigan requested assistance in 1991 with a small herd of deer. WS recommended improved fencing and habitat modification. In 1992, the airport did upgrade existing fencing to a height of 11' but requested further assistance in eliminating deer inside the facility. Since 1995, WS has assisted in removing 118 deer from the airport without incident.

In 1994, WS entered into an agreement with [redacted] to remove deer that may be a hazard to aviation. Since 1994 WS has removed 252 deer from this facility without incident.

In 1996, WS entered into an agreement with [redacted] to remove deer that may be a hazard to aviation. Since 1996, WS has removed 125 deer from this facility without incident.

1.4 NEED FOR DEER DAMAGE MANAGEMENT IN MICHIGAN

The biological carrying capacity (BCC) of a wildlife population is defined as the maximum number of animals that an area can support without degradation to the animal's health and the environment over an extended period of time. When this number is exceeded, the health of the population begins to suffer, reproduction declines, parasitism and disease increase, and habitat quality and diversity decrease due to overbrowsing of plant species preferred as food by deer (Kroll et al. 1986). Overbrowsing negatively impacts the habitat and landscape, and overall animal health declines due to less nutritious food items being available.

The cultural carrying capacity (CCC), more recently referred to as the Wildlife Acceptance Capacity (WAC), is defined as the maximum density of a given species that can coexist compatibly with the local human population (Decker and Purdey 1988). This

term is useful because it defines when conflicts with deer have exceeded an acceptable level, and provides managers with a target for establishing management objectives. Certain factors may influence the WAC, such as landscape or vegetation impacts, threats to public safety, the potential for illegal killing of deer, and personal attitudes and values. The threshold of wildlife damage acceptance is a primary limiting factor in determining the WAC. For any given damage situation, there will be varying acceptance thresholds by those directly, as well as indirectly, affected by the damage. While the WAC and BCC are not the same, both are important factors in managing conflicts between humans and deer.

With the expansion of human populations into rural environments, the potential for human-deer encounters will inevitably increase. Unfortunately, these encounters are often in the form of deer-vehicle collisions, deer-aircraft encounters, damage to landscaping, damage to horticulture, and damage to agricultural commodities. While hunting is still an effective tool to manage deer populations in rural environments, other options need to be investigated to handle overabundant deer herds in non-traditional settings (i.e., airports, city parks, suburban areas, etc.). Both lethal and non-lethal options need to be addressed to minimize the potential negative impact that overabundant deer may have on the environment.

1.5 WILDLIFE SERVICES OBJECTIVES

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

- Hold the lethal take of nontarget animals by WS personnel during damage management to less than 5% of the total animals taken.

1.6 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

ADC Programmatic EIS. WS has issued a final EIS (USDA 1997) and Record of Decision on the National APHIS-WS program. This EA is tiered to that EIS.

1.7 DECISION TO BE MADE

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

- Should WS conduct white-tailed deer damage management in Michigan to alleviate damage to agriculture, property, natural resources, and human health and safety?

- What mitigation measures should be implemented?

- Would the proposed action have significant impacts on the quality of the human environment requiring preparation of an EIS?

1.8 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT ANALYSIS

Actions Analyzed. This EA evaluates white-tailed deer damage management to protect property, agricultural resources, natural resources, and human health and safety in the state of Michigan.

American Indian Lands and Tribes. Currently WS does not have any MOUs or signed agreements with any American Indian tribe in Michigan. If WS enters into an agreement with a tribe for white-tailed deer damage management, this EA would be reviewed and supplemented if appropriate to insure compliance with NEPA.

Period for which this EA is Valid. This EA would remain valid until Michigan WS and other appropriate agencies determine that new needs for action, changed conditions or new alternatives having different environmental effects must be analyzed. At that time, this analysis and document would be supplemented pursuant to NEPA. Review of the EA would be conducted each year to ensure that the EA is sufficient.

Site Specificity. This EA analyzes the potential impacts of white-tailed deer damage management and addresses WS activities on all private and public lands in Michigan under MOU, Cooperative Agreement, and in cooperation with the appropriate public land management agencies. It also addresses the impacts of WS deer damage management on areas where additional agreements may be signed in the future. Because the proposed action is to reduce damage and because the program's goals and directives are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional wildlife damage management efforts could occur. Thus, this EA anticipates this potential expansion and analyzes the impacts of such efforts as part of the WS program. This EA emphasizes major issues as they relate to specific areas whenever possible, however, many issues apply wherever deer damage and resulting management occurs, and are treated as such. The standard WS Decision Model (Slate et al. 1992) would be the site-specific procedure for individual actions conducted by WS in Michigan. (see Description of Alternatives for a description of the Decision Model and its application).

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

1.9 AUTHORITY AND COMPLIANCE

1.9.1 Authority of Federal Agencies in Wildlife Damage Management in Michigan

1.9.1.1 Wildlife Services Legislative Authority

The primary statutory authority for the Wildlife Services program is the Animal Damage Control Act of 1931, as amended in the Fiscal Year 2001 Agriculture Appropriations Bill, which provides that:

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

Since 1931, with the changes in societal values, WS policies and its programs place greater emphasis on the part of the Act discussing "bringing (damage) under control", rather than "eradication" and "suppression" of wildlife populations. In 1988, Congress strengthened the legislative mandate of WS with the Rural Development, Agriculture, and Related Agencies Appropriations Act. This Act states, in part:

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

WS has limited Federal authority in controlling deer damage in Michigan, and must acquire State issued permits in order to collect, trap, or otherwise take wildlife in the State of Michigan.

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

The U. S. Fish and Wildlife Service's (USFWS) authority for action is based on the Migratory Bird Treaty Act of 1918 (as amended), which implements treaties with the United States, Great Britain (for Canada), the United Mexican States, Japan, and the

Soviet Union. The authority of the Secretary of Agriculture with respect to the Migratory Bird Treaty was transferred to the Secretary of the Interior in 1939 pursuant to Reorganization Plan No. II. Section 4(f), 4 Fed. Reg. 2731, 53 Stat. 1433.

1.9.1.3 Authority of State Agencies in Wildlife Management in Michigan

The Michigan Department of Natural Resources authority in wildlife management is given under Article I, Part 5, Regulation 324.503 of Public Act 451 of 1994. This section states in part;

The department shall protect and conserve the natural resources of this state; provide and develop facilities for outdoor recreation; prevent the destruction of timber and other forest growth by fire or otherwise; promote the reforesting of forest lands belonging to the state; prevent and guard against the pollution of lakes and streams within the state and enforce all laws provided for that purpose with all authority granted by law; and foster and encourage the protecting and propagation of game and fish.

The State is responsible for management of white-tailed deer including deer damage in Michigan.

1.9.1.4 Compliance with Other Federal and State Statutes

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

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

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

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

Endangered Species Act (ESA). It is Federal policy, under the ESA, that all Federal agencies seek to conserve threatened and endangered (T&E) species and utilize their authorities in furtherance of the purposes of the Act (Sec.2(c)). Where appropriate, WS conducts Section 7 consultations with the U.S. Fish & Wildlife Service (USFWS) to ensure that "*any action authorized, funded or carried out by such an agency . . . is not likely to jeopardize the continued existence of any endangered or threatened species . . . Each agency shall use the best scientific and commercial data available*" (Sec.7(a)(2)). WS obtained a Biological Opinion (BO) from USFWS in 1992 describing potential effects on T&E species and prescribing reasonable and prudent measures for avoiding jeopardy (USDA 1997, Appendix F). WS is in the process of initiating formal consultation at the programmatic level to reevaluate the 1992 B.O. and to fully evaluate potential effects on T&E species listed or proposed for listing since the 1992 FWS BO. In addition to these programmatic efforts to comply with the ESA, individual WS programs may confer with FWS Ecological Services in the State of the proposed action to determine the presence of T&E species in project areas, and to identify potential impacts of proposed actions and alternatives on these species.

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

Environmental Justice and Executive Order 12898 - *"Federal Actions to Address Environmental Justice in Minority Populations and Low_Income Populations."*
Executive Order 12898, entitled, "Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations" promotes the fair treatment of people of all races, income levels and cultures with respect to the development, implementation and enforcement of environmental laws, regulations and policies.

Environmental justice is the pursuit of equal justice and protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. Environmental Justice is a priority within APHIS and WS. Executive Order 12898 requires Federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of Federal programs, policies and activities on minority and low income persons or populations. APHIS implements Executive Order 12898 principally through its compliance with NEPA. All WS activities are evaluated for their impact on the human environment and compliance with Executive Order 12898. WS personnel use only legal, effective, and environmentally safe wildlife damage management methods, tools, and approaches. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low income persons or populations**.**

Executive Order 13045 - *Protection of Children from Environmental Health and Safety Risks.* Children may suffer disproportionately from environmental health and safety risks for many reasons, including their development, physical and mental status. Because WS makes it a high priority to identify and assess environmental health and safety risks that may disproportionally affect children, WS has considered the impacts that this proposal might have on children. The proposed deer damage management 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.

2.0 CHAPTER 2: ISSUES AND AFFECTED ENVIRONMENT

2.1 AFFECTED ENVIRONMENT

In 1921 the Michigan Legislature created the State Department of Conservation to oversea the management of wildlife in the state of Michigan. The Department of Conservation was later renamed the Department of Natural Resources. The department is responsible for the management of wildlife on all lands throughout the state of Michigan. The affected environment includes not only the local wildlife populations within the area under consideration, but also native flora and human populations and their respective environments.

2.2 ISSUES ANALYZED IN DETAIL

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

- Effects on White-tailed Deer Populations
- Effects on Plants and other Wildlife Species, including Threatened and Endangered Species.
- Effects on Human Health and Safety
- Humaneness of methods to be used
- Effects on Aesthetic Values
- Effects on Regulated White-tailed Deer Hunting

2.2.1 Effects on White-tailed Deer Populations.

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

2.2.2 Effects on Plants and other Wildlife Species, including Threatened and Endangered Species.

There are concerns among members of the public and wildlife professionals, including WS, that there is the potential for control methods used in the proposed action or any of the alternatives to inadvertently capture or remove nontarget animals or potentially cause adverse impacts to nontarget species populations, particularly T&E species. 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 consulted with the USFWS under Section 7 of the Endangered Species Act (ESA) concerning potential impacts of deer damage management control methods on T&E species and has obtained a Biological Opinion (B.O.). For the full context of the B.O., see Appendix F of the ADC FEIS (USDA 1997, Appendix F). WS's standard operating procedures include measures intended to reduce the effects on nontarget species populations and are described in other sections of this EA. MDNR's Natural Heritage Unit has provided a list of State T&E species (Appendix C). USFWS has provided a list of Federal T&E species that occur in Michigan (Appendix D).

To reduce the risks of adverse affects to nontarget species, WS would select damage management methods that are as target-selective as possible or apply such methods in ways to reduce the likelihood of negatively effecting nontarget species.

Some people are concerned about the damaging effects that deer are having on native flora and fauna, and on the recovery of state and federally listed Endangered and Threatened species, and species of concern. These people are concerned as to whether the proposed action or any of the alternatives would reduce such damage to acceptable levels.

2.2.3 Effects on Human Health and Safety.

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

Firearm use is very sensitive and a public concern because of safety issues relating to the public and firearms misuse. To ensure safe use and awareness, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within 3 months of their appointment and a refresher course every 3 years afterwards (WS Directive 2.615). WS employees who use firearms as a condition of employment, are required to sign a form certifying that they meet the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

2.2.4 Humaneness of Methods to be Used.

The issue of humaneness, as it relates to the killing or capturing of wildlife is an important but complex concept. Kellert and Berry (1980) in a survey of American attitudes toward animals related that 58% of their respondents, *"... care more about the suffering of individual animals ... than they do about species population levels."* Schmidt (1989) indicated that vertebrate pest control for societal benefits could be

compatible with animal welfare concerns, if *" . . . the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process."*
Suffering has been described as a *" . . . highly unpleasant emotional response usually associated with pain and distress*." However, suffering *" . . . can occur without pain . . .* ," and *" . . . pain can occur without suffering . . . "* (American Veterinary Medical Association (AVMA) 1986). Because suffering carries with it the implication of a time frame, a case could be made for *" . . . little or no suffering where death comes immediately . . . "* (California Department of Fish and Game (CDFG) 1991), such as the WS technique of shooting.

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

Pain and suffering as it relates to a review of WS damage management methods to capture animals, has both a professional and lay point of arbitration. Wildlife managers and the public would both be better served to recognize the complexity of defining suffering, since *" . . . neither medical or veterinary curricula explicitly address suffering or its relief"* (CDFG 1991).

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

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

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

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

2.2.5 Effects on Aesthetic Values

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

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

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

Michigan WS recognizes that all wildlife has aesthetic value and benefit. WS only conducts deer damage management at the request of the affected home/property owner or resource manager. If WS received requests from an individual or official for deer

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.

2.2.6 Effects on Regulated White-tailed Deer Hunting

Some people may be concerned that WS conducted deer removal activities would affect regulated deer hunting by significantly reducing local deer populations.

2.3 ISSUES NOT CONSIDERED IN DETAIL WITH RATIONALE

2.3.1 WS's Impact on Biodiversity.

No Michigan WS deer damage management is conducted to eradicate a native wildlife population. WS operates according to international, federal, and state laws and regulations enacted to ensure species viability. In addition, any reduction of a local population or group is frequently temporary because immigration from adjacent areas or reproduction replaces the animals removed. The impacts of the current WS program on biodiversity are minor and not significant nationwide, statewide, or region wide (USDA 1997). WS operates on a relatively small percentage of the land area of the State, and the WS take of any wildlife species analyzed in this EA is a small proportion of the total population and insignificant to the viability and health of the population.

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

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

3.0 CHAPTER 3: ALTERNATIVES

3.1 INTRODUCTION

This chapter consists of 6 parts: 1) an introduction, 2) description of alternatives considered and analyzed in detail including the Proposed Action (Alternative 1), 3) a description of Integrated Wildlife Damage Management, 4) Deer damage management methods available for use or recommendation by WS in Michigan, 5) Alternatives considered but not in detail, with rationale, and 6) Mitigation measures and Standard Operating Procedures (SOPs) for deer damage management.

Alternatives were developed for consideration using the WS Decision Model (Slate et al. 1992), "*Methods of Control*" (USDA 1997 Appendix J) and the "*Risk Assessment of Wildlife Damage Control Methods Used by the USDA Animal Damage Control Program"* (USDA 1997, Appendix P) of USDA (1997).

The four alternatives analyzed in detail are:

- Alternative 1 – Integrated Deer Damage Management Program by WS (Proposed Action).
- Alternative 2 – Non-lethal Deer Damage Management only by WS
- Alternative 3 – Lethal Deer Damage Management only by WS
- Alternative 4 – No Deer Damage Management by WS (No Action)

3.2 ALTERNATIVES CONSIDERED, INCLUDING THE PROPOSED ACTION

3.2.1 Alternative 1. Integrated Deer Damage Management Program (Proposed Action)

Under this alternative, Wildlife Services would administer an Integrated Wildlife Damage Management (IWDM) approach to alleviate white-tailed deer damage to agriculture, property, natural resources, and human health and safety. An IWDM approach would be implemented on all private and public lands of Michigan where a need exists, a request is received, and funding is available. An IWDM strategy would be recommended and used, encompassing the use of practical and effective methods of preventing or reducing damage while minimizing harmful effects of damage management measures on humans, other species, and the environment. Under this action, WS would provide technical assistance and operational damage management, including non-lethal and lethal management methods by applying the WS Decision Model (Slate et al. 1992). When appropriate, habitat modifications, harassment, repellants, and physical exclusion could be recommended and utilized to reduce deer damage. In other situations, deer would be removed as humanely as possible by sharpshooting and live capture followed by euthanasia under permits issued by the MDNR. In determining the damage management strategy, preference would be given to practical and effective non-lethal methods. However, non-lethal methods may not always be applied as a first response to

each damage problem. The most appropriate response could often be a combination of non-lethal and lethal methods, or there could be instances where application of lethal methods alone would be the most appropriate strategy. WS deer damage management would be conducted in the State, when requested, on private or public property after an *Agreement for Control* or other comparable document has been completed. All WS deer damage management would be consistent with other uses of the area and would comply with appropriate federal, state and local laws.

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

This alternative would require WS to use and recommend non-lethal methods only to resolve all deer damage problems. Requests for information regarding lethal management approaches would be referred to MDNR, local animal control agencies, or private businesses or organizations. Persons receiving deer damage could still resort to lethal methods or other methods not recommended by WS, use contractual services of private businesses that were available to them, or take no action. Appendix B describes a number of non-lethal methods available for recommendation and use by WS under this alternative.

3.2.3 Alternative 3. Lethal Deer Damage Management only by WS

Under this alternative, WS would provide only lethal direct control services and technical assistance. Requests for information regarding non-lethal management approaches would be referred to MDNR, local animal control agencies, or private businesses or organizations. Individuals might choose to implement WS lethal recommendations, implement non-lethal methods or other methods not recommended by WS, contract for WS lethal direct control services, use contractual services of private businesses, or take no action. Appendix B describes lethal methods available for recommendation and use by WS under this alternative.

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

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

3.3 DEER DAMAGE MANAGEMENT STRATEGIES AND METHODOLOGIES AVAILABLE TO WS

The strategies and methodologies described below include those that could be used or recommended under Alternatives 1, 2, and 3 described above. Alternative 4 would terminate both WS technical assistance and operational deer damage management by WS. Appendix B is a more thorough description of the methods that could be used or recommended by WS.

3.3.1 Integrated Wildlife Damage Management (IWDM)

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

3.3.2 Technical Assistance Recommendations.

"Technical assistance" as used herein is information, demonstrations, and advice on available and appropriate wildlife damage management methods. Technical assistance is generally provided following an on-site visit or verbal consultation with the requester. WS personnel provide technical assistance such as information, instructional sessions, demonstrations and advice on available deer damage management techniques. Technical assistance includes demonstrations on the proper use of management devices (pyrotechnics, exclusion devices, etc.), wildlife habits and biology, habitat management, exclusion, and animal behavior modification. 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. Technical assistance may require substantial effort by WS personnel in the decision making process, but the actual work is the responsibility of the requester.

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.

3.3.3 Direct Operational Damage Management Assistance.

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

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

Professional skills of WS personnel are often required to effectively resolve problems, if the problem is complex.

3.3.4 Education

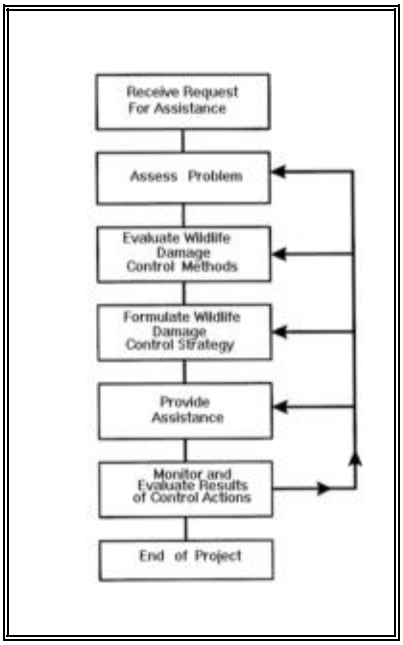
Education is an important element of WS's program activities because wildlife damage management is about finding "balance" or co-existence between the needs of people and needs of wildlife. This is extremely challenging as nature has no balance, but rather, is in continual flux. In addition to the routine dissemination of recommendations and information to individuals or organizations sustaining damage, lectures and demonstrations are provided to farmers, homeowners, and other interested groups. WS frequently cooperates with other agencies in education and public information efforts. Additionally, technical papers are presented at professional meetings and conferences so that WS personnel, other wildlife professionals, and the public are updated on recent developments in damage management technology, laws and regulations, and agency policies.

3.3.5 WS Decision Making

The procedures used by WS personnel to determine management strategies or methods applied to specific damage problems can be found in USDA (1997 Appendix N).

WS personnel use a methodical thought process for evaluating and responding to damage complaints and requests for assistance that are depicted by the WS Decision Model described by Slate et al. (1992) (Figure 3-1). WS personnel are frequently contacted after requesters have tried or considered nonlethal methods and found them to be impractical, too costly, or inadequate for reducing damage to an acceptable level. WS personnel assess the problem, 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 may be ended. In some cases, continual conduct of effective wildlife damage management activities is necessary to relieve damage. In terms of the WS Decision Model (Slate et al. 1992), most damage management efforts consist of continuous feedback between receiving the request and monitoring the results of the ongoing damage management strategy. The Decision Model is not necessarily a written process, but a mental problem-solving process common to most, if not all professions.

Figure 3-1
WS Decision Model



3.3.6 Community Based Selection of a Deer Damage Management Program

3.3.6.1 Technical Assistance Provided by WS to Resource Owners for Selection of a Deer Damage Management Program.

The WS program in Michigan 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 white-tailed deer and effective, practical, and reasonable methods available to reduce deer damage to local requesters. This includes non-lethal and lethal methods. WS and other state and federal wildlife or wildlife damage management agencies may facilitate discussions at local community meetings when resources are available. Resource owners/managers and others directly affected by deer damage or conflicts in Michigan have direct input into the resolution of such problems. They may implement management recommendations provided by WS or others, or may request management assistance from WS, other wildlife management agencies, local animal control agencies, or private businesses or organizations.

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

3.3.6.2 Community Selection of a Deer Damage Management Program

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

3.3.6.3 Private Property Selection of a Deer Damage Management Program.

When one person privately owns a parcel of property, the authority selecting the damage management plan would be him or herself. WS would provide technical assistance and recommendations to this person to reduce damage. If no homeowner or civic association represents the affected resource owners of the local community, then WS would provide technical assistance to the self or locally appointed authority(ies). Direct damage management would be provided by WS if requested, funding was provided, and the requested direct damage management was consistent with WS recommendations, policy and federal and state laws. Additionally, a minimum of 67% of the affected resource owners must agree to the direct damage management. The affected resource owners would be those whose property is adjacent to the areas where the deer primarily inhabit or damage resources. Affected resource owners who disagree with the direct damage management may request WS not conduct this action on their property and WS will honor this request.

3.3.6.4 Public Property Selection of a Deer Damage Management Program

The authority selecting the damage management plan 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 and recommendations to this person to reduce damage. Direct damage management would be provided by WS if requested, funding was provided, and the requested direct damage management was consistent with WS recommendations, policy and federal and state laws.

3.3.7 Summary for Community Selection of a Deer Damage Management Program

This process for involving local communities and local stakeholders in the decisions for deer damage management assures that local concerns are considered before individual damage management actions are taken.

3.4 WILDLIFE DAMAGE MANAGEMENT METHODS AUTHORIZED FOR USE OR RECOMMENDED

USDA (1997 Appendix J) describes methods currently used by the WS program. Several of these were considered in this assessment because of their potential use in reducing deer damage to agriculture, property, natural resources, and public health and safety. A listing and more detailed description of the methods used by Michigan WS for deer damage management is found in Appendix B of this EA

3.4.1 Non-lethal Methods

Habitat Modifications - Modifying or eliminating habitat utilized by deer may change deer behavior and reduce deer damage. This could include reducing vegetative cover, forage crops, or using less palatable landscape plants.

Physical Exclusion - Fencing, netting, or other barriers can limit deer access to a particular area. There are several types of fences that can inhibit deer access including: temporary electric, high tensile electric, woven wire, chain-link, and solid wall fencing.

Harassment/Behavioral Modifications - The proper use of harassment techniques including sirens, flashing lights, electronic distress sounds, pyrotechnics, propane exploders, and dogs could help reduce conflicts.

Repellents - Repellents fall under two categories, contact repellants and area repellants. Contact repellents are those repellents which are applied to vegetation to discourage deer from browsing. Area repellents are designed to repel deer by odor alone

3.4.2 Lethal Methods

Sharpshooting is the practice of selectively removing deer by shooting.

Live-capture of deer followed by euthanasia in areas where sharpshooting may be inappropriate due to safety concerns. Capture methods for deer would include: darting with capture drugs, clover traps, box traps, drop nets, net guns, and rocket nets. Captured deer would be euthanized by methods recommended by the AVMA (Beaver et al. 2001) or the recommendations of a veterinarian.

Hunting Programs. WS may recommend the use of state regulated firearm and archery deer hunting programs to reduce deer damage in local areas.

3.5 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

3.5.1 Live Trap and Relocation.

Under this alternative WS would capture deer alive using cage-type live traps or capture drugs administrated by dart gun and then relocate the captured deer to another area. Numerous studies have shown that live-capture and relocation of deer is relatively expensive, time-consuming and inefficient (Ishmael and Rongstad 1984, O'Bryan and McCullough 1985, Diehl 1988, Jones and Witham 1990, Ishmael et al. 1995). Population reduction achieved through capture and relocation is labor intensive and would be costly ($273-$2,876/deer) (O'Bryan and McCullough 1985, Bryant and Ishmael 1991). Additionally, relocation frequently results in high mortality rates for deer (Cromwell et. al. 1999, O'Bryan and McCullough 1985, Jones and Witham 1990, Ishmael et. al. 1995). Deer frequently experience physiological trauma during capture and transportation, (capture myopathy) and deer mortality after relocation, from a wide range of causes within the first year, has ranged from 25-89% (Jones and Witham 1990, Mayer et al. 1993). O'Bryan and McCullough (1985) found that only 15% of radio-collared black-tailed deer that were live-captured and relocated from Angel Island, California, survived for one year after relocation. Although relocated deer usually do not return to their location of capture, some do settle in familiar suburban habitats and create nuisance problems for those communities (Bryant and Ishmael 1991). High mortality rates of relocated deer, combined with the manner in which many of these animals die, make it difficult to justify relocation as a humane alternative to lethal removal methods (Bryant and Ishmael 1991). Chemical Capture methods require specialized training and skill. A primary limitation of darting, the limited range at which deer can be effectively hit, is generally less than 40 yards. With modern scoped rifles, however, a skilled sharpshooter can hit the head or neck of a deer for a quick kill out to 200 yards and beyond. Thus, chemical capture is far less efficient, more labor intensive, and much more costly than lethal removal with rifles

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

3.5.2 Population Stabilization Through Birth Control.

Deer would be sterilized or contraceptives administered to limit the ability of deer to produce offspring. Contraceptive measures for deer can be grouped into four categories: surgical sterilization, oral contraception, hormone implantation, and immunocontraception (the use of contraceptive vaccines). Sterilization could be accomplished through surgical sterilization (vasectomy, castration, and tubal ligation), chemosterilization, and gene therapy. Contraception could be accomplished through

hormone implantation (synthetic steroids such as progestins), immunocontraception (contraceptive vaccines), and oral contraception (progestin administered daily). These techniques would require that deer receive either single, multiple, or possibly daily treatment to successfully prevent conception.

Use and effectiveness of reproductive control as a wildlife population management tool is limited by population dynamic characteristics (longevity, age at onset of reproduction, population size and biological/cultural carrying capacity, etc.), habitat and environmental factors (isolation of target population, cover types and access to target individuals, etc.), socioeconomic and other factors. Population modeling indicates that reproductive control is more efficient than lethal control only for some rodent and small bird species with high reproductive rates and low survival rates (Dolbeer 1998). Additionally, the need to treat a sufficiently large number of target animals, multiple treatments, and population dynamics of free-ranging populations place considerable logistic and economic constraints on the adoption of reproduction control technologies as a wildlife management tool for some species. Research into reproductive control technologies, however, has been ongoing, and the approach will probably be considered in an increasing variety of wildlife management situations.

The use of this method would be subject to approval by Federal and State Agencies. This alternative was not considered in detail because:

- It would take a number of years of implementation before the deer population would decline and therefore, damage would continue at the present unacceptable levels for a number of years.

- Surgical sterilization would have to be conducted by licensed veterinarians, and would therefore be extremely expensive.

- It is difficult, time-consuming, and expensive to effectively live trap, chemically capture, or remotely treat the number of deer necessary to effect an eventual decline in the population.

- State and Federal regulatory authorities have approved no chemical or biological agents for deer contraception for use.

3.6 MITIGATION AND STANDARD OPERATING PROCEDURES FOR WILDLFE DAMAGE MANAGEMENT TECHNIQUES

3.6.1 Mitigation in Standard Operating Procedures (SOP)

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 Michigan, uses many such mitigation measures and these are discussed in detail in Chapter 5 of the FEIS (USDA 1997). Some key mitigating

measures pertinent to the proposed action and alternatives that are incorporated into WS's Standard Operating Procedures include:

Mitigation Measures	**Alternatives**			
	1	2	3	4
Animal Welfare and Humaneness of Methods Used by WS				
Research on selectivity and humaneness of management practices would be monitored and adopted as appropriate.	X	X	X	
The Decision Model (Slate et al. 1992) is used to identify effective biological and ecologically sound deer damage managemnet strategies and their impacts.	X	X	X	
Euthanasia procedure approved by the AVMA that cause minimal pain are used for live animals	X		X	
The use of newly developed, proven non-lethal methods would be encouraged when appropriate.	X	X		
Safety Concerns Regarding WS Damage Management Methods				
The Decision Model (Slate et al. 1992), designed to identify the most appropriate damage management strategies and their impacts, is used to determine deer damage management strategies	X	X	X	
Concerns about Impacts of Damage Management on Target Species, T&E Species, Species of Special Concern, and Non-target Species				
WS consulted with the USFWS regarding the nation-wide program and would continue to implement all applicable measure identified by the USFWS to ensure protection of T&E species.	X	X	X	
Management actions would be directed toward localized populations or groups and/or individual offending animals.	X	X	X	
WS personnel are trained and experienced to select the most appropriate methods for taking targeted animals and excluding non-target species.	X	X	X	
WS would initiate informal consultation with the USFWS following any incidental take of T&E species.	X		X	
WS take is monitored by number of animals by species or species groups (i.e. blackbirds, raptors) with overall populations or trends in population to assure the magnitude of take is maintained below the level that would cause significant adverse impacts to the viability of native species populations (See Chapter 4)	X		X	

4.0 CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

Chapter 4 provides information for making informed decisions on the deer damage management program outlined in Chapter 1, and the issues and affected environment discussed in Chapter 2. This chapter consists of: 1) analysis of environmental consequences, 2) analysis of each alternative against the issues considered in detail, and 3) summary of WS's impacts.

4.2 ENVIRONMENTAL CONSEQUENCES

This section analyzes the environmental consequences using Alternative 4 as the no action alternative and therefore will be used as the baseline when comparing the other alternatives to determine if the real or potential impacts are greater, lesser or the same (Table 4-4). The No Action alternative is a procedural NEPA requirement (40 CFR 1502.14(d)) and is a viable and reasonable alternative that could be selected and serves as a baseline for comparison with the other alternatives. The No Action Alternative, as defined here, is consistent with the Council on Environmental Quality (CEQ) (1981).

The following resource values within Michigan would not be adversely 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.

4.2.1 Social and Recreational Concerns are discussed throughout the document as they relate to issues raised during public involvement, and they are discussed in USDA (1997).

4.2.2 Cumulative and Unavoidable Impacts are discussed in relationship to each of the wildlife species and the environmental impacts are analyzed in this chapter. This EA recognizes that the total annual removal of individual animals from wildlife populations by all causes is the cumulative mortality. Analysis of the Michigan WS "*takes*" during 1997, 1998, 1999 and 2000, and anticipated future WS take, in combination with other mortality, indicates that cumulative impacts are not adversely affecting the viability and health of populations. It is not anticipated that the WS program would result in any adverse cumulative impacts to T&E species, and deer damage management activities do not jeopardize public health and safety.

4.2.3 Irreversible and Irretrievable Commitments of Resources: Other than minor uses of fuels for motor vehicles and electrical energy for office maintenance, there are no irreversible or irretrievable commitments of resources. Based on these estimates, the Michigan WS program produces very negligible impacts on the supply of fossil fuels and electrical energy.

4.3 ISSUES ANALYZED IN DETAIL

This section presents the expected consequences of each alternative on each of the issues analyzed in detail.

4.3.1 Alternative 1. Integrated Deer Damage Management Program by WS (Proposed Action)

Effects on White-tailed Deer Populations. The current program removes only a very small number of deer from the statewide Michigan population (Table 4-1) (see Section 1.3). However, based upon an anticipated increase of work, Michigan WS expects that no more than 2,500 deer would be removed annually, under permits issued by the MDNR, while conducting WS direct control activities within the state. Therefore, 2,500 deer was used to analyze WS potential impacts to the statewide deer population in Michigan.

White-tailed Deer Population Impact Analysis.

The authority for management of resident wildlife species is the responsibility of the MDNR and deer are classified as protected furbearers. MDNR collects and compiles information on white-tailed deer population trends and take, and uses this information to manage deer populations. This information has been provided to WS to assist in the analysis of potential impacts of WS activities on the deer herd in Michigan.

The number of deer taken by WS and harvested by hunters in MI is shown in Table 4-1 (MIS 1995, 1996, 1997, 1998, 1999, 2000, and MDNR) The FY95 take of 228 deer was the highest number ever removed in one year by the Michigan WS program. Barring any major catastrophe, WS does not expect the number of deer taken by WS to increase substantially above current levels (Table 4-1). However, in the event of catastrophic disease outbreaks, such as Chronic Wasting Disease and Foot and Mouth Disease, WS feels it is necessary to have the flexibility to be able to remove a greater number of deer in an effort to protect human health and safety. In the event of these extremely unlikely cases, WS anticipates that they would remove no more than 2,500 deer statewide. Therefore, 2,500 deer were used to analyze potential impacts to the statewide deer population in Michigan. The ADC FEIS (USDA 1997) determined using qualitative information (population trend indicators and harvest data) that if WS deer kill is less than or equal to 33% of the total harvest, the magnitude is considered low. Magnitude is defined as a measure of the number of animals killed in relation to their abundance. Using the harvest data and the annual take of 2,500 deer by WS, the magnitude is considered extremely low for WS take of deer in Michigan. Thus, cumulative take appears to be far beneath the level that would begin to cause a decline in the deer population. MDNR biologists have concurred with WS's finding that WS deer damage management activities will have no adverse effect on statewide deer populations (R. Humphries, pers. commu., 2002).

Table 4.1 Deer Harvest Data for Michigan 1995-2000						
Deer Harvest Data	1995	1996	1997	1998	1999	2000
# removed by WS	228	109	66	127	51	31
# taken during state regulated harvest season	478,958	478,342	478,725	597,988	544,895	541,701
% WS take (% of total take)	0.047%	0.022%	0.014%	0.021%	0.009%	0.006%

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

WS personnel are trained and experienced to select the most appropriate tools and methods for taking target animals and excluding nontargets.

WS take of nontarget species is expected to be minimal or nonexistent. Other wildlife populations would not be negatively affected, except for the occasional scaring effect from the sound of gunshots. In these cases, birds and other mammals may temporarily leave the immediate vicinity of shooting, but would most likely return after conclusion of the action. To date, no nontarget animals have been killed by WS conducting deer damage management activities in Michigan.

Nationally, WS has consulted with the USFWS regarding potential impacts of control methods on T&E species, and abides by reasonable and prudent alternatives (RPAs) and/or reasonable and prudent measures (RPMs) established as a result of that consultation. For the full context of the Biological Opinion see the ADC FEIS, Appendix F (USDA 1997). Further consultation on species not covered by or included in that formal consultation process has been initiated with the USFWS and WS will abide by any RPAs, RPMs, and terms and conditions that result from that process to avoid jeopardizing any listed species. The USFWS office has provided a list of Federal T&E species in MI counties. WS has determined that the proposed WS actions will not likely adversely affect

Federal and State T&E species in Michigan. The MDNR and USFWS has concurred with this conclusion (R. Humphries, pers. commu., 2002, C. Czarnecki, pers. commu., 2002). WS could positively benefit T&E species by reducing deer browsing damage to listed plant species and to habitat that is being used by T&E species. WS will contact USFWS if the proposed action changes in the future.

This alternative would reduce the damaging effects that deer are having on native flora and fauna, including the recovery of state listed threatened and endangered species to acceptable levels.

Effects on Human Health and Safety. WS methods of shooting and trapping pose minimal or no threat to human health and safety. All firearm safety precautions are followed by WS when conducting damage management and WS complies with all laws and regulations governing the lawful use of firearms. Shooting with shotguns or rifles is used to reduce deer damage when lethal methods are determined to be appropriate. Shooting is selective for target species. WS could use firearms to humanely euthanize deer captured in live traps. WS' traps are strategically placed to minimize exposure to the public and pets. Appropriate signs are posted on all properties where traps are set to alert the public of their presence.

Firearm use is very sensitive and a public concern because of misuse of firearms. To ensure safe use and awareness, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within 3 months of their appointment and a refresher course every 3 years afterwards (WS Directive 2.615). WS employees who use firearms as a condition of employment, are required to certify that they meet the criteria as stated in the *Lautenberg Amendment*.

This alternative would reduce threats to public health and safety by removing deer from a site, and thus alleviating potential threats of transmitting diseases, and potential deer/aircraft and deer/vehicle collisions.

Humaneness of methods to be used. WS personnel are experienced and professional in their use of management methods, and methods are applied as humanely as possible. Under this alternative, deer would be shot or trapped as humanely as possible by experienced WS personnel using the best method available. Deer live-captured in traps would be euthanized. Some individuals may perceive this method as inhumane because they oppose all lethal methods of damage management. However, this alternative allows WS to consider non-lethal methods, and WS would implement non-lethal methods for deer damage management when appropriate.

Effects on Aesthetic Values. The impacts of this alternative to stakeholders would be variable depending on their values towards wildlife and compassion for their neighbors. This alternative would likely be favored by most resource

owners who are receiving damage and by WS as it allows for an IWDM approach to resolving damage problems. An IWDM approach allows for the use of the most appropriate damage management methods. Most stakeholders without damage would also prefer this alternative to Alternative 3, where all deer are killed, because non-lethal methods could be appropriate to resolve damage problems in some situations. Some individuals would strongly oppose this alternative, and most action alternatives, because they believe it is morally wrong to kill or use animals for any reason or they believe that the benefits from deer outweigh the associated damage.

The ability to view and aesthetically enjoy deer at a particular site could be limited if the deer are removed. New deer, however, would likely use the site in the future, although the length of time until new animals arrive is variable, depending on the habitat, time of year, and population densities in the area. The opportunity to view deer is available if a person makes the effort to visit sites with adequate habitat outside of the damage management area.

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

Effects on Regulated White-tailed Deer Hunting. Shooting of deer by WS biologists under the Proposed Action would only occur after a permit has been issued by the MDNR to remove deer that are causing damage or in those situations where deer are a potential human health and safety threat or are a threat of spreading diseases. This activity would result in reduced deer densities on project areas and may reduce densities in some project area deer management zones, hence slightly reducing the number of deer that may otherwise be available to hunters during hunting seasons. The impact of this, however, is expected to be minimized due to:

- The number of deer expected to be shot by WS is minimal when compared to the number taken by hunters across the state.
- The number of deer expected to be taken by WS would not cause a statewide deer population reduction.

There may be some cases, where landowners have not permitted regulated deer hunting, but would allow WS biologists to shoot deer. This would have only a minimal impact on deer hunting, since the land was not previously accessible to hunters.

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

Effects on White-tailed Deer Populations. No deer would be killed by WS under this alternative. The effects on deer populations could reduce, stay the same, or increase depending on actions taken by others. Some resource owners may kill deer, or allow other hunters access to kill deer during the legal harvest season. Resource owners may also obtain special permits from the MDNR to allow them to shoot deer outside of the regular season and in those areas where regulated hunting is not allowed. Deer populations could continue to increase where hunting pressure was low or when an insufficient number of deer are removed under special permits issued by MDNR. Some local populations of deer would temporarily decline or stabilize where hunting pressure and permitted removal activities were adequate. Some resource owners may take illegal, unsafe, or environmentally harmful action against local populations of deer out of frustration or ignorance. While WS could only provide non-lethal assistance under this alternative, other individuals or entities could conduct lethal damage management resulting in impacts similar to the proposed action alternative.

Effects on plants and other wildlife species, including T&E species.
In the absence of an integrated deer damage management program by WS that includes the option of lethal removal of deer from damage sites, some resource owners with little or no shooting experience may attempt to remove deer. These resource owners would be more likely than WS personnel to take a non-target species and not report non-target take.

WS take of nontarget species is expected to be minimal or nonexistent. The effects of WS use of non-lethal methods would be similar to those described under the proposed action. However, unless lethal means are implemented by the resource owners, damage caused by deer to wildlife species, including T&E species, may increase in those situations where the use of nonlethal methods do not reduce damage to acceptable levels resulting in impacts similar to the No Action alternative.

Effects on Human Health and Safety. Non-lethal methods would not be efficient or successful in resolving many deer damage situations. If deer populations would continue to increase without implementing lethal damage management,

there are potential for increased threats to public health and safety similar to the No Action alternative. Additionally, resource owners may attempt to lethally resolve deer damage problems through illegal use of chemicals/pesticides, trapping, and shooting without WS expertise. In these situations there may be some risk to human health and safety from improper or inexperienced use of these methods.

Humaneness of methods to be used. WS personnel are experienced in their use of management methods, and methods are applied as humanely as possible. Some individuals may perceive this approach as humane because they oppose all lethal methods of damage management. However, without effective damage management methods available, resource owners may take illegal action against some local populations of deer out of frustration of continued damage. Some of these illegal actions may be less humane than methods used by WS personnel. While WS could only provide non-lethal assistance under this alternative, other individuals or entities could conduct lethal damage management with impacts similar to the No Action alternative.

Effects on Aesthetic Values. The impacts of this alternative to stakeholders would be variable depending on the damage management efforts employed by resource owners, their values toward deer and compassion for their neighbors. Resource owners who are receiving damage from deer would likely oppose this management alternative. Some people would support this alternative because they believe resource owners would do little to remove deer. Others would oppose this alternative because they believe resource owners would use illegal, inhumane, or environmentally unsafe methods. While WS could only provide non-lethal assistance under this alternative, other individuals or entities could conduct lethal damage management resulting in impacts similar to the No Action Alternative.

Effects on Regulated White-tailed Deer Hunting. WS would have no direct impact on regulated deer hunting since WS would not lethally remove deer under this alternative. However, resource owners may remove deer under special permits issued by MDNR resulting in impacts similar to the proposed action.

4.3.3 Alternative 3. Lethal Deer Damage Management Only by WS

Effects on White-tailed Deer Populations. This alternative could result in a localized decrease in the deer population at the specific site where the damage management occurs. Even if WS lethally removed deer at all project sites, it is not anticipated that more than 2,500 deer would be killed annually by WS. Therefore, the impacts on deer populations are expected to be similar to those described in the Proposed Action. New deer would likely re-inhabit the site as long as suitable habitat exists. The amount of time until new deer move into the area would vary depending on the habitat type, time of year, and population densities in the area.

Effects on plants and other wildlife species, including T&E species. WS impacts would be similar to those described in the proposed action, except in those situations where lethal methods could not be used effectively. In those situations the impacts from this alternative would be similar to the No Action alternative.

Effects on Human Health and Safety. WS methods of shooting and trapping pose minimal or no threat to human health and safety. All firearm safety precautions are followed by WS when conducting damage management and WS complies with all laws and regulations governing the lawful use of firearms. Impacts would be similar to those described under the proposed action where lethal methods are effective. In those situations where lethal methods do not reduce damage and human health and safety threats to an acceptable level, impacts would be similar to the No Action alternative.

Humaneness of methods to be used. WS personnel are experienced in their use of management methods, and methods are applied as humanely as possible. Under this alternative, deer would be shot or trapped as humanely as possible by experienced WS personnel using the best method available. Some individuals could perceive these methods as inhumane because they oppose all lethal methods of damage management. Overall impacts would be similar to the Proposed Action alternative.

Effects on Aesthetic Values. The impacts of this alternative to stakeholders would be variable depending on their values towards wildlife and compassion for their neighbors. This alternative would likely be favored by resource owners who are receiving damage. Although, some resource owners would be saddened if the deer were removed. Some individuals would strongly oppose this alternative because they believe it is morally wrong to kill or use animals for any reason or they believe the benefits from deer would outweigh the associated damage. The ability to view and aesthetically enjoy deer at a particular site could be limited if the deer are removed. New animals, however, would most likely use the site in the future, although the length of time until new deer arrive is variable, depending on the habitat type, time of year, and population densities of deer in the area. The opportunity to view deer is available if a person makes the effort to visit sites with adequate habitat outside of the damage management area.

Effects on Regulated White-tailed Deer Hunting. Shooting of deer by WS biologists under this alternative would only occur after a permit has been issued by the MDNR to remove deer that are causing damage or in those situations where deer are a potential human health and safety threat or are a threat of spreading diseases. This activity would result in reduced deer densities on project areas and may reduce densities in some project area deer management zones, hence slightly reducing the number of deer that may otherwise be available to hunters during hunting seasons. The impact of this, however, is expected to be minimized due to:

- The number of deer expected to be shot by WS is minimal when compared to the number taken by hunters in the zone(s).
- The number of deer expected to be taken by WS would not cause a statewide deer population reduction.

There may be some cases, where landowners have not permitted regulated deer hunting, but would allow WS biologists to shoot deer. This would have only a minimal impact on deer hunting, since the land was not previously accessible to hunters. Overall impacts of this alternative would be similar to the Proposed Action alternative.

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

Effects on White-tailed Deer Populations. No deer damage management activities would be conducted by WS under this alternative. The effects on deer populations could reduce, stay the same, or increase depending on actions taken by others. Some resource owners may kill deer, or allow other hunters access to kill deer during the legal harvest season. Resource owners may also obtain special permits from the MDNR to allow them to shoot deer outside of the regular season and in those areas where regulated hunting is not allowed. Deer populations could continue to increase where hunting pressure was low or when an insufficient number of deer are removed under special permits issued by MDNR. Some local populations of deer would temporarily decline or stabilize where hunting pressure and permitted removal activities were adequate. Some resource owners may take illegal, unsafe, or environmentally harmful action against local populations of deer out of frustration or ignorance. While WS would provide no assistance under this alternative, other individuals or entities could conduct lethal damage management resulting in impacts similar to the proposed action alternative.

Effects on plants and other wildlife species, including T&E species. In the absence of an integrated deer damage management program by some resource owners with little or no shooting experience may attempt to remove deer. These resource owners would be more likely than WS personnel to take a non-target species and not report non-target take.

Damage caused by deer to wildlife species, including T&E species, may increase in those situations where the resource owner does not implement their own deer damage management program.

Effects on Human Health and Safety. If deer populations continue to increase without a damage management program in place, there are potential for increased threats to public health and safety. Additionally, resource owners may attempt to solve deer damage problems through trapping and shooting without WS expertise.

Therefore, there could be increased risks to human health and safety from improper or inexperienced use of damage management methods.

Humaneness of methods to be used. This alternative would be considered humane by many people. Resource/property owners could use lethal and non-lethal methods to reduce deer damage. In addition, some resource/property owners may take illegal action against localized populations of deer out of frustration of continued damage. Some of these illegal actions may be less humane than methods used by experienced WS personnel.

Effects on Aesthetic Values. The impacts of this alternative to stakeholders would be variable depending on their values towards wildlife and compassion for their neighbors. Resource owners receiving damage from deer would likely strongly oppose this alternative because they would bear the damage caused by deer. Some individuals would prefer this alternative because activists believe it is morally wrong to kill or use animals for any reason. Some people would support this alternative because they enjoy seeing deer, or having deer nearby. However, while WS would take no action under this alternative, other individuals or entities could, and likely would, conduct deer damage management activities.

Effects on Regulated White-tailed Deer Hunting. WS would have no direct impact on regulated deer hunting. However, resource owners may remove deer under special permits issued by MDNR resulting in impacts similar to the proposed action.

Table 4-2 summarizes the expected impacts of each of the alternatives on each of the issues.

4.4 CUMULATIVE IMPACTS

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

Table 4.2 Comparisons of Issues/Impacts and Alternatives

Issues/Impacts	***Alternative 1***	***Alternative 2***	***Alternative 3***	***Alternative 4***
Effects on White-tailed deer population	Local population would be reduced and sustained at a lower level. No effect on statewide deer population.	Populations would not be affected by WS. If resource owner conducts deer management, effect would be similar to Alternative 1.	Local population would be reduced and sustained at a lower level. No effect on statewide deer population	Populations would not be affected by WS. If resource owner conducts deer management, effect would be similar to Alternative 1.
Effects on plants and other wildlife species, including T&E species	No adverse impacts by WS. Positive impact to those species that are being negatively impacted by deer.	No adverse impacts by WS. Positive impact to those species that are being negatively impacted by deer if nonlethal methods are effective.	No adverse impacts by WS. Positive impact to those species that are being negatively impacted by deer if lethal methods are effective.	No impact by WS. Positive impact to those species that are being negatively impacted by deer if resource owner implements damage reduction program.
Effects on Human Health and Safety.	No probable direct negative effect. Positive effect from reduced deer strikes and disease transmission.	No probable direct negative effect. Slight positive effect from reduced deer strikes and disease transmission.	No probable direct negative effect. Moderate positive effect. from reduced deer strikes and disease transmission.	No impact by WS. Probable increase in risks associated from deer strikes and disease transmission. If resource owners conducts deer damage management, effect would be variable .
Humaneness of methods to be used.	Some would view as inhumane. Others would view as more humane than deer injured or killed by an aircraft or vehicle collisions.	Most would view as humane. If resource owners conduct lethal deer management activities, effects would be similar to Alternative 4.	Some would view as inhumane. Others will view as more humane than deer injured of killed by an aircraft or vehicle collisions.	No impact by WS. Most would view as humane. If resource owners conduct deer management activities, effects would be variable.

Effects on Aesthetic Values.	Variable; Population would be reduced, less opportunity to view deer. Positive effects on individuals receiving damage.	Variable; Population would remain the same or increase. Increased opportunity to view deer. If resource owners conduct deer damage management activities effect would be similar to Alternative 4.	Variable; Population would be reduced, less opportunity to view deer.	Variable; Population would remain the same or increase. Increased opportunity to view deer. If resource owner conducts deer damage management activities, effects would be similar to Alternative 1.
Effects on Regulated White-tailed Deer Hunting.	Minimal impact; Slight reduction in the number of deer that may otherwise be available to hunters during hunting seasons	Minimal impact; No impact by WS. If resource owner implements lethal control, impacts similar to Alternative 1.	Minimal impact; Slight reduction in the number of deer that may otherwise be available to hunters during hunting seasons. Similar to Alternative 1.	Minimal impact; No impact by WS. If resource owner implements lethal control, impacts similar to Alternative 1.

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APPENDIX A

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APPENDIX B

WHITE-TAILED DEER DAMAGE MANAGEMENT METHODS AVAILABLE FOR USE OR RECOMMENDATIONS BY THE MICHIGAN WILDLIFE SERVICES PROGRAM

NONLETHAL METHODS

Habitat Modifications

Habitat Modification can be an integral part of wildlife damage management (WDM). Wildlife production and/or presence are directly related to the type, quality and quantity of suitable habitat. Therefore, habitat can be managed to reduce or eliminate the production or attraction of certain wildlife species. Habitat management is most often a primary component of WDM strategies at or near airports to reduce problems by eliminating loafing, bedding and feeding sites. Modifying or eliminating habitat utilized by deer may change deer behavior and reduce deer damage. This could include reducing vegetative cover, forage crops, or using less palatable landscape plants.

Physical Exclusion

Fencing, netting, or other barriers can limit deer access to a particular area. There are several types of fences that can inhibit deer access including: temporary electric, high tensile electric, woven wire, chain-link, and solid wall fencing. Temporary electric fences are simple, inexpensive fences used in protecting gardens and agricultural crops during the growing season. Permanent high-tensile electric fences provide year-round protection from deer and are used around high-value specialty crops. Permanent woven-wire fences provide the ultimate deer barrier. They require little maintenance but are more expensive to build than the previous designs. Deer pressure, crop value, field size, and cost-benefit analysis are often the best determinants of fence design (Craven and Hygnstrom 1994).

Animal Behavior Modification

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

Auditory scaring devices

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

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

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

LETHAL METHODS

Sharpshooting
WS would conduct sharpshooting, with center-fire rifles, during daylight or at night using spotlights or night-vision equipment. Rifles would be equipped with noise suppressors, to avoid disturbance to airport operations or other airport users and to facilitate success by minimizing the tendency of deer to flee from the sound of gunfire. Shots would be taken from elevated positions in tree stands or in the beds of trucks. Elevated positions cause a downward angle of trajectory, so that any bullets that inadvertently miss or pass through targeted deer, will hit into the ground or into earthen embankments to minimize the risk of stray bullets presenting a safety hazard to people, pets, or property. WS personnel would strive for head and neck shots when shooting deer to achieve quick, humane kills. Bait may be used to attract deer to safe sites for shooting and to enhance success and efficiency. The venison from deer killed by WS would be processed and donated for consumption, at one or more charitable organizations. WS will be responsible for properly preparing deer and the delivery to a USDA approved meat processor.

Only WS personnel who have completed firearms safety training, have demonstrated skill and proficiency with the firearms used for deer removal, and have been approved for sharpshooting by the State Director in Michigan will participate in sharpshooting deer.

Firearm use is very sensitive and a public concern because of safety issues relating to the public and misuse. To ensure safe use and awareness, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within 3 months of their appointment and a refresher course every 3 years afterwards (WS Directive 2.615). WS employees who carry firearms as a condition of employment, are required to sign a form certifying that they meet the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

Live-capture of deer followed by euthanasia

In areas where sharpshooting may be inappropriate due to safety concerns, live-capture of deer followed by euthanasia may be used. Capture methods for deer would include darting with capture drugs, clover traps, box traps, drop nets, net guns, and rocket nets. Captured deer would be euthanized by methods recommended by the AVMA (Beaver et al. 2001) or the recommendations of a veterinarian.

APPENDIX C

MICHIGAN FEDERAL ENDANGERED AND THREATENED SPECIES

U.S. FISH AND WILDLIFE SERVICE

EAST LANSING, MICHIGAN

Mammals

1. Gray wolf (E)
2. Indiana bat (E)
3. Eastern cougar (E, X)
4. Canada lynx (PT, X)

Birds

1. Kirtland's warbler (E)
2. Piping plover (E)
3. Bald eagle (T)

Reptiles

1. Northern copperbelly watersnake (T)

Insects

1. Mitchell's satry butterfly (E)
2. Karner blue butterfly (E)
3. Hungerford's crawling water beetle (E)
4. American burying beetle (E)
5. Hine's emerald dragonfly (E)

Mussels

1. Northern riffleshell (E)
2. Clubshell (E)

Plants

1. Michigan monkey-flower (E)
2. Pitcher's thistle (T)
3. Houghton's goldenrod (T)
4. Dwarf lake iris (T)
5. Eastern prairie fringed orchid (T)
6. American hart's-tongue fern (T)
7. Lakeside daisy (E)
8. Small whorled pogonia (T)

E = endangered; T = threatened; PT = proposed threatened
X = not currently found, status uncertain in Michigan

Appendix D

Michigan State Endangered and Threatened Species

DEPARTMENT OF NATURAL RESOURCES

WILDLIFE AND FISHERIES DIVISIONS

ENDANGERED AND THREATENED SPECIES

Filed with the Secretary of State on March 5, 1999. These rules take effect 15 days after filing with the Secretary of State (3/20/99).

(By authority conferred on the commission of natural resources by section 36503 of Act No. 451 of the Public Acts of 1994, as amended, being § 324.36503 of the Michigan Compiled Laws)

R 299.102l, R 299.1022, R 299.1023, R 299.1024, R 299.1025, R 299.1026, R 299.1027, and R 299.1028 of the Michigan Administrative Code are amended to read as follows:

R 299.1021 Mollusks.

Rule 1. (1) The following species of mollusks of class Pelecypoda (mussels) are included on the state list of endangered species:

(a) *Epioblasma obliqua perobliqua* (Lea) [*Dysnomia sulcata* (Conrad)]	White catspaw
(b) *Epioblasma torulosa rangiana* (Rafinesque) [*Dysnomia torulosa rangiana* (Lea)]	Northern riffleshell
(c) *Epioblasma triquetra* (Rafinesque) [*Dysnomia triquetra* (Rafinesque)]	Snuffbox
(d) *Obovaria subrotunda* (Rafinesque)	Round hickorynut
(e) *Pleurobema clava* (Lamarck)	Clubshell
(f) *Simpsonaias ambigua* (Say) [*Simpsoniconcha ambigua* (Say)]	Salamander mussel
(g) *Toxolasma lividus* (Rafinesque) [Carunculina glans (Lea)]	Purple lilliput
(h) *Villosa fabalis* (Lea)	Rayed bean

(2) The following species of mollusks of class Pelecypoda (mussels) are included on the state list of threatened species:

(a) *Anodonta subgibbosa* (Anthony)	Lake floater
(b) *Lampsilis fasciola* Rafinesque	Wavyrayed lampmussel

(3) The following species of mollusks of class Gastropoda (snails) are included on the state list of endangered species:

(a) *Planorbella multivolvis*(Case) *[Helisoma multivolvis]*	Acorn ramshorn
(b) *Stagnicola petoskeyensis* (Walker)	Petoskey pondsnail

(4) The following species of mollusks of class Gastropoda (snails) are included on the state list of threatened species:

(a) *Hendersonia occulta* (Say)	Cherrystone drop
(b) *Stagnicola contracta* (Currier) [*Lymanaea contracta*]	Deepwater pondsnail

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R 299.1022 Insects.

Rule 2. (1) The following species of insects are included on the state list of endangered species:

(a) *Brychius hungerfordi* Spangler beetle	Hungerford's crawling water
(b) *Catocala amestris* Strecker	Three-staff underwing
(c) *Neonympha mitchellii mitchellii* French	Mitchell's satyr
(d) *Nicrophorus americanus* Olivier	American burying beetle
(e) *Schinia indiana* (Smith)	Phlox moth
(f) *Schinia lucens* (Morrison)	Leadplant moth
(g) *Somatochlora hineana* Williamson	Hine's emerald dragonfly
(h) *Speyeria idalia* (Drury)	Regal fritillary

(2) The following species of insects are included on the state list of threatened species:

(a) *Atrytonopsis hianna* Scudder	Dusted skipper
(b) *Erynnis persius persius* Scudder	Persius dusky wing
(c) *Euphyes dukesi* (Lindsey)	Dukes' skipper
(d) *Hesperia ottoe* Edwards	Ottoe skipper
(e) *Incisalia irus* Godart	Frosted elfin
(f) *Lepyronia gibbosa* Ball	Great Plains spittlebug
(g) *Lycaeides idas nabokovi* Masters	Northern blue
(h) *Lycaeides melissa samuelis* Nabakov	Karner blue
(i) *Oarisma powesheik* (Parker)	Powesheik skipperling
(j) *Papaipema silphii* Bird	Silphium borer moth
(k) *Trimerotropis huroniana* E. M. Walker	Lake Huron locust

R 299.1023 Fishes.

Rule 3. (1) The following species of fishes are included on the state list of endangered species:

(a) *Clinostomus elongatus* (Kirtland)	Redside dace
(b) *Erimyzon oblongus* (Mitchill)	Creek chubsucker
(c) *Notropis photogenis* (Cope)	Silver shiner
(d) *Noturus stigmosus* Taylor	Northern madtom
(e) *Opsopoeodus emiliae* Hay	Pugnose minnow
(f) *Percina shumardi* (Girard)	River darter
(g) *Percina copelandi* (Jordan)	Channel darter
(h) *Phoxinus erythrogaster* (Rafinesque)	Southern redbelly dace

(2) The following species of fishes are included on the state list of threatened species:

(a) *Acipenser fulvescens* Rafinesque	Lake sturgeon
(b) *Ammocrypta pellucida* (Putnam)	Eastern sand darter
(c) *Coregonus artedii* Lesueur	Cisco or lake herring
(d) *Coregonus zenithicus* (Jordan and Evermann)	Shortjaw cisco
(e) *Hiodon tergisus* Lesueur	Mooneye
(f) *Moxostoma carinatum* (Cope)	River redhorse
(g) *Stizostedion canadense* (Smith)	Sauger

(3) The following species of fishes are thought to be extirpated in Michigan, but, if rediscovered, will automatically be listed as threatened:

(a) *Coregonus johannae* (Wagner)	Deepwater cisco
(b) *Coregonus nigripinnis* (Gill)	Blackfin cisco

(c) *Coregonus reighardi* (Koelz) Shortnose cisco
(d) *Notropis amblops* (Rafinesque) Bigeye chub
(e) *Notropis chalybaeus* (Cope) Ironcolor shiner
(f) *Notropis texanus* (Girard) Weed shiner
(g) *Polyodon spathula* (Walbaum) Paddlefish
(h) *Stizostedion vitreum glaucum* (Hubbs) Bluepike
(i) *Thymallus arcticus* (Richardson) Arctic grayling

R 299.1024 Amphibians.

Rule 4. (1) The following species of amphibians is included on the state list of endangered species:
Ambystoma texanum (Matthews) Smallmouth salamander

(2) The following species of amphibians is included on the state list of threatened species:
Ambystoma opacum (Gravenhorst) Marbled salamander

R 299.1025 Reptiles.

Rule 5. (1) The following species of reptiles are included on the state list of endangered species:
(a) *Clonophis kirtlandii* (Kennicott) Kirtland's snake
(b) *Nerodia erythrogaster neglecta* (Conant) Copperbelly watersnake

(2) The following species of reptiles are included on the state list of threatened species:
(a) *Elaphe vulpina gloydi* Conant Eastern fox snake
(b) *Clemmys guttata* Spotted turtle

R 299.1026 Birds.

Rule 6. (1) The following species of birds are included on the state list of endangered species:
(a) *Asio flammeus* (Pontoppidan) Short-eared owl
(b) *Charadrius melodus* Ord Piping plover
(c) *Dendroica discolor* (Vieillot) Prairie warbler
(d) *Dendroica kirtlandii* (Baird) Kirtland's warbler
(e) *Falco peregrinus* Tunstall Peregrine falcon
(f) *Lanius ludovicianus migrans* (Palmer) Migrant loggerhead shrike
(g) *Rallus elegans* Audubon King rail
(h) *Tyto alba* (Scopoli) Barn owl

(2) The following species of birds are included on the state list of threatened species:
(a) *Ammodramus henslowii* Audubon Henslow's sparrow
(b) *Asio otis* (Linnaeus) Long-eared owl
(c) *Buteo lineatus* (Gmelin) Red-shouldered hawk
(d) *Corturnicops noveboracensis* (Gmelin) Yellow rail
(e) *Dendroica dominica* (Linnaeus) Yellow-throated warbler
(f) *Falco columbarius* (Linnaeus) Merlin
(g) *Gavia immer* (Brunnich) Common loon
(h) *Haliaeetus leucocephalus* (Linnaeus) Bald eagle
(i) *Ixobrychus exilis* (Gmelin) Least bittern
(j) *Pandion haliaetus* (Linnaeus) Osprey
(k) *Sterna caspia* Pallas Caspian tern
(l) *Sterna hirundo* Linnaeus Common tern
(m) *Cygnus buccinator* Richardson Trumpeter swan

(3) The following species of birds are thought to be extirpated in Michigan, but, if rediscovered, will automatically be listed as threatened:

Chondestes grammacus (Say)	Lark sparrow

R 299.1027 Mammals.

Rule 7. (1) The following species of mammals are included on the state list of endangered species:

(a) *Canis lupus* Linnaeus	Gray wolf
(b) *Felis concolor* Linnaeus	Cougar
(c) *Lynx canadensis* Kerr	Lynx
(d) *Microtus ochrogaster* (Wagner)	Prairie vole
(e) *Myotis sodalis* Miller and Allen	Indiana bat

(2) The following species of mammals is included on the state list of threatened species:

Cryptotis parva (Say)	Least shrew

R 299.1028 Plants.

Rule 8. (1) The following species of plants are included on the state list of endangered species:

(a) *Agalinas gattingeri* Small [*Gerardia gattingeri* Small]	Gattinger's gerardia
(b) *A. skinneriana* (A. Wood) Britton [*Gerardia skinneriana* A. Wood]	Skinner's gerardia
(c) *Amerorchis rotundifolia* (Pursh) Hultén	Small round-leaved orchis
(d) *Asclepias ovalifolia* Dcne.	Dwarf milkweed
(e) *Androsace occidentalis* Pursh	Rock-jasmine
(f) *Arnica cordifolia* Hooker	Heart-leaved arnica
(g) *Asplenium ruta-muraria* L.	Wall-rue
(h) *A. scolopendrium* L. var. *americana* (Fernald) Kartesz & Ghandi [*Phyllitis scolopendrium* var. *americanum* Fern.]	Hart's-tongue fern
(i) *Baptisia leucophaea* Nutt.	Cream wild indigo
(j) *Botrychium acuminatum* W. H. Wagner	Moonwort
(k) *Carex heleonastes* Ehrh.	Hudson Bay sedge
(l) *C. nigra* (L.) Reichard	Black sedge
(m) *C. straminea* Willd.	Straw sedge
(n) *Castanea dentata* (Marsh.) Borkh.	American chestnut
(o) *Chamaerhodos nuttallii* Fern.	Rock-rose
(p) *Chelone obliqua* L.	Purple turtlehead
(q) *Cryptogramma acrostichoides* R. Br.	American rock-brake
(r) *Disporum hookeri* (Torrey) Nicholson	Fairy bells
(s) *Dodecatheon meadia* L.	Shooting star
(t) *Draba glabella* Pursh.	Smooth whitlow grass
(u) *Echinodorus tenellus* (Mart.) Buchenau	Dwarf burhead
(v) *Eleocharis atropurpurea* (Retz.) Kunth	Purple spike rush
(w) *E. microcarpa* Torrey	Small-fruited spike-rush
(x) *E. nitida* Fern.	Slender spike rush
(y) *Gentiana flavida* A. Gray [*G. alba* Muhl.]	White gentian
(z) *G. puberulenta* J. Pringle [*G. puberula* Michaux]	Downy gentian
(aa) *Gymnocarpium jessoense* (Koidz.) Koidz.	Northern oak fern
(bb) *Hedysarum alpinum* L.	Alpine sainfoin
(cc) *Hymenoxys herbacea* (Greene) Cusick	Lakeside daisy

	[*Hymenoxys acaulis* var. *glabra* (Gray) Parker	
(dd)	*Isoetes engelmannii* A. Braun	Engelmann's quillwort
(ee)	*Isotria medeoloides* (Pursh) Raf.	Smaller whorled pogonia
(ff)	*Lygodium palmatum* (Bernh.) Sw.	Climbing fern
(gg)	*Mimulus glabratus* var. *michiganensis* (Pennell) Fassett	Michigan monkey flower
(hh)	*Nuphar pumila* (Timm) DC. [*N. microphylla* (Pers.) Fern.]	Small yellow pond lily
(ii)	*Nymphaea tetragona* Georgi	Pygmy water lily
(jj)	*Opuntia fragilis* (Nutt.) Haw.	Fragile prickly pear
(kk)	*Panicum polyanthes* Schultes	Many-flowered panic grass
(ll)	*Penstemon gracilis* Nutt.	Slender beard tongue
(mm)	*Platanthera leucophaea* (Nutt.) Lindley [*Habenaria leucophea* (Nutt.) A. Gray]	Prairie white-fringed orchid
(nn)	Plantago cordata Lam.	Heart-leaved plantain
(oo)	*Poa canbyi* (Scribner) Piper	Canbyi's bluegrass
(pp)	*Populus heterophylla* L.	Swamp or Black cottonwood
(qq)	*Proserpinaca pectinata* Lam.	Mermaid-weed
(rr)	*Rhynchospora globularis* (Chapman) Small	Globe beak-rush
(ss)	*Rubus acaulis* Michaux	Dwarf raspberry
(tt)	*Rumex occidentalis* S. Wats	Western dock
(uu)	*Scleria pauciflora* Willd.	Few-flowered nut rush
(vv)	*Subularia aquatica* L.	Awlwort
(ww)	*Trillium undulatum* Willd.	Painted trillium
(xx)	*Utricularia inflata* Walter [*U. radiata* Small]	Floating bladderwort
(yy)	*Vaccinium vitis*-idaea L.	Mountain cranberry

(2) The following species of plants, listed by major group and family, are included on the state list of threatened species:

(a)	PTERIDOPHYTES:	
(i)	ASPLENIACEAE (Spleenwort Fanily):	
(A)	*Asplenium rhizophyllum* L. [*Camptosorus rhizophyllus* (L.) Link]	Walking fern
(B)	*A. trichomanes-ramosum* L. [*A. viride* Hudson]	Green spleenwort
(ii)	DRYOPTERIDACEAE (Wood Fern Family):	
(A)	*Dryopteris celsa* (W. Palmer) Small	Small log fern
(B)	*Gymnocarpium robertianum* (Hoffman) Newman	Limestone oak fern
(C)	*Woodsia alpina* (Bolton) S. F. Gray	Northern woodsia
(D)	*W. obtusa* (Sprengel) Torrey	Blunt-lobed woodsia
(iii)	LYCOPODIACEAE (Clubmoss family):	
	Lycopodiella margaritae J. G. Bruce, W. H. Wagner, & Beitel	Clubmoss
(iv)	OPHIOGLOSSACEAE (Adder's-tongue family):	
(A)	*Botrychium campestre* W. H. Wagner	Prairie Moonwort or Dunewort
(B)	*B. hesperium* (Maxon & Clausen) W. H. Wagner & Lellinger	Western moonwort
(C)	*B. mormo* W. H. Wagner	Goblin moonwort
(D)	*Ophioglossum vulgatum* L. [*O. pycnostichum* (Fern.) Löve & Löve]	Southeastern adder's-tongue

(v)	PTERIDACEAE (Maidenhair Fern Family)	
	Pellaea atropurpurea (L.) Link.	Purple cliff brake
(b)	MONOCOTYLEDONS:	
(i)	ALISMATACEAE (Water-plantain family):	
	Sagittaria montevidensis Cham. & Schlecht.	Arrowhead
(ii)	CYPERACEAE (Sedge family):	
(A)	*Carex albolutescens* Schw.	Sedge
(B)	*C. assiniboinensis* W. Boott	Assiniboia sedge
(C)	*C. atratiformis* Britton	Sedge
(D)	*C. conjuncta* F. Boott.	Sedge
(E)	*C. crus-corvi* Kunze	Raven's-foot sedge
(F)	*C. lupuliformis* Dewey	False hop sedge
(G)	*C. media* R. Br.	Sedge
(H)	*C. novae-angliae* Schwein.	New England sedge
(I)	*C. oligocarpa* Willd.	Eastern few-fruited sedge
(J)	*C. platyphylla* Carey	Broad-leaved sedge
(K)	*C. rossii* Boott	Ross's sedge
(L)	*C. scirpoidea* Michaux	Bulrush sedge
(M)	*C. seorsa* Howe	Sedge
(N)	*C. typhina* Michaux	Cattail sedge
(O)	*C. wiegandii* Mackenzie	Wiegand's sedge
(P)	*Eleocharis geniculata (L.) R & S.* [*E.caribaea* (Rottb.) S. F. Blake]	Spike rush
(Q)	*E. compressa* Sulliv.	Flattened spike rush
(R)	*E. parvula* (R. & S.) Link.	Dwarf spike rush
(S)	*E. tricostata* Torrey	Three-ribbed spike rush
(T)	*Fuirena squarrosa* Michaux	Umbrella grass
(U)	*Psilocarya scirpoides* Torrey	Bald rush
(V)	*Scirpus hallii* A. Gray	Hall's bulrush
(W)	*S. americanus* Pers. [*S. olneyi* A. Gray]	Olney's bulrush
(X)	*Scleria reticularis* Michaux	Netted nut rush
(iii)	IRIDACEAE (Iris family):	
(A)	*Iris lacustris* Nutt.	Dwarf lake iris
(B)	*Sisyrinchium atlanticum* Bickn.	Atlantic blue-eyed-grass
(iv)	JUNCACEAE (Rush family):	
(A)	*Juncus brachycarpus* Engelm.	Short-fruited rush
(B)	*J. militaris* Bigelow	Bayonet rush
(C)	*J. scirpoides* Lam.	Scirpus-like rush
(D)	*J. stygius* L.	Moor rush
(E)	*J. vaseyi* Engelm.	Vasey's rush
(F)	*Luzula parviflora* (Ehrh.) Desv.	Small-flowered wood rush
(v)	LEMNACEAE (Duckweed family):	
	Wolffia papulifera Thompson [*W. brasiliensis* Weddell]	Watermeal

(vi)	LILIACEAE (Lily family):	
(A)	*Allium schoenoprasum* L. (native variety)	Chives
(B)	*Camassia scilloides* (Raf.) Cory	Wild hyacinth
(C)	*Disporum trachycarpum* (Wats) B. & H.	Northern fairy bells
(D)	*Tofieldia pusilla* (Michaux) Pers.	False asphodel
(E)	*Trillium nivale* Riddell	Snow trillium
(F)	*T. recurvatum* Beck	Prairie trillium
(G)	*T. sessile* L.	Toadshade
(vii)	ORCHIDACEAE (Orchid family):	
(A)	*Calypso bulbosa* (L.) Oakes	Calypso or fairy-slipper
(B)	*Cypripedium candidum* Willd.	White lady slipper
(C)	*Galearis spectabilis* (L.) Raf.	Showy orchis
(D)	*Isotria verticillata* (Willd.) Raf.	Whorled pogonia
(E)	*Platanthera ciliaris* (L.) Lindley [*Habenaria ciliaris* (L.) R. Br.]	Orange- or yellow-fringed orchis
(F)	*Spiranthes ovalis* Lindley	Lesser ladies'-tresses
(G)	*Tipularia discolor* (Pursh) Nutt.	Cranefly orchid
(H)	*Triphora trianthophora* (Sw.) Rydb.	Nodding pogonia or three birds orchid
(viii)	POACEAE (Grass family):	
(A)	*Aristida longespica* Poiret	Three-awned grass
(B)	*A. tuberculosa* Nutt.	Beach three-awned grass
(C)	*Beckmannia syzigachne* (Steudel) Fern.	Slough grass
(D)	*Bouteloua curtipendula* (Michaux) Torrey	Side oats grama
(E)	*Bromus pumpellianus* Scribner	Pumpelly's bromegrass
(F)	*Calamagrostis lacustris* (Kearney) Nash	Northern reedgrass
(G)	*C. stricta* (Timm) Koeler	Narrow-leaved reedgrass
(H)	*Chasmanthium latifolium* (Michx.) Yates [*Uniola latifolia* Michaux]	Wild oats
(I)	*Diarrhena americana* Beauv.	Beak grass
(J)	*Festuca scabrella* Torrey [*F. altaica* Trin.]	Rough fescue
(K)	*Muhlenbergia richardsonis* (Trin.) Rydb.	Mat muhly
(L)	*Oryzopsis canadensis* (Poiret) Torrey	Canada rice grass
(M)	*Panicum leibergii* (Vasey) Scribner	Leiberg's panic grass
(N)	*P. longifolium* Torrey	Panic grass
(O)	*P. verrucosum* Muhl.	Warty panic grass
(P)	*Poa alpina* L.	Alpine bluegrass
(Q)	*P. paludigena* Fern. & Wieg.	Bog bluegrass
(R)	*Zizania aquatica* var. *aquatica* L.	Wild rice
(ix)	POTAMOGETONACEAE (Pondweed family):	
(A)	*Potamogeton bicupulatus* Fern. [*P. capillaceus* Poiret]	Waterthread pondweed
(B)	*P. hillii* Morong	Hill's pondweed
(C)	*P. pulcher* Tuckerman	Spotted pondweed
(D)	*P. vaseyi* Robins	Vasey's pondweed

(x)	RUPPIACEAE (Widgeon grass family):	
	Ruppia maritima L.	Widgeon grass
(c)	DICOTYLEDONS:	
(i)	ACANTHACEAE (Acanthus family):	
(A)	*Justicia americana* (L.) Vahl	Water willow
(B)	*Ruellia humilis* Nutt.	Hairy wild petunia
(C)	*R. strepens* L.	Smooth wild petunia
(ii)	APIACEAE (Parsley family):	
(A)	*Berula erecta* (Nutt.) Fern.	Cut-leaved water parsnip
	[*B. pusilla* (Nutt.) Fern.]	
(B)	*Eryngium yuccifolium* Michaux	Rattlesnake-master or button snakeroot
(C)	Os*morhiza depauperata* Phil.	Sweet Cicely
(D)	*Zizia aptera* (A. Gray) Fern.	Prairie golden alexanders
(iii)	ARALIACEAE (Ginseng family):	
(A)	*Oplopanax horridus* (Smith) Miq.	Devil's club
(B)	*Panax quinquefolius* L.	Ginseng
(iv)	ARISTOLOCHIACEAE (Birthwort family):	
	Aristolochia serpentaria L.	Virginia snakeroot
(v)	ASCLEPIADACEAE (Milkweed family):	
(A)	*Asclepias hirtella* (Pennell) Woodson	Tall green milkweed
(B)	*A. sullivantii* Engelm.	Sullivant's milkweed
(vi)	ASTERACEAE (Composite family):	
(A)	*Agoseris glauca* (Pursh) Raf.	Prairie or pale agoseris
(B)	*Antennaria rosea* Greene	Rosy pussytoes
(C)	*Artemisia ludoviciana* Nutt.	Western mugwort
(D)	*Aster furcatus* Burgess	Forked aster
(E)	*A. modestus* Lindley	Great northern aster
(F)	*A. sericeus* Vent.	Western silvery aster
(G)	*Cirsium pitcheri* (Eaton) Torrey & A. Gray	Pitcher's thistle
(H)	*Coreopsis palmata* Nutt.	Prairie coreopsis
(I)	*Erigeron hyssopifolius* Michaux	Hyssop-leaved fleabane
(J)	*Eupatorium fistulosum* Barratt	Hollow-stemmed Joe-pye weed
(K)	*E. sessilifolium* L.	Upland boneset
(L)	*Gnaphalium sylvaticum* L.	Woodland everlasting
(M)	*Helianthus mollis* Lam.	Downy sunflower
(N)	*Lactuca floridana* (L.) Gaertner	Woodland lettuce
(O)	*L. pulchella* (Pursh) DC.	Wild blue lettuce
(P)	*Petasites sagittatus* (Pursh) A. Gray	Sweet coltsfoot
(Q)	*Polymnia uvedalia* L.	Yellow-flowered leafcup
(R)	*Senecio indecorus* Greene	Northern ragwort
(S)	*Silphium integrifolium* Michaux	Rosinweed
(T)	*S. laciniatum* L.	Compass plant

(U)	*S. perfoliatum* L.	Cup plant
(V)	*Solidago houghtonii* A. Gray	Houghton's goldenrod
(W)	*S. missouriensis* Nutt.	Missouri goldenrod
(X)	*Tanacetum huronense* Nutt.	Lake Huron tansy
(vii)	BORAGINACEAE (Borage family):	
	Mertensia virginica Pers. (L.)	Virginia bluebells
(viii)	BRASSICACEAE (Mustard family):	
(A)	*Arabis perstellata* E. L. Braun	Rock cress
(B)	*Armoracia lacustris* (A. Gray) Al-Shehbaz & V. Bates [*A. aquatica* (Eaton Wiegand)]	Lake cress
(C)	*Braya humilis* (C. A. Meyer) Robinson	Low northern rock cress
(D)	*Dentaria maxima* Nutt.	Large toothwort
(F)	*Draba cana* Rydb.	Ashy whitlow grass
(G)	*D. incana* L.	Twisted whitlow grass
(H)	*D. reptans* (Lam.) Fern.	Creeping whitlow grass
(ix)	CALLITRICHACEAE (Water-starwort family):	
	Callitriche heterophylla Pursh	Large water starwort
(x)	CAPRIFOLIACEAE (Honeysuckle family):	
(A)	*Lonicera involucrata* (Richardson) Banks	Black twinberry
(B)	*Viburnum edule* (Michx.) Raf.	Squashberry or mooseberry
(xi)	CARYOPHYLLACEAE (Pink family):	
(A)	*Arenaria macrophylla* Hooker	Large-leaved sandwort
(B)	*Sagina nodosa* (L.) Fenzl	Pearlwort
(C)	*Silene stellata* (L.) Aiton f.	Starry campion
(D)	*S. virginica* L.	Fire pink
(E)	*Stellaria crassifolia* Ehrh.	Fleshy stitchwort
(xii)	CISTACEAE (Rockrose family):	
	Lechea pulchella Raf. [*L. leggettii* Britton & Hollick]	Leggett's pinweed
(xiii)	CONVOLVULACEAE (Morning-glory family):	
	Ipomoea pandurata (L.) G. F. W. Meyer	Wild potato vine or man-of-the-earth
(xiv)	EMPETRACEAE (Crowberry family):	
	Empetrum nigrum L.	Black crowberry
(xv)	ERICACEAE (Heath family):	
(A)	*Pterospora andromedea* Nutt.	Pine-drops
(B)	*Vaccinium cespitosum* Michaux	Dwarf bilberry
(C)	*V. uliginosum* L.	Alpine blueberry
(xvi)	EUPHORBIACEAE (Spurge family):	

	Euphorbia commutata Engelm.	Tinted spurge
(xvii)	FABACEAE (Pea family):	
(A)	*Astragalus canadensis* L.	Canadian milk vetch
(B)	*Wisteria frutescens* (L.) Poiret	Wisteria
(xviii)	FUMARIACEAE (Fumitory family):	
	Corydalis flavula (Raf.) DC.	Yellow fumewort
(xix)	GENTIANACEAE (Gentian family):	
(A)	*Bartonia paniculata* (Michaux) Muhl.	Panicled screwstem
(A)	*Gentiana linearis* Froel.	Narrow-leaved gentian
(B)	*Gentianella quinquefolia* (L.) Small	Stiff gentian
(C)	*Sabatia angularis* (L.) Pursh	Rosepink
(xx)	HALORAGACEAE (Water-milfoil family):	
	Myriophyllium farwellii Morong	Farwell's water milfoil
(xxi)	HYDROPHYLLACEAE (Waterleaf family):	
	Phacelia franklinii (R. Br.) A. Gray	Franklin's phacelia
(xxii)	HYPERICACEAE (St. John's-wort family):	
	Hypericum sphaerocarpum Michaux	Round-fruited St. John's-wort
(xxiii)	LAMIACEAE (Mint family):	
(A)	*Lycopus virginicus* L.	Virginia water-horehound
(B)	*Pycnanthemum muticum* (Michx.) Pers.	Mountain mint
(C)	*P. pilosum* Nutt.	Hairy mountain mint
(D)	*Scutellaria nervosa* Pursh	Skullcap
(E)	*S. parvula* Michaux [sensu lato]	Small skullcap
(F)	*Trichostema brachiatum* L. [*Isanthus brachiatus* (L.) BSP.]	False pennyroyal
(G)	*T. dichotomum* L.	Bastard pennyroyal
(xxiv)	LENTIBULARIACEAE (Bladderwort family):	
	Utricularia subulata L.	Bladderwort
(xxv)	LINACEAE (Flax family):	
	Linum virginianum L.	Virginia flax
(xxvi)	MELASTOMATACEAE (Melastome family):	
	Rhexia mariana L.	Maryland meadow beauty
(xxvii)	MORACEAE (Mulberry Family):	
	Morus rubra L.	Red mulberry
(xxviii)	NYMPHAEACEAE (Water-lily family):	
	Nelumbo lutea (Willd.) Pers.	American lotus
	[*N. pentapetala* (Walter) Fern.]	

(xxix)	OLEACEAE (Olive family):	
	Fraxinus profunda (Bush) Bush [*F. tomentosa* F. Michaux]	Pumpkin ash
(xxx)	ONAGRACEAE (Evening-primrose family):	
	Ludwigia sphaerocarpa Ell.	Globe-fruited seedbox
(xxxi)	OROBANCHACEAE (Broom-rape family):	
	Orobanche fasciculata Nutt.	Broomrape
(xxxii)	OXALIDACEAE (Wood-sorrel family):	
	Oxalis violacea L.	Violet wood sorrel
(xxxiii)	POLEMONIACEAE (Phlox family):	
(A)	*Phlox bifida* Beck.	Cleft phlox
(B)	*P. maculata* L.	Wild sweet William
(C)	*Polemonium reptans* L.	Jacob's ladder
(xxxiv)	POLYGONACEAE (Smartweed family):	
(A)	*Polygonum careyi* Olney	Carey's smartweed
(B)	*P. viviparum* L.	Alpine bistort
(xxxv)	RANUNCULACEAE (Crowfoot family):	
(A)	*Hydrastis canadensis* L.	Goldenseal
(B)	*Ranunculus ambigens* Watson	Spearwort
(C)	*R. cymbalaria* Pursh	Seaside crowfoot
(D)	*R. lapponicus* L.	Lapland buttercup
(E)	*R. macounii* Britton	Macoun's buttercup
(F)	*R. rhomboideus* Goldie	Prairie buttercup
(xxxvi)	RHAMNACEAE (Buckthorn family):	
	Ceanothus sanguineus Pursh	Wild lilac
(xxxvii)	RUBIACEAE (Madder family):	
	Galium kamtschaticum Schultes & J. H. Schultes	Bedstraw
(xxxviii)	ROSACEAE (Rose family):	
(A)	*Dalibarda repens* L.	False violet
(B)	*Filipendula rubra* (Hill) Robinson	Queen-of-the-prairie
(C)	*Geum triflorum* Pursh	Prairie smoke
(D)	*Porteranthus trifoliatus* (L.) Britton [*Gillenia trifoliata* (L.) Moench.]	Bowman's root
(E)	*Potentilla paradoxa* Nutt.	Sand cinquefoil
(F)	*P. pensylvanica* L.	Prairie cinquefoil
(G)	*Sanguisorba canadensis* L.	Canadian burnet
(xxix)	SALICACEAE (Willow family):	
	Salix planifolia Pursh	Tea-leaved willow

(xl)	SARRACENIACEAE (Pitcher-plant family):	
	Sarracenia purpurea f. *heterophylla* (Eaton) Fern.	Yellow pitcher plant
(xli)	SAXIFRAGACEAE (Saxifrage family):	
(A)	*Parnassia palustris* L.	Marsh grass-of-parnassus
(B)	*Saxifraga paniculata* Miller [S. aizoön Jacq.]	Encrusted saxifrage
(C)	*S. tricuspidata* Rottb.	Prickly saxifrage
(xliii)	SCROPHULARIACEAE (Figwort family):	
(A)	*Besseya bullii* (Eaton) Rydb.	Kitten-tails
(B)	*Castilleja septentrionalis* Lindley	Pale Indian paintbrush
(C)	*Collinsia parviflora* Lindley	Small blue-eyed Mary
(D)	*Dasystoma macrophylla* (Nutt.) Raf.	Mullein foxglove
(E)	*Euphrasia hudsoniana* Fernald & Weigand	Eyebright
(F)	*E. nemorosa* (Pers.) Wallr.	Eyebright
(G)	*Gratiola aurea* Pursh)[*G. lutea* Raf.]	Hedge-hyssop
(H)	*G. virginiana* L.	Annual hedge hyssop
(I)	*Penstemon calycosus* Small	Beard tongue
(xliii)	VALERIANACEAE (Valerian family):	
(A)	*Valeriana edulis* var. *ciliata (T. & G.) Cronquest*	Edible valerian
(B)	*Valerianella chenopodiifolia* (Pursh) DC.	Goosefoot corn salad
(C)	*V. umbilicata* (Sull.) A. W. Wood	Corn salad
(xliv)	VIOLACEAE (Violet family):	
(A)	*Viola epipsila* Ledeb.	Northern marsh violet
(B)	*V. novae-angliae* House	New England violet
(C)	*V. pedatifida* G. Don	Prairie birdfoot violet
(xlv)	VITACEAE (Grape family)	
	Vitis vulpina L.	Frost grape

(3) This rule does not apply to cultivated plants.

(4) The following species of plants are thought to be extirpated in Michigan, but, if rediscovered, will automatically be listed as threatened:

(a)	*Agropyron spicatum* (Pursh) Scribner & J. G. Smith	Bluebunch wheatgrass
(b)	*Aristida dichotoma* Michaux	Three-awned grass
(c)	*Asplenium montanum* Willd.	Mountain spleenwort
(d)	*Buchnera americana* L.	Bluehearts
(e)	*Carex decomposita* Muhl.	Log sedge
(f)	*C gravida* Bailey	Sedge
(g)	*C. haydenii* Dewey	Hayden's sedge
(h)	*Commelina erecta* L.	Slender dayflower
(i)	*Cyperus acuminatus* Torrey & Hooker	Cyperus, Nut grass
(j)	*Dalea purpurea* Vent. [*Petalostemon purpurem* (Vent.) Rydb.]	Purple prairie clover
(k)	*Dennstaedtia punctiloba* (Michx.) T. Moore	Hay-scented fern
(l)	*Digitaria filiformis* (L.) Koeler	Slender finger grass

(m)	*Disporum maculatum* (Buckley) Britton	Nodding madarin
(n)	*Draba nemorosa* L.	Whitlow grass
(o)	*Eleocharis radicans* (Poiret) Kunth	Spike rush
(p)	*Echinacea purpurea* (L.) Moench.	Purple coneflower
(q)	*Equisetum telmateia* Ehrh.	Giant horsetail
(r)	*Fimbristylis puberula* (Michaux) Vahl	Chestnut sedge
(s)	*Gentiana saponaria* L.	Soapwort gentian
(t)	*Glyceria acutiflora* Torrey	Manna grass
(u)	*Hedyotis nigricans* (Lam.) Fosb.	Hedyotis
(v)	*Helianthus microcephalus* Torrey & Gray	Small wood sunflower
(w)	*Lemna valdiviana* Phil.	Pale duckweed
(x)	*Lespedeza procumbens* Michaux	Trailing bush clover
(y)	*Liatris punctata* Hooker	Dotted blazing star
(z)	*L. squarrosa* (L.) Michx.	Plains blazing star
(aa)	*Lithospermum incisum* Lehm.	Narrow-leaved puccoon
(bb)	*Mikania scandens* (L.) Willd.	Mikania
(cc)	*Mimulus alatus* Aiton	Winged monkey flower
(dd)	*Monarda didyma* L.	Bee balm, Oswego tea
(ee)	*Muhlenbergia cuspidata* (Hooker) Rydb.	Plains muhly
(ff)	*Onosmodium molle* Michx.	Marbleweed
(gg)	*Phleum alpinum* L.	Mountain timothy
(hh)	*Polygala incarnata* L.	Pink milkwort
(ii)	*Polygonatum biflorum* var. *melleum* (Farw.) Ownbey	Honey-flowered solomon seal
(jj)	*Polytaenia nuttallii* DC.	Prairie parsley
(kk)	*Rudbeckia subtomentosa* Pursh	Sweet coneflower
(ll)	*Scutellaria incana* Biehler	Skullcap
(mm)	*S. ovata* Hill	Forest skullcap
(nn)	*Senecio congestus* (R. Br.) DC.	Marsh fleabane
(oo)	*Sisyrinchium farwellii* Bickn.	Farwell's blue-eyed grass
(pp)	*S. hastile* Bickn.	Blue-eyed grass
(qq)	*Tomanthera auriculata* (Michaux) Raf. [*Agalinas auriculata* (Michaux) S. F. Blake]	Eared foxglove
(rr)	*Tradescantia bracteata* Small.	Long-bracted spiderwort
(ss)	*Trillium viride* Beck	Green trillium
(tt)	*Woodwardia areolata* (L.) T. Moore	Netted chain fern