To: Board of Commissioners  
From: Paul Muelle, Natural Resources and Environmental Compliance Manager  
Subject: Deer Management  
Project Title: 2015 Deer Management Report and Plan Update  
Location: Authority Wide  
Date: Aug. 4, 2015

Action Requested: Motion to Approve

That the Board of Commissioners’ approve and accept the 2015 Deer Management Report and Plan Update as recommended by Paul Muelle, Natural Resources and Environmental Compliance Manager and staff.

Fiscal Impact: None

Background: In the 1990’s, data gathered by the Michigan Department of Natural Resources (MDNR) and Metropark staff indicated that the Metropark deer herd had lower body weights and productivity rates than the state average. These were indicators that the Metroparks deer herd was under stress from a high population density and lack of proper nourishment. This information correlated with staff observations and vegetation studies indicating a high degree of plant damage.

To address the concerns of deer overabundance in the park system, a Metroparks Wildlife Management Advisory Committee was formed in 1998 to assist in the development a wildlife management plan. Following their recommendations, the Metroparks’ first deer management program using lethal methods was conducted at Kensington, Stony Creek, and Hudson Mills Metroparks in the fall of 1999. In May of 2001, the Huron-Clinton Metroparks Board of Commissioners approved a long-term deer management policy that allows deer populations in the Metroparks to be managed on an annual basis.

The 2015 White-Tailed Deer Management Plan is an updated version of the White-Tailed Deer Management Report and Proposed Policy approved by the Board in 2001. The Metroparks Deer Management Plan is part of a comprehensive effort to manage native ecosystems and recreational open space within the Metropark system.

Attachment: White-Tailed Deer Management Plan
HURON-CLINTON METROPOLITAN AUTHORITY

WHITE-TAILED DEER MANAGEMENT PLAN

May 2001
Revised July 2015
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The Huron-Clinton Metropolitan Authority (HCMA) deer management program is part of a comprehensive effort to manage native ecosystems and recreational open space within the Metropark system. By working toward a balanced and functional environment, native plants and animals (including white-tailed deer) contained within these ecosystems stand a greater chance of long term survival and have an opportunity to thrive.

White-tailed deer can consume up to 12 pounds of vegetation per day. They can affect the composition of the faunal and floral communities in ecological systems throughout Michigan and have put some species and ecological systems at risk. Decreased plant populations can lead to loss of plant and animal species and a gross alteration of native communities. Plants are significant component of the foundation an ecosystem’s function, and when this foundation begins to crumble, there is a cascade affect that alters other levels of the food chain and other species of wildlife including insects, birds and mammals. Scientific journals, studies and position papers from a wide range of organizations and institutions have documented the effects of overabundance of white-tailed deer across North America. Impacts cited include increased instances of car-deer collisions, public health issues, property damage, and ecosystem degradation are widely noted. The majority of studies cite the effects of deer over abundance on forests and other native ecosystems.

Vegetation surveys in 1998-99 at Kensington Metropark revealed a loss of 69 species of plants, with an additional 25 species listed as uncommon. During the same year, surveys at Stony Creek Metropark revealed a loss of seven (7) plant species and 21 listed uncommon. In addition, data gathered by the Michigan Department of Natural Resources (MDNR) from the Metroparks management program in 1999 indicated that the Metropark deer herd was under stress from the high population density and lack of proper nourishment.

To address the concerns of deer overabundance in the park system, a Metroparks Wildlife Management Advisory Committee was formed in 1998 to assist in the development a wildlife management plan. Following their recommendations, the Metroparks’ first deer management program using lethal methods was conducted at Kensington, Stony Creek, and Hudson Mills Metroparks in the fall of 1999. In May of 2001, the Huron-Clinton Metroparks Board of Commissioners approved a long-term deer management policy that allows deer populations in the Metroparks to be managed using lethal methods on an annual basis.

**HCMA Deer Management Program:** The Michigan Department of Natural Resources annually issues Deer Management Assistance permits to the HCMA to reduce the deer herds during regular deer seasons. Local conservation and sportsmen’s groups work with the Metroparks to provide volunteers for controlled deer harvests at designated parks using archery, muzzleloaders and shotguns. Approximately 45 percent of all of the deer removed from the parks thus far have been done through the efforts of volunteer hunters. Deer herd reductions conducted out of season are managed through MDNR Wildlife Damage Investigation and Control Permits. Park police officers trained as sharpshooters are called upon to assist in the reduction of deer herds. The entire park or designated areas of a park, is closed to visitors when deer management activities are taking place, however, every effort is made to keep the remainder of each park open to the public. Sharpshooting by Metropark police officers is primarily conducted in the evening during the winter, which has minimal impact on park usage.

In both harvesting techniques, safety is of utmost importance. Prior to each controlled hunt, qualified volunteers participate in an orientation, which reviews hunting and safety procedures, state regulations and HCMA requirements. The volunteers are placed in specific predetermined locations throughout the management area. Locations are spaced apart and shooting zones established to provide safety to the participants, employees and the surrounding landholders. Participants are allowed to take animals only within the shooting lanes specified. Once placed at a location, the volunteers must remain in place until Metropark staff picks them up. Other hunting techniques have been explored and are possible but each specific technique will need to be reviewed and approved by the HCMA prior to initiation.
A sharpshooting team is comprised of Metropark police officers who are trained marksman and are led by a coordinating unit leader. The unit leader is responsible for directing park police officers to secure areas of the park prior to harvesting operations, assigning the shooting teams and support vehicles to the culling site and dealing with public incidents. Each police officer is in constant radio contact with all other members of the team and the unit leader. Shooting typically takes place from a platform, assuring a downward trajectory of the shot. Special ammunition designed to disintegrate upon impact is used. All state mandated safety distances from occupied dwellings are adhered to as a minimum.

**Population Surveys**: Deer concentrations are surveyed on a yearly basis in order to set management goals for the individual parks and determine necessary actions. Several methods have been used to gather this data, including the use of helicopters, infrared technology and visual monitoring. The most efficient survey method used is by helicopter. This method has been used each year since the beginning of the program. Surveys are typically conducted in January or February with sufficient snow cover (six inches +) to provide good visibility. Three spotters plus the pilot, fly approximately 1/8 mile wide transects across the parks at a height of 500 to 700 feet depending on conditions. In 2015, 6.5 hours of flight time was logged with nearly 732 deer identified during the process.

The survey data is used in a population model to predict the herd size the following year. Indications are that approximately 80 percent of the deer are actually counted during aerial surveys. The 20 percent error is not factored into the prediction models, so actual population estimates are undoubtedly conservative. In general a population density of around 15 deer per square mile is the preferred carrying capacity for habitats within the Metroparks. Currently, population densities average 22 deer per square mile (unadjusted) with the highest density at Oakwoods Metropark with 62 deer per square mile.

**Population Control**: The focus of the management effort is to reduce the population by taking primarily antlerless deer. As outlined in the MDNR permit, antlered deer may be taken when part of a group of antlerless deer. Individual animals that are recognized to be unique, unusual, or uncommon and hold value either biologically or socially will not be targeted. These unique individuals, recognized as bringing added value to the Metroparks, will be protected for the public interest and enjoyment, or environmental/genetic diversity, unless determined by the Metroparks and/or MDNR to be detrimental to public or environmental (including deer or other plant or animal species) health, safety and welfare.

A total of 125 deer were removed in the fall of 2014 and winter of 2015 at five Metroparks (Kensington, Stony Creek, Hudson Mills, Lake Erie and Oakwoods). As of February 2015, 3,312 deer have been removed from the parks. Biological data (i.e.: age, weight, sex, reproductive status, and general condition of the deer) is collected from all of the deer taken in the program and is provided to the MDNR annually. During the initial culls, samples were also provided to Michigan State University, Department of Fisheries and Wildlife, as part of a comprehensive statewide collection of DNA samples for white-tailed deer. Upon request, samples are also regularly provided to the MDNR who monitor for Bovine Tuberculosis (bTB), Chronic Wasting Disease (CWD), Eastern Equine Encephalitis (EEE), Epizootic Hemorrhagic Disease (EHD), and Lyme disease. This biological information assists biologists and park managers in assessing deer herd health, program success, and future management needs. Minor outbreaks of EHD have occurred at Stony Creek and Huron Meadows Metroparks. In 2015, the MDNR confirmed the second outbreak in Michigan of CWD in neighboring Ingham County, which only emphasizes the importance of sound population management practices to help prevent this devastating disease from occurring within the Metroparks deer population.

All of the meat harvested from the Metroparks’ deer management program, both volunteer hunt and sharpshooting, is distributed to food banks to help feed persons in need. Since the program began in 1999, the Metroparks have donated more than 130,000 pounds of venison, which has provided more than 413,000 meals to those less fortunate. The Michigan Sportsmen Against Hunger program and other sportsmen volunteer organizations have regularly assisted in covering the cost of meat processing.
Ecosystem Response: Overall, the Metropark deer population has shown a significant improvement in its physical condition since the beginning of the program. Changes were most noticeable in fawns and yearlings through increases in body weights. Fawn dressed weights are suggestive of a shift from poor diet to good diet. Presence of fawn breeding also indicates an improvement in physical condition and perhaps physiological maturity. Total herd productivity either has remained good or increased in many instances.

The flora and fauna continue to be monitored throughout the Metroparks by HCMA Natural Resource Department and Interpretive Department staff, trained in photo monitoring and observing changes in the ecosystems. Since the initiation of the deer management program, several uncommon plant species are once again being observed in the parks and in many instances overall ecosystem health is improving. Moderate to good increases have been noticed in indicator species like trillium and geranium along with white cedar, cherry and oak regeneration. Unfortunately, the increase in non-native invasive plant infestation is slowing or impeding the recovery process.

“This year, 2010, was the first time since 1993 that Michigan Lily were observed in blossom. Deer seem to have a special affinity for members of the lily family, and this plant is no exception. Staff has been anticipating the return of this species ever since the deer culls began in 1999.” (Stony Creek Deer Photomonitoring Report 2010).
INTRODUCTION
The Huron-Clinton Metropolitan Authority (HCMA) deer management program is part of a comprehensive effort to manage native ecosystems and recreational open space within the Metropark system. By working toward a balanced and functional environment, native plants and animals (including white-tailed deer) contained within these ecosystems stand a greater chance of long term survival and have an opportunity to thrive.

White-tailed deer can consume up to 12 pounds of vegetation per day. They can affect the composition of the faunal and floral communities in ecological systems throughout Michigan and have put some species and ecological systems at risk. Decreased plant populations can lead to loss of plant and animal species and a gross alteration of native communities. Plants are significant component of the foundation an ecosystem's function, and when this foundation begins to crumble, there is a cascade affect that alters other levels of the food chain and other species of wildlife including insects, birds and mammals. Scientific journals, studies and position papers from a wide range of organizations and institutions have documented the effects of overabundance of white-tailed deer across North America. Impacts cited include increased instances of car-deer collisions, public health issues, property damage, and ecosystem degradation are widely noted. The majority of studies cite the effects of deer over abundance on forests and other native ecosystems.

Biology of White-tailed Deer
White-tailed deer (*Odocoileus virginianus*) are native to Michigan and an important part of the Metroparks natural community. They are one species interacting with thousands of other plants and animal species in a complex ecosystem. The complexity of this system makes it difficult to determine one species importance over another, so it is imperative that these natural ecosystems are maintained to promote full native species diversity. Deer however are an opportunistic species that can, without checks and balances, become abundant enough to disrupt the equilibrium within native communities.

The population of white-tailed deer has increased dramatically throughout Southeast Michigan in the past twenty years, including in the Metroparks. Population increases within the Metroparks can be attributed to many factors including the deer's own high reproductive rate, the absence of natural predators and the restriction of open hunting on park property. In addition, the continued urbanization of the areas around the park system, reduces habitat quality and quantity, constrains their movement patterns and may force animals into the remaining natural areas including parks. At higher densities, deer can place a heavy burden on the natural communities by reducing species diversity of plants and wildlife as well as impairing forest regeneration. If overbrowse continues, plant populations can decline with some species disappearing altogether, which in turn, further disrupts nature’s balance.

By the mid-1990s, it was quite evident that damage to both the parks natural habitats and landscaped areas by deer was reaching a critical stage. As responsible stewards and managers of the natural resources within the Metroparks it was determined that a deer management plan must be initiated. The goal of this plan would be to manage white-tailed deer to maintain the bio-diversity within the Metroparks, while maintaining a healthy deer herd.
SECTION 1
GENERAL DEER MANAGEMENT


Introduction
White-tailed deer (Odocoileus virginianus) are important to the people of the state of Michigan. The expectations, concerns, and values associated with deer by Michigan residents are diverse and complex making successful management of this natural resource challenging. The Michigan Department of Natural Resources (DNR) is responsible for the management of deer in this state and uses a scientific approach when considering the biological, social, economic, and political aspects of deer management. Although wildlife management recommendations and decisions are based on best available biological science, they are nearly always determined within a social context where stakeholder values and priorities must be addressed. The integration of social considerations into scientific examination is necessary to move wildlife management recommendations and actions forward, especially in an environment where public knowledge and inquiry regarding management of public resources is significant.

This document is a review of scientific information pertaining to deer, deer-related issues, and deer-management options in Michigan and summarizes the best available biological and social science relevant to these topics. The information presented in this document was obtained from published scientific literature, agency and university reports, unpublished agency data, and personal communication with deer experts. The purpose of this review is to present general information on deer and specific information relevant to deer management in Michigan.

Distribution, Taxonomy and Physical Description
Deer are probably the best recognized and most widely distributed large mammal in North America. The white-tailed deer is found in nearly every state in the United States. Deer can be found throughout the southern provinces of Canada, in tropical forests of South America, and in the midst of an urban location in Michigan. White-tailed deer successfully live across a wide range of habitats and can be found in every Michigan county (Baker 1983). Deer are creatures of the forest edge and thrive in agricultural areas interspersed with woodlots and riparian habitat. They favor forest stands in early succession in which brush and sapling browse are within reach. Dense forest cover is used for winter shelter and protection.

White-tailed deer are ungulates, or hoofed mammals, belonging to the family Cervidae. The white-tailed deer’s coat and color change semi-annually. Deer are more reddish brown with a thin coat during summer months. Deer shed their summer coat in late summer or early fall and replace it with a thick, brownish-grey winter coat. The underside of the tail, belly, chin, and throat are white year round. The winter coat consists of both a short underfur and hollow, outside guard hairs that provide additional insulation and protection during the winter. The winter coat is shed in mid- to late-spring. Hair color is alike in both sexes. Fawns are born with white spots in the upper coat which provides excellent camouflage. They shed their spotted coats in three to four months and it is replaced with a brownish-grey fall and winter coat.

In Michigan, adult deer typically weigh between 125 to 225 pounds live weight and stand 32 to 34 inches at the shoulder. Female deer (does) tend to be smaller than males (bucks) of the same age from the same area. Deer weights vary considerably, depending upon age, sex, diet and the time of year the weight is checked. Deer are extremely agile and may run at speeds of up to 30 miles per hour. White-tailed deer are also good swimmers and often enter rivers and lakes to escape predators or insects.
Reproduction
Deer productivity rates (fawns produced per doe) generally are highest in regions with an abundance of nutritious food. Thus, deer occupying fertile farmland regions typically have higher productivity rates than deer in heavily forested regions. Likewise, deer living in areas with low annual snow accumulation tend to be more productive than those living in regions where snow covers available food for months at a time and inhibits deer movement to food sources. In southern Michigan where winter conditions are relatively mild, a high percentage of fawns and almost all yearling and adult does breed each year. Productivity rates also vary with age of the doe. Adult does have the highest productivity rates, and yearlings (deer that are 1 year old) have higher productivity rates than fawn does (less than 1 year old). In addition, the health of a doe, often a function of habitat quality, influences her reproductive capacity as females from the best range produce more fawns than those from poor range. Adult females (three-years and older) usually produce twins, and triplets are not uncommon.

In Michigan, the deer-mating season typically occurs during late October through December. Peak mating activity is in November. Does are in estrus for 24 hours every 28 days. If not bred does will cycle two or three times until bred. One buck may breed several does. A doe may be bred by more than one buck. Gestation is about 200 days, and the peak of fawn drop is mid-May to mid-June. Fawns weigh seven to eight pounds at birth and are able to walk shortly thereafter. For the first couple of weeks, does leave their fawns in a hiding place for several hours at a time, returning briefly to nurse them. This strategy reduces the likelihood of predators locating the newborn fawn. Fawns begin to follow their mother on her foraging trips at about four weeks of age. White-tailed deer fawns are nursed for eight to 10 weeks before they are weaned.

In southern lower Michigan, where habitat for deer is excellent and winters are relatively mild, about 30 to 50 percent of females breed as fawns and produce a fawn themselves when 1-year old. In northern regions of the state, particularly in the Upper Peninsula (UP), only about 5 percent of 1-year-old does produce a fawn. Pregnancy rates for does two years and older typically are very high, ranging from 80 to 95 percent. Pregnant one-year olds usually produce a single fawn, whereas older does usually produce twins, with singles or triplets possible depending upon their age and nutritional status.

Food Habits
The diet of white-tailed deer changes with the seasons. Succulent herbaceous plants, such as ferns, wild strawberry, dandelions, and goldenrod are preferred by deer during the summer months, and these “forbs” are supplemented with berries, mushrooms, new leaves from trees, and aquatic plants. A wide variety of agricultural crops are also eagerly consumed by deer, including corn, soybeans, oats, barley, alfalfa, pumpkins, and potatoes. In the autumn, deer continue to make use of available agricultural crops but turn to hard mast crops that are high in energy, such as acorns and beechnuts, as well as soft mast such as apples and other fruits. They also consume hay and clover at this time.

During winter, deer abruptly change their diet in northern areas to stems and buds of woody plants. Favorite winter “browse” species in Michigan are white cedar, maple, birch, aspen, dogwood, and sumac, as well as many shrubs. Deer in northern Michigan typically enter a “negative energy balance” during winter and lose weight even when browse is present and abundant.

Causes of Mortality
A deer’s life expectancy in Michigan is influenced greatly by hunting pressure and hunting regulations. Simply put, Michigan has a large number of deer hunters who are very effective at harvesting deer. In 2007, an estimated 683,000 hunters spent 9.7 million days afield and harvested nearly 484,000 deer. Statewide, 48 percent of hunters harvested a deer, about 24 percent took an antlerless deer (doe or fawn) and 35 percent took an antlered buck. About 16 percent of deer hunters harvested two or more deer. Poaching, or illegal taking of deer by people, is also a cause of mortality.

Vehicle-deer collisions are another major source of deer mortality in the state. According to State Farm Insurance research, Michigan ranks second in the nation in reported vehicle deer collisions. During 2008, there were 61,010 reported collisions with 12 motorists killed and 1,648 injured (Michigan Traffic Crash Facts 2008). Crashes occurred most often in Michigan’s southern, heavily
populated counties. Vehicle-deer crashes occur during all months of the year, but they are especially prevalent during autumn (October - December) when roadways offer the last green forage of the season, cornfields are being harvested, the deer-mating season ("rut") is in progress, and daily commute occurs around dawn and dusk, when deer are most active.

In Michigan, white-tailed deer are susceptible to a host of diseases and parasites. Many parasites and some diseases may weaken infected animals or use them as a host but generally are not fatal. Others can be deadly to individuals and may potentially effect local or even statewide populations. In recent years, several significant disease outbreaks in Michigan’s deer herd have stimulated public concern and driven deer management decisions as real and perceived threats are realized. Bovine tuberculosis (bTB), caused by *Mycobacterium bovis*, was first diagnosed in free ranging Michigan white-tailed deer in November 1975 (Schmitt et al. 1997). Since that time, the extent and characteristics of the outbreak, as well as its ongoing management by the DNR, have been extensively described (de Lisle et al. 2002, Hickling 2002, O’Brien et al. 2002, O’Brien et al. 2006, Schmitt et al. 2002). Bovine tuberculosis is primarily of concern because of its ability to infect a wide variety of species (Oreilly 1995), including humans (Wilkins et al. 2003, Wilkins et al. 2008), and the resulting economic costs of infection for the livestock industry due to herd condemnations and closure of markets (Morris et al. 1994). After more than 13 years of surveillance and research, white-tailed deer remain the only proven reservoir of infection for cattle besides other cattle (Corner 2006).

Chronic Wasting Disease (CWD) is a Transmissible Spongiform Encephalopathy (TSE), caused by mutant cellular protein that affects four species of North American cervids (Sigurdson 2008, Williams 2005, Williams et al. 2002), including white-tailed deer. The clinical features, pathology and epidemiology of the disease have been well described in areas where the disease is endemic. Both simulation modeling (Gross and Miller 2001, Miller et al. 2000) and field research (Miller et al. 2008) suggest that once established, CWD can build to high prevalence in infected deer populations, resulting in marked decreases in survival of infected deer and likely causing substantial population declines over decades. Where the disease has become established, no management agency has thus far been able to control its spread, let alone eradicate it.

Following confirmed diagnosis of Michigan’s first case of CWD in a captive white-tailed deer in a Kent County facility in August 2008, the DNR’s intensified surveillance was implemented per the Michigan Surveillance and Response Plan For Chronic Wasting Disease of Free-Ranging and Privately-owned/Captive Cervids (Michigan Department of Natural Resources/Department of Agriculture. 2002). In 2008, 9,151 free-ranging deer were tested for CWD statewide, including 1,523 from a nine township area surrounding the infected captive facility. All were negative. Since 1998, more than 31,000 wild white-tailed deer have been tested statewide, and all have been negative.

Epizootic Hemorrhagic Disease (EHD) is an acute, infectious, often fatal viral disease of some wild ruminants. This malady, characterized by extensive hemorrhages, EHD has occurred in significant outbreaks in deer in the northern United States and southern Canada. Die-offs of white-tailed deer in Michigan occurred in 1955, 1974, 2006 and 2008. Total mortality in these events ranged between 50 and 200 deer. Because of its very high mortality rate, EHD can have a significant effect upon the deer population in a given area, reducing numbers drastically. There is no known treatment for the disease and there is no evidence that the virus can infect humans.

Eastern Equine Encephalitis (EEE) is a fatal viral disease of horses that can infect a variety of avian and mammalian species but seldom causes clinical disease. It rarely occurs, but white-tailed deer can be infected and the disease is fatal in affected animals. There have been single reports of mortality in deer in Georgia (Tate et al. 2005) and Wisconsin and multiple cases in Michigan (Schmitt et al. 2007). The die-off in Michigan occurred in 2005 in the southwestern portion of the state. Seven mortalities were documented in this outbreak. Due to a high mortality rate, EEE can have a significant effect on the deer population in a given area, but because it rarely occurs, it is not an important mortality factor to the state as a whole. Although it occurs rarely, humans are susceptible to this disease and it can be fatal.

Lyme Disease is an illness caused by a spirochete bacterium (*Borrelia burgdorferi*). This disease is transmitted to humans and animals primarily by the bite of the tick, *Ixodes scapularis*. The white-tailed
deer is a host for the adult stage of this tick and therefore can be involved in exposing humans to the tick, and consequently, to the bacterium. Whitetailed deer do not develop disease when infected with *Borrelia burgdorferi*, and therefore this disease is not an important mortality factor (Brown and Burgess 2001). This disease is of public health significance as the bacterium can affect the cardiovascular system and the neurological system and cause severe arthritis.

**Social Structure and Behavior**
The social organization of white-tailed deer is largely matriarchal with the most common social group being an adult doe, some of her female offspring from previous years, and all their fawns. Sometimes three or four generations of related does are present in a family group. When fawning season arrives in mid-May, adult does leave the family group and remain alone to bear and rear their fawns.

Deer activity is usually highest during fall because of breeding behavior and the need to increase food consumption while preparing for winter. Deer decrease their activity in winter when food is limited and their mobility is hindered due to snow. Non-migratory deer in the southwestern LP of Michigan had an estimated annual home range size of 0.2–2.9 square miles (Pusateri 2003). Yearling and adult does in south-central Michigan had seasonal home ranges of 0.3-0.8 square miles (Hiller 2007). Deer occupying better habitats can fulfill all their necessary requirements in smaller areas whereas deer residing in poorer ranges may have to travel further distances to find suitable food and cover. Males generally have larger home ranges than females.

**Carrying Capacity**
Carrying capacity is a term that refers to the maximum sustainable size of a population. Carrying capacity of a population is limited by any number of constraints, both biological (Biological Carrying Capacity) and social (Social Carrying Capacity). The effective and appropriate management of deer populations must consider both biological and social carrying capacities.

**Biological Carrying Capacity (BCC)**
Biological carrying capacity is defined as the maximum number of animals that a given area can support over a prolonged period of time (McCullough 1984). BCC is determined by the capability of the area to provide the habitat components of a wildlife species – food, water, cover, and space. As deer populations grow, individual animals compete for the resources that their habitat provides, with less of the four requisites being available per deer. In Michigan, healthy, well-fed does are capable of producing triplet fawns and routinely produce twins. Under ideal conditions, even fawns are able to breed and produce their first young when they are about 1-year-old. However, as populations near BCC, adult does raise fewer fawns, fawn survival decreases and fewer fawns are capable of breeding. Another impact when a deer population approaches BCC is antler development in yearling bucks may be retarded. In addition, more deer die from malnutrition. When BCC is reached, the number of deaths equals the number of births.

BCC varies throughout Michigan based on climate and the distribution of habitat. BCC may also change over time, if forests age without cutting or burning, and may fluctuate with annual variations in weather. Although these considerations mean that BCC cannot be exactly known in any given year, and is somewhat of a moving target over time (Macnab 1985), using it as a context in setting population management objectives is possible if long-term trends are used to establish average conditions and short-term perturbations are acknowledged as having periodic significance in population dynamics (Strickland et al. 1994).

When deer populations remain at or above BCC for extended periods of time, BCC may actually be reduced due to vegetation damage that can result from the sustained browsing pressure of high deer populations. This sustained activity may alter the plant species, structural composition, or successional processes of the landscape, resulting in negative impacts on the habitat, which can result in cascading effects on other wildlife species long before negative impacts on the condition of deer occur (deCalesta 1997).

**Social Carrying Capacity (SCC)**
The concept of SCC proposes the abundance of a wildlife species is limited by the human social environment or human tolerance for that wildlife species. The SCC is not simply the highest level of
deer abundance that will be accepted. SCC is a notion proposing that human society represents a social environment capable of setting limits on the number and distribution of a wildlife species. SCC is defined by both the maximum and minimum population sizes society will tolerate. That is, Michigan society may not tolerate too many deer, but it may not tolerate too few either. SCC is also defined by the interactions between humans and a wildlife species. Issues and conflicts are created when stakeholders disagree on what level of interactions is acceptable. The status of such deer-related issues is a critical feature of the SCC model. Deer management can be less about management of deer than about managing the issues created by deer–human interactions (which can be both negative & positive) and differences in stakeholder tolerances regarding those interactions.

A SCC for deer is defined by the level of abundance and interactions acceptable to enough stakeholders such that there is a low level of deer-related issues (Minnis and Peyton 1995). When deer abundance and interactions with stakeholders fall within a range that most stakeholders can accept, deer are being managed within SCC. If no range is agreeable to key stakeholders, a SCC does not exist and could only be created by shifting attitudes and tolerances of stakeholders. There is the potential to change SCC to support more or fewer deer, or to manage the abundance and distribution of deer to fit an existing SCC.

Ecological Impacts

White-tailed deer evolved in a forested environment and it is likely that there are both wildlife and plant species that benefit from the presence of deer and their activities. By foraging selectively, deer affect the growth and survival of many herbaceous, shrub and tree species, modifying patterns of relative abundance and species interactions. When populations are not in balance with habitat, deer have the ability to alter their environment by over-browsing preferred plants and destroying the vegetative cover upon which they and other species depend. Overbrowsing can result in reduced availability of adequate ground level vegetation (herbaceous plants, seedlings, saplings, and shrubs) that provides the food and cover required by deer (Alverson et al. 1988). In addition to impacts on deer habitat, over-browsing by deer can degrade the quality of habitats for other wildlife species and alter entire ecosystems. Numerous wildlife species use ground level and mid-story vegetation of forests in Michigan for nesting and escape cover that may be negatively impacted by intense deer browsing (deCalesta 1997, Cote et al. 2004). In addition, deer compete directly with wild turkeys, ruffed grouse, squirrels, and a variety of other birds and small mammals for acorns, fruits, and other mast.

Deer browsing can affect the quality and viability of entire natural communities. Damage to natural communities extends to a variety of other species including insects, birds, reptiles, amphibians, and other mammals that are dependent on those communities. Impacts on rare plants, animals, and communities are of special concern as years of over-browsing can threaten viability of local populations. In addition, over-browsing of native vegetation facilitates invasion of aggressive, non-native plant species like garlic mustard. Many of these invasive plants degrade habitat for deer and other species by crowding out preferred deer forage and changing ground flora to species that provide little or no benefit to most wildlife species. Management activities designed to benefit deer must ensure that other resources are not negatively impacted. It is important that deer numbers are kept below levels where they may cause long-term damage to the ecosystems in which they live.

Conflicts between Humans and Deer

While white-tailed deer are highly valued by Michigan residents, conflicts between deer and humans occur at various levels of intensity across the State. Damage to agricultural and horticultural crops, suppressed forest regeneration, high rates of deer-vehicle collisions, and destruction of landscaping and other property by deer in urban/suburban areas can be significant.

Deer readily feed on a variety of agricultural crops and can reduce yields significantly. Agriculture is an enormous part of Michigan’s economy and in 2007 more than 55,000 farms encompassing over 10 million acres, produced a net farm income of $2.03 billion and generated $71.3 billion in economic activity. Michigan ranks 19th nationally in total cash receipts for agricultural products and is the leading producer of crops such as dry beans, blueberries, cherries, cucumbers, and bedding and garden plants in the U.S. (USDA 2009). Deer in most Michigan counties damage agricultural crops,
but the most significant damage occurs in areas where deer numbers are high and agricultural crops are common on the landscape.

Another significant conflict between deer and humans is deer-vehicle collisions. Approximately 1.5 million deer-vehicle collisions occur on U.S. roads annually and Michigan ranks second in the country in reported collisions. In 2008, 61,010 deer-vehicle collisions were reported in Michigan resulting in 12 human deaths and 1,648 injuries to the persons involved (Michigan Office of Highway Safety Planning 2009). Reduction of deer numbers in areas where deer vehicle collisions present a significant public safety concern is imperative, as are education campaigns that promote safe driving and explain what to do when deer are present on roads.

Urban/Suburban Deer Management
White-tailed deer are an important part of the culture in Michigan. As white-tailed deer have expanded in number and adjusted to living in and around urban areas, they have taken up permanent or semi-permanent residence in many Michigan communities. With adequate cover and food available deer successfully navigate sidewalks, traffic and backyard fences, appearing quite comfortable with daily interactions involving humans, barking dogs and vehicles. Management of urban/suburban deer populations can be difficult. Similarly, as deer populations increase and conflicts with deer arise, different expectations, concerns, and values make addressing these conflicts problematic.

Deer populations in rural settings are managed nearly exclusively by recreational hunting with the exception of utilizing deer damage shooting permits for addressing specific situations. However, these lethal techniques face several challenges to application in many urban/suburban areas including: (1) real or perceived safety concerns, (2) conflicting social attitudes and perceptions about wildlife, (3) hunting and firearm discharge restrictions, and (4) liability or public relations concerns (DeNicola 2000). Lethal tools are more effective than others but may be unacceptable in areas where social or safety concerns are an issue. Applying a combination of several techniques specifically tailored for each situation should prove to be more successful than utilizing a single tool.

Integrated Management Strategies
No single technique or strategy is universally appropriate. The complexities of suburban deer issues and the current limitations of available techniques make quick-fix solutions unlikely. Resolving conflicts associated with deer often requires an integrated management program. Short-term strategies can relieve immediate problems, while long-term approaches will maintain deer populations at target levels. Combining two or more methods may improve results and increase the acceptability of the program for a wider range of stakeholders. Management programs should be monitored to assess their impacts. Baseline data (e.g. roadkill reports, vegetation impacts, deer health, and population census and homeowner complaints) will be required to determine accurately the effects of any management action and to evaluate program effectiveness.

Nonlethal Management Options
Nonlethal techniques are generally well accepted by the public. However, limited effectiveness and/or high cost may prevent their exclusive use to resolve deer conflicts. Non-lethal techniques can be justified when the potential financial savings from their applications are equal to or greater than the cost for implementation. Non-lethal techniques may not affect deer impacts to plants and animals on a community-wide scale because these methods were designed to supplement, not replace, deer population management. Consequently, nonlethal alternatives are best employed within the context of a comprehensive deer management program.

Habitat Modification
Deer adapt well to nearly all human-modified environments, except for downtown urban locations and other large areas that are devoid of woodland cover. These intensely developed urban areas are usually less aesthetically appealing to people than suburban landscapes that contain a patchwork of woodlots and homes. Therefore, habitat modifications to discourage deer presence are rarely practical.
Ban on Deer Feeding
Many people enjoy providing food for deer and other wildlife during winter. This may contribute to an artificially high deer population, especially during harsh winters when natural food sources are in short supply. Supplemental food can enhance deer reproductive rates, encourage deer to congregate in sensitive areas (Doenier et al. 1997). Also, food provisioning can lead to deer crowding and increased susceptibility to diseases (Davidson and Nettles 1997). Education and/or regulations may reduce the number of people who feed deer. Unfortunately, law enforcement agencies sometimes consider antifeeding regulations unenforceable, as some people ignore them. Therefore, it may be difficult to discourage or prevent residents from feeding deer unless there is a concerted effort by the community and law enforcement agencies.

Unpalatable Landscape Plants
Although deer are generalist foragers, they do have preferences for certain plant species. Selecting less palatable herbaceous and woody plants can minimize deer browsing to ornamental plants (Cummings et al. 1980, Fargione et al. 1991, Craven and Hygnstrom. 1994, Curtis and Richmond 1994). Careful plant selection for home landscapes, combined with the selective use of repellents, may minimize damage if deer-feeding pressure is low to moderate. Few ornamental plant varieties, however, are classified as rarely damaged by deer, and application of this technique is limited in areas with high deer densities.

Repellents
Repellents are best suited for use in orchards, nurseries, gardens, and on ornamentals or other high-value plants. High application cost, label restrictions on use, and variable effectiveness make most repellents impractical for row crops, pastures, or other low-value commodities. Success with repellents is measured in reduction of damage; total elimination of damage should not be expected (Craven and Hygnstrom 1994). Repellents work by reducing the attractiveness and palatability of treated plants to a level lower than that for other available forage. Repellents are more effective on less palatable plant species than for those that are highly preferred (Swihart et al. 1991). Effectiveness also depends on the availability of alternate forage (Conover 1987, Conover and Kania 1988, Andelt et al. 1991), and repellent performance seems to be negatively correlated with deer density. Scientists have classified repellents by four specific modes of action: fear, conditioned aversion, pain, and taste (Beauchamp 1997, Mason 1997). Fear-inducing repellents emit sulfurous odors that mimic predator scents. Conditioned aversion is an avoidance response associated with a treated item and an illness. Pain-inducing repellents affect the trigeminal receptors located in the mucous membranes of the eyes, nose, mouth, and throat. Taste repellents generally include a bitter agent that makes treated items unpalatable. In addition to mode of action, several other factors that influence the effectiveness of repellents must be considered. Some repellents weather poorly, so it is usually best to use products that contain a commercial “sticker” or adherent. Also, repellents only protect the foliage to which they are applied. New growth that emerges after the application of the treatment is unprotected (Allan et al. 1984). Therefore, repellents have to be reapplied repeatedly during the growing season to retain their effectiveness (Sullivan et al 1985, DeYbe and Schapp 1987, Andelt et al. 1991). For peak efficacy, many repellents should be reapplied every four to five weeks as long as deer-feeding pressure remains high (Sayre and Richmond 1992).

Supplemental Feeding
Supplemental feed can be used to draw deer away from specific problem areas. Deer must be concentrated a significant distance (more than 400 meters) from the site with conflicts (Doenier et al. 1997). Deer problems may be created near the baiting station, however, and this should be assessed prior to providing, supplemental feed. For example, concentrating deer may result in excessive plant damage in the vicinity of the artificial food source. In many areas of North America, supplemental feeding would likely increase deer-human conflicts. Feeding would concentrate deer, possibly increasing disease transmission and/or predation of deer by dogs and coyotes. Implementation of a supplemental feeding program to prevent malnutrition would be counterproductive to control efforts directed at free ranging herds because it could encourage additional population growth. Furthermore, it is costly to provide ad libitum winter-feed (Ozoga and Verme 1982, Baker and Hobbs 1985).
Fencing
Fencing is a reliable method to address site-specific problems such as landscape or agricultural damage or airport conflicts (Caslick and Decker 1979, Craven and Hygnstrom 1994, Curtis et al. 1994). Fencing also can be used to protect public health in areas where there is a high prevalence of tick-borne diseases (Daniels et al. 1993, Stafford 1993). Agencies often recommend barrier fencing around schoolyards and other high-risk areas to minimize deer access, tick abundance, and the associated risks of contracting Lyme disease. Several factors should be assessed before using fencing as a deer control option. These include fence design, site history, deer density, crop or landscape value, local ordinances, and the size of the area to be protected (McAninch et al. 1983). For a given deer density, the potential for damage will often be greater on larger areas than smaller ones (Caslick and Decker 1979, McAninch et al. 1983). Consequently, large areas often require more substantial fencing designs to achieve a level of protection similar to small areas. Blocks larger than 50 acres usually require eight-foot-high, woven wire fencing to reliably prevent deer from entering the area if feeding pressure is high.

Hazing and Frightening Techniques
Several techniques can be used to frighten deer away from specific areas. Hazing has been effective under certain circumstances, however, deer often habituate to novel disturbances. In addition, deer may not leave the general vicinity and complaints may arise from neighbors about the noise made by the devices. Hazing is most effective if implemented either before or at the initial stages of a conflict situation. Deer movements or behavioral patterns are difficult to modify once they have been established. Pyrotechnics provide quick but temporary relief from deer damage. Motion-sensing detectors have been used to trigger both audible and ultrasonic devices for frightening deer in an effort to minimize habituation. Strobes, siren, water sprays, and other devices have been used to frighten deer with limited effectiveness. Although deer can detect ultrasound, they are not repelled by it because they do not associate the disturbance with danger (Curtis et al. 1995).

Population Reduction Methods
Population control programs have two phases: the initial reduction phase when the number of deer removed is high, and the maintenance phase after deer densities have been lowered and fewer deer are handled. It should be emphasized that any population control effort will require long-term maintenance. Management efforts may occur annually following attainment of population density goals or less frequently depending on program efficiency and local deer management objectives. Regardless of the culling frequency, the HCMA should be committed to a long-term population control program to maintain the deer density near a determined goal. With any technique, the cost per deer handled will increase as the proportion of the population removed or treated increases (Rudolph et al. 2000). High costs associated with diminishing returns may prevent achieving population goals with some techniques. Deer learn to avoid threatening situations, and the use of a variety of methods to capture or kill deer can help maintain program efficiency.

Trap and Transfer
Trapping and translocation requires the use of traps, nets, and/or remote chemical immobilization (i.e., darting) to restrain deer and shipping crates to translocate captured animals. Capture and translocation has been demonstrated to be impractical, stressful to the deer handled, and may result in high post-release mortality. Deaths of translocated deer have been attributed to capture myopathy (Beringer et al. 1996), unfamiliarity with the release site, and encounters with novel mortality agents (Jones and Witham 1990, Bryant and Ishmael 1991, Jones et al. 1997, Cromwell et al. 1999). Capture myopathy is a stress-related disease that results in delayed mortality of captured deer. O'Bryan and McCullough (1985) documented 85 percent mortality after one year for deer captured and translocated in California at a cost of $431 per deer. Other capture and relocation programs have recorded costs ranging from $400 to $2,931 per deer (Ishmael and Rongstad 1984, Drummond 1995, Ishmael et al. 1995, Mayer et al. 1995). Trap and translocation programs also require release sites that are capable of receiving deer, and such areas are often scarce. An additional concern associated with translocation of deer, especially from an overpopulated range, is the potential for spreading disease. The presence of Lyme disease and tuberculosis in some areas of North America makes this a serious consideration. In addition, tame deer often seek out comparable residential locations and may create problems similar to those identified at the trapping location (O'Bryan and McCullough
Land-use conflicts and disease concerns caused by relocated deer could lead to questions of liability. Most deer immobilization drugs are classified as controlled substances, and their use requires U.S. Drug Enforcement Agency licenses.

**Trap and Euthanasia**

Capture with box traps, Clover traps, drop nets, or rocket nets followed by euthanasia has been assessed or considered in only a few locations (Jordan et al. 1995). This technique can be used in areas where there is a concern about the discharge of firearms or in areas with very high deer densities to complement a sharpshooting program. This method, however, is inefficient and expensive, with costs likely exceeding $300 per deer. Physical restraint and euthanasia of deer in traps is sometimes preferred over chemical means because it allows for the consumption of meat from the deer. Deer are greatly stressed, however, during the restraint phase of the capturing process (DeNicola and Swihart 1997).

**Sharpshooting**

Several communities have employed trained, experienced personnel to lethally remove deer through sharpshooting with considerable success (Deblinger et al. 1995, Drummond 1995, Jones and Witham 1995, Stradtmann et al. 1995, Ver Steeg et al. 1995, Butfiloski et al. 1997, DeNicola et al. 1997c). A variety of techniques can be used in sharpshooting programs to maximize safety, humaneness, discretion, and efficiency. The cost per deer for sharpshooting programs has varied, ranging from $91 to $310 per deer. Human safety concerns are often associated with the discharge of firearms in suburban landscapes. The noise associated with discharging firearms after dark in suburban areas must be considered when developing a sharpshooting program. Often the negative public reaction to sharpshooting is minimal if firearms are fitted with suppressors. Also, perceptions of public safety can be enhanced by having police or other uniformed officials responsible for shooting the deer and/or providing on-site security.

The level of experience of the personnel involved and the program design should be thoroughly assessed. As for any population reduction method, the extent and distribution of access to deer on private or public property will directly affect program efficiency and outcomes. The following methods are recommended for sharpshooting programs: (1) use baits to attract deer to designated areas prior to removal efforts, (2) shoot deer from portable tree stands, around blinds, or from a vehicle during the day or night, (3) when possible, select head (brain) or neck (spine) shots to ensure quick and humane death, (4) process deer in a closed and sheltered facility, and (5) donate meat to food banks for distribution to needy people in the community.

Archery equipment has been used to remove deer in suburban areas, usually when firearms discharge was not permitted. Compound bows or cross-bows with a minimum peak draw weight of 50 pounds are recommended. In one New York community only a few square miles in size, deer were shot at close range (ten to fifteen yards) while feeding at bait piles, similar to the procedure described for sharpshooting. More than 500 deer were removed from this community using bow and arrows in less than two years.

**Controlled Hunting**

Another option in controversial management areas is the use of controlled hunts (Ellingwood 1991). Controlled hunting is the application of legal, regulated deer hunting methods in combination with more stringent controls or restrictions as dictated by the landowner or elected officials. Controlled hunts have been successful in several locations (Sigmund and Bernier 1994, Deblinger et al. 1995, Kilpatrick et al. 1997, Mitchell et al. 1997, McDonald et al. 1998, Kilpatrick and Walter 1999). The potential for intervention and/or interference by activist groups is often high when using hunters to manage locally overabundant deer populations. Thus, in controversial situations where hunters are used, intensive involvement of state agency and law enforcement personnel is required. The site must be assessed and patrolled to minimize ingress by protesters, trespassers, and vandals. Costs for law enforcement personnel should be considered in the planning process. Examples of indirect costs affiliated with controlled hunts have ranged from $160 per deer harvested (Connecticut) to $622 per deer harvested (New Jersey) (Sigmund and Bernier 1994, Deblinger et al. 1995, Connecticut Department of Environmental Protection 1996). Selection of hunting techniques will depend on local circumstances, including parcel size, deer numbers, problem severity, and the potential for conflict.
Archery hunting for deer has the advantage of being a relatively discreet and silent activity. The limited shooting range for archery equipment, coupled with the tendency of archers to hunt from tree stands (which ensures a backstop for shots), makes archery hunting a safe and nondisruptive removal technique (Richter and Reed 1998).

Archery has the disadvantage of being less efficient at reducing deer density than firearms hunting because of lower success rates for bowhunters. Special archery seasons may be longer than firearm hunts to allow for sufficient deer harvest over time. The length of the hunt should be thoroughly evaluated if an area is closed to public access because of the incompatibility of archery hunting with other activities. An additional disadvantage, particularly on small parcels, is that even deer that are mortally wounded with an arrow can travel 100 yards or more before succumbing. In developed areas, this could result in fatally struck deer dying on adjacent properties.

When feasible, shotguns loaded with slugs should be used to maximize program efficiency and help ensure that management goals are attained. Shotguns should be equipped with rifle sights or a scope and a rifled barrel to help ensure accurate shot placement. Where legal, rifles are the firearm of choice in expansive rural areas.

**Experimental Deer Management**

**Fertility Control Agents**

Recently, much research has focused on alternative, nonlethal techniques to regulate deer populations in suburban areas that are closed to hunting because of safety concerns or social attitudes. Wildlife researchers are attempting to determine if immunocontraception, or some other form of fertility control, can be a practical management alternative. Field studies are under way to determine the feasibility of using contraceptive vaccines to regulate free-ranging deer populations (Rudolph et al. 2000). Fertility control agents function by reducing the reproductive output so that it equals or is less than the rate of mortality. Because annual mortality rates for suburban deer populations are often very low, a large portion of does (70–90 percent) need to be effectively treated to curb or reduce population growth (Rudolph et al. 2000).

Unfortunately, much confusion surrounds the status of fertility control agents. The lack of public understanding regarding the availability and practicality of fertility control has caused unnecessary delays in the implementation of effective management programs, because fertility control is perceived as the ideal solution. To put fertility control technology in perspective, after four decades of research, effective antifertility programs for controlling populations of free-ranging wildlife simply do not exist. To date, HCMA is unaware of any safe and cost-effective non-lethal method to control deer populations.

**Regulatory and Permit Requirements for Antifertility Research**

Antifertility agents for wildlife are not commercially available. All antifertility agents are currently classified as experimental drugs and are only produced in a few research laboratories. Experimental drugs can only be administered to deer following U.S. Food and Drug Administration (FDA) guidelines. A federal Investigational New Animal Drug permit and state or provincial wildlife agency approval are necessary to capture or treat any deer with drugs. Consequently, in North America, treatment of deer with contraceptive vaccines is only being conducted in research projects by universities, state and federal wildlife agencies, and the Humane Society of the United States. The FDA has concerns about the safety of consuming deer treated with experimental drugs and currently requires that all treated, free-ranging deer be marked with warning that stipulate consumption restrictions. It is not clear if or when FDA restrictions on consumption of deer meat treated with experimental drugs will be modified. In addition, fertility control agents are usually delivered to deer using either dart rifles or biobullets.

Restrictions on firearms discharge in suburban areas often limits practical delivery of drugs to free-ranging deer. Consequently, there are many aspects of the regulatory and delivery systems effectively that still need to be developed before contraceptive vaccines can be a viable management alternative for communities with overabundant deer herds.
Antifertility Agents Under Investigation

The two general categories of fertility control agents include: (1) drugs or vaccines that prevent conception (contraception) and (2) chemicals that are administered postconception to terminate pregnancy (abortifacient or contragestation).

Steroid Contraception.
Fertility control with steroids (i.e., synthetic progestins and estrogens) has been evaluated for controlling deer reproduction during the past 25 years. Orally delivered steroids have shown limited success in preventing deer reproduction (Matschke 1977, Roughton 1979). However, implants containing synthetic steroids have been effective in some studies (Matschke 1980, Plotka and Seal 1989, Jacobsen et al. 1995, DeNicola et al. 1997a). Regardless of proven efficacy, the FDA will not permit the use of steroidal agents on free-ranging deer because of unresolved questions regarding the effect of long-term steroid exposure on deer, the impact of steroid-treated carcasses on animals in the food chain, and concerns about steroid consumption by humans.

Immuocontraception
Immuocontraceptive vaccines control fertility by stimulating the production of antibodies against proteins and hormones that are essential for reproduction. The antibodies interfere with the normal physiological activity of these reproductive agents (Talwar and Gaut 1987). Immunofertility agents (e.g., Porcine Zona Pellucida [PZP] and Gonadotropin-Releasing Hormone [GnRH]) have been successfully employed to control reproduction in individual deer (Turner et al. 1992, 1996; Miller et al. 1998).

Contragestation
One contragestation agent, prostaglandin (PGF2(x), has proven to be both safe and highly effective in white-tailed deer (DeNicola 1996, DeNicola et al. 1997b). Risk to secondary consumers is minimal because PGF2(x) is metabolized readily in the lungs of treated animals (Piper et al. 1970). In addition, prostaglandin can be remotely delivered using the biobullet delivery system. Negative public perception of using, "abortion" agents, however, may limit future application of this technique with deer. A limited number of delivery methods are available for antifertility agents. The usefulness of each depends on the site conditions, deer behavior, and number of deer to be treated.

Surgical sterilization or implantation.
Implantation is effective, but it requires animal restraint and is stressful to the treated animal, time consuming and costly (Eagle et al. 1992, Garrott et al. 1992). Surgical sterilization by implants or tubal ligation has been evaluated (Plotka and Seal 1989), however, this approach has significant limitations because of the effort required to capture and handle individual deer. This method may be practical in small (less than two square miles), isolated or enclosed parks, arboretums, and corporate complexes with few deer.

Remote delivery.
Antifertility agents have been administered using darts and biobullets. Biobullets are biodegradable hydroxypropyl cellulose and calcium carbonate projectiles used to administer antifertility agents, vaccines, anthelminthics, antibiotics, and immobilization agents (Herriges et al. 1991, Jessup et al. 1992, DeNicola et al. 1996). The biobullet system allows for the remote delivery of intramuscular treatments. Remote delivery reduces the probability of direct consumption of fertility control agents by nontarget species. The limited life expectancy of implants, the expense involved in treatment, and the difficulty of treating an adequate portion of the herd suggests that large-scale implant programs would be impractical, yet remote delivery may have value in controlling small, isolated deer herds.

Oral application of antifertility agents.
To allow for practical application of fertility control agents to larger populations or areas (two square miles or more), it will be necessary to develop an oral delivery system. Presently no orally active, nonsteroidal, antifertility agent is available. Additional major obstacles to oral contraception in deer include dosage control absorption of active agents and ingestion of bait by nontarget wildlife. Based on these concerns and past studies, much research is still required before an oral antifertility agent becomes available.
In conclusion, advances in delivery systems coupled with improvement in the efficacy of antifertility agents improve the prospects of wildlife population control through contraception in the future. Much information is still needed, however, regarding the biological and practical concerns associated with administering immunocontraceptive vaccines. The cost of labor and materials and the practicality of treating an adequate number of deer likely will limit the use of immunocontraceptives to small insular herds that are habituated to humans (Curtis et al. 1998, Walter 2000, Rudolph et al. 2000). Furthermore, with low annual mortality rates for suburban deer, populations will remain at high levels for several years after the initiation of a contraception program. If short-term population reduction is the management goal, it will be necessary to reduce the herd to an acceptable density and then treat the majority of the remaining, females with contraceptive vaccines to stabilize herd growth (Nielsen et al. 1997).
Assessment
In March of 1998, the Metroparks convened a Metroparks Wildlife Management Advisory Council (MWMAC) to help develop guidelines for management of white-tailed deer, Canada geese (*Branta canadensis*) and other potential nuisance species found within the park system. Citizens on the committee represented a variety of interests and included representatives from: Michigan Humane Society, Michigan Audubon Society, Michigan Department of Natural Resources, Michigan United Conservation Clubs, Michigan Botanical Society, Michigan Bowhunters Assoc. /United Sportsman of America and two private wildlife photographers.

The objectives of the committee were:
- To gather data on how deer were affecting plant and animal life in the parks.
- To assess the deer populations in several parks and develop methods of monitoring these populations.
- To develop recommendations for methods of controlling deer in the Metroparks.

Over the next six months a subcommittee of the MWMAC gathered data on the Metroparks deer populations and their impact on the habitat of the Metroparks, especially Kensington and Stony Creek. In October 1998, the subcommittee concluded:

- The preponderance of evidence demonstrates that deer are overabundant in the Metroparks as indicated by severely browsed plants and the decline or disappearance of plant species.
- To safeguard the ecological integrity of the Metroparks, efforts must be sought to bring the deer population into balance with the carrying capacity of each park.
- HCMA needs to establish a system of periodic, park-specific assessments to determine the extent of deer damage and of vegetation recovery in the various Metroparks.

Vegetation Surveys
Multiple studies (Shelton 2014, Rawinski 2014, Waller 2014) note that deer overbrowsing can change forest habitat by reducing tree reproduction, changing tree species composition, reducing the abundance and diversity to herbaceous understory species and reducing the habitat of canopy-nesting birds. Other studies demonstrate that overbrowsing also contributes to the decline of several bird and butterfly species (Cutright & Kearns 2005, Casey and Hein 1983, Miller et al. 1992, deCalesta 1994, McGuinness & deCalesta 1996). Consistent with this current ecological literature, park officials had noticed the effects of overabundant deer since the 1980s. In response to these concerns, the HCMA installed several vegetation enclosures (deer exclosures) in Kensington Metropark in 1996, to help quantify the loss of habitat. After two years, the data collected from these plots strongly suggested that deer browsing was affecting species diversity and density of local plants types. Vegetation density in exclosures was estimated to be three times greater in exclosures than the control sites.

Subsequently, additional vegetation enclosures (deer exclosures) were installed throughout the park system. An initial study (Courteau, Nov. 1998), detailed the methodology of this sampling process. The survey concluded that “the Kensington Metropark deer exclosures shows a pattern of higher species diversity and density where vegetation has been protected from browsing deer for two seasons” and that “data on browse damage and mortality clearly demonstrate the extent of deer browsing and its correlation with seedling mortality. These data comprise the strongest direct evidence that deer are, indeed, overbrowsing vegetation past the point of recovery, in some cases.” Additional research goals (Courteau 1999 & 2000) have since been established to further compile quantitative scientific data. This ongoing data collection process will continue to aid the HCMA in its management decisions and to assess the effectiveness of its policies regarding deer management in the Metroparks.
MWMAC Recommendations

- Based on several factors including the desire of the committee and HCMA to retain a visible deer herd for public enjoyment, (Social Carrying Capacity) the Metroparks Wildlife Management Advisory Committee (MWMAC) recommended a deer density goal for the Metroparks of 20-25 deer per square mile. The Committee recommended actively controlling deer in a park when the population assessments show the density is greater than that proposed, or when flora monitoring indicates that deer browsing is damaging the vegetation beyond its capacity to recover.

- The MWMAC researched a number of methods for controlling deer populations in the Metroparks and concluded that non-lethal methods were either not available for initiation or would not be effective in reducing deer populations given the large size of the parks, their open borders, the large numbers of deer, and the current state of technology of non-lethal methods such as immunocontraception, and sterilization. It was concluded that traditional methods of deer removal be implemented and the option of non-lethal methods continue to be evaluated as they are made available and prove to be economically feasibility. To date, HCMA is unaware of any safe and cost-effective non-lethal method for controlling deer populations.

While the MWMAC research focused only on the impacts of deer damage on various plant and animal species in the natural systems, it is important to recognize the negative impact of an overpopulated deer herd on the manmade landscape. Each year, deer damage or destroy thousands of dollars worth of herbaceous plants, shrubs and trees that are planted throughout the park system. Damage occurs from deer browse of vegetation and male deer rubbing their antlers on the trunks of planted trees. These “buck rubs” can permanently damage or even kill these plants. Trees damaged in this way typically decline in vigor and will eventually need to be removed and replaced adding additional expense. Damaged trees also have a greater potential for storm and wind damage to occur which could cause additional property or personal damage.

Many agencies across the eastern U.S. have also found it necessary to actively manage deer in their parks or communities. The Metroparks Wildlife Management Advisory Committee spent much time investigating the methods employed by these agencies as it considered options for the Metroparks. HCMA staff continues to monitor the management experiences of other agencies to help determine the efficacy of using various methods in managing deer within the Metroparks.

The list of agencies below is not exhaustive but it gives an idea of the breadth of this park management issue. We have been in direct contact with many of these agencies to get their help and advice. Some have provided us with in-depth management reports that are available upon request.

<table>
<thead>
<tr>
<th>AGENCY</th>
<th>CONTROL METHODS USED</th>
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<tbody>
<tr>
<td>1. Oakland County Parks Commission</td>
<td>Controlled firearms hunts at Addison Oaks</td>
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<tr>
<td></td>
<td>Open bow hunting at several other parks</td>
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<tr>
<td>2. Indiana State Parks</td>
<td>Controlled firearms hunts in several parks</td>
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<tr>
<td>3. Hennepin Regional Park District (MN)</td>
<td>Controlled shotgun and archery hunts; sharpsheoting in one park</td>
</tr>
<tr>
<td>4. Cleveland Metroparks (OH)</td>
<td>Sharpsheoting, immunocontraception</td>
</tr>
<tr>
<td>5. Lake County Forest Preserves (IL)</td>
<td>Sharpsheoting</td>
</tr>
<tr>
<td>6. Columbus and Franklin County Metroparks (OH)</td>
<td>Controlled public hunts, sharpsheoting, trap and transfer, and immunocontraception</td>
</tr>
<tr>
<td>7. Milwaukee County Parks (WI)</td>
<td>Sharpsheoting</td>
</tr>
<tr>
<td>8. Milwaukee Zoo (WI)</td>
<td>Sterilization</td>
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<tr>
<td>9. Cook County Forest Preserve (IL)</td>
<td>Sharpsheoting</td>
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</tbody>
</table>
10. Dupage County Forest Preserve (IL) | Sharpshooting
11. Chippewa Nature Center (MI) | Controlled bow hunting
12. Morris County Parks (NJ) | Controlled hunts, immunocontraception
13. Hunterdon County Parks (NJ) | Controlled hunts
14. Watchung State Park (NJ) | Controlled hunts, sharpshooting
15. Tyler State Park (PA) | Controlled hunts
16. Eden Prairie (MN) | Sharpshooting
17. Long Island (NH) | Sharpshooting, immunocontraception
18. Briarcliffe Acres (SC) | Sharpshooting using arrow gun
19. Missouri Department of Conservation | Controlled public hunts in urban areas

**Public Information**

Knowing that discussions of deer management can be controversial, both from the aspect of controlling deer populations or from not being proactive enough to reduce deer damage to the parks ecosystems, the Metroparks staff instituted a process to provide the public with the information gathered from the MWMAC data. Public informational meetings were held as well as meetings with local officials. Brochures and informational fact sheets were and continue to be available to the public. The public also has opportunities to express their opinion at regularly scheduled monthly HCMA Board of Commissioners meetings.

**Deer Population Surveys**

Several methods have been used in assessing the population of deer in the Metroparks:

- **Aerial (helicopter) surveys** – This method consists of several people (typically 4) flying over the park and visually counting deer. Optimal conditions for this method is after several inches of snowfall.
- **Infrared surveys** – In this method, a plane equipped with an infrared camera mounted on the underside of the plane flies over the park at night. The camera detects the heat generated from the deer and other heat-producing objects and animals. Measurements and calculations identify deer from other animals. This method is best done when the weather has turned cold and after the leaves have fallen off the trees.
- **Visual monitoring** – Metropark staff drive designated routes and count deer on a regular basis throughout the year. This information will continually be gathered and assessed to see what, if any, trends develop.
- **Vegetation Monitoring** – Used as a proxy for deer populations, vegetation monitoring allows HCMA to assess the impact deer are having on a given ecosystem.

The actual number of deer within an area is difficult to determine and can change daily as deer move throughout their natural range. Surveys typically reflect only a percentage of the population but produce valuable baseline population estimates of the approximate deer density. Visual monitoring provides a relative index as an indicator of deer densities or changes in deer abundance. It is also useful in the planning process to estimate deer populations when an actual survey isn’t feasible. This estimating process is conducted in a consistent, scientific manner using the most recent survey data available.

Deer concentrations are surveyed annually in order to set management goals for the individual parks and determine necessary actions. Several methods have been used to gather this data; the most efficient survey method used is by helicopter. This method has been used each year since the beginning of the program. Surveys are typically conducted in January or February with sufficient snow cover (six inches +) to provide good visibility. Three spotters plus the pilot, fly approximately 1/8 mile...
wide transects across the parks at a height of 500 to 700 feet depending on conditions. In 2015, 6.5 hours of flight time was logged with nearly 732 deer identified during the process.

The survey data is used in a population model to predict the herd size the following year. Indications are that approximately 80 percent of the deer are actually counted during aerial surveys. The 20 percent error is not factored into the prediction models, so actual population estimates are undoubtedly conservative. In general, a population density of around 15 deer per square mile is the preferred carrying capacity for habitats within the Metroparks. Currently, population densities average 22 deer per square mile (unadjusted) with the highest density at Hudson Mills Metropark with 62 deer per square mile.
It was determined by the MWMAC that a variety of control measures should be instituted the first two years to help determine the best method to harvest deer. Controlled deer harvests at Stony Creek using both firearms and archery were conducted by qualified volunteers from Metro Wildlife Management Base Inc. (MWMBI) in 1999. Archery was used exclusively by MWMBI at Hudson Mills in 1999. Only firearms were used by MWMBI at Stony Creek and Hudson Mills in 2000/2001. HCMA police officers trained as sharpshooters were used exclusively in reducing the herd in Kensington Metropark in both 1999/2000 and 2000/2001. The MWMAC concluded its’ meetings after presenting its final findings to Metroparks staff in 1999. Over the lifetime of the Program, staff has determined that the efficiency of control measures varies from park to park, and works toward utilizing the most efficient and cost effective method available as allowed through the permits. The focus of this effort is to reduce the population by taking primarily antlerless deer. Antlered deer may be take when part of a group of antlerless deer, however all antlers must be given to the MDNR.

Current Program
As of 2015, 3312 deer have been removed from the Metroparks. In total, over 130,000 pounds of venison was distributed to food banks throughout Michigan, providing more than 413,000 meals to those less fortunate. The Michigan Sportsmen Against Hunger program and other sportsmen volunteer organizations have regularly assisted in covering the cost of meat processing. The largest number of deer culled to date has been at Stony Creek Metropark with 1188. Kensington has had the second most deer culled at 846. The totals for the remaining parks are provided in the table below. Success at harvesting the determined number of deer is variable and dependent on weather conditions including snowfall and temperature.
Safety
Regardless of the harvesting technique utilized, safety is of utmost importance. Prior to each controlled hunt, qualified volunteers participate in an orientation, which reviews hunting and safety procedures, state regulations and HCMA requirements. For the hunt, the volunteers are placed in specific predetermined locations throughout the management area. Locations are spaced apart and shooting zones established to provide safety to the participants, employees and the surrounding landholders. Participants are allowed to take animals only within the shooting lanes specified. Once placed at a location, the volunteers must remain there until Metropark staff pick them up. Other hunting techniques have been explored and are possible but each specific technique would need to be reviewed and approved by the HCMA prior to initiation.

A sharpshooting team is comprised of Metropark Police officers who are trained marksman and a coordinating unit leader. The unit leader is responsible for directing other park rangers to secure areas of the park prior to harvesting operations, assigning the shooting teams and support vehicles to the culling site and dealing with public incidents. Each officer is in constant radio contact with all other members of the team and the unit leader. Shooting typically takes place from a platform over a baited area assuring a downward trajectory of the shot. Special ammunition designed to disintegrate upon impact is also used. All state mandated safety distances from occupied dwellings are adhered to as a minimum. With both culling methods, shots are placed toward the interior of the park, away from park boundaries, roadways, areas of the parks still open to the public and private property.

Animal Handling
Animals taken during the culling process are tagged and the sex and location where the animal was taken are documented as required by MDNR/HCMA. The animals are promptly taken back to a designated building where they are dressed out, and when required by the MDNR, biological data is taken. Animals are transported to a food processor approved by the MDNR and Michigan Department of Agriculture for final processing. The Michigan Sportsmen Against Hunger program and other sportsmen volunteer organizations have regularly assisted in covering the cost of meat processing and distribution of the venison to area food banks. Per deer, cost for removal varies from year to year depending on removal rates. An average total of $30,500 has been budgeted over the past five years for wildlife management. Costs to remove deer through this program has ranged from $595 per deer at the beginning of the program in 1999/2000 to an average of $85 per deer over the last five years.

Biological Data
Biological data is taken from the deer during the Metropark culls. Initially, this included the age, sex and weight of the animal as well as blood samples, fat analysis and the observance of any parasites. Preliminary analysis from the MDNR indicated nutritional stress and herd productivity less than would be expected for a healthy, well-fed deer herd in southern Michigan. Evidence of deer ticks was not found is a study conducted by the Oakland County Public Health and the Michigan Lyme Disease Association. Data continues to be collected on an annual basis, which consists of age, sex, weight, and reproductive rates.
Introduction

Managing white-tailed deer populations within the Huron-Clinton Metroparks is going to be a necessary part of managing the parks for the foreseeable future. As stewards of the parklands, if we are to repair and preserve the biodiversity within the parks, as well as maintain the health of the deer themselves, we must consider deer management as a necessary part of doing business.

The focus of the management effort is to reduce the population by taking primarily antlerless deer. As outlined in the MDNR permit, antlered deer may be taken when part of a group of antlerless deer. Individual animals that are recognized to be unique, unusual, or uncommon and hold value either biologically or socially, will not be targeted. These unique individuals, recognized as bringing added value to the Metroparks, will be protected for the public interest and enjoyment, or environmental/genetic diversity, unless determined by the Metroparks and/or MDNR to be detrimental to public or environmental (including deer or other plant or animal species) health, safety and welfare.

In considering a management plan, staff continues to build on the research work of the Metroparks Wildlife Management Advisory Committee, on 16 years of active management experience and on new research and information gathered on an annual basis. The first two years of managing deer showed that deer can be safely and efficiently removed using various lethal methods. It has since been determined that, depending on the physical properties or constraints of the park, weather conditions, and volunteer availability, that a combination of these methods should be considered to efficiently control numbers. Assessment of deer populations using various survey techniques, and monitoring of changes in the flora within the parks will continue throughout the program. Working with interested groups, staff will continue to research and evaluate the possible use of non-lethal measures and deterrents such as vegetative management strategies, repellants or fencing, which will all be considered under certain situations in this integrated deer management strategy.

Management Plan Goal

The goal of the plan to manage white-tailed deer is to maintain the biodiversity within the Metroparks, while maintaining a visible, healthy deer herd. As responsible stewards and managers of the natural resources within the Metroparks, the Authority is committed to maintaining healthy, natural ecosystems that support a diversity of flora and fauna for park guests to study and enjoy today and in the future.

Methods of Analyzing the Need to Control Deer

The decision to actively control deer in a particular park will be based on deer population assessments and on the condition and changes in flora and fauna of that park. Deer populations will continue to be assessed by using aerial counts from a helicopter and/or infrared survey from a plane depending on climatic and snow-cover conditions. Sample surveys along park roads will no longer be conducted as they have been found to be the least accurate method. Aerial counts will be done annually to establish reliable population trends.

Vegetation surveys will be conducted annually and flora changes will be analyzed by monitoring the deer exclosure plots and control plots that have been located in the parks. Established HCMA protocols for vegetation monitoring as well as photo monitoring will be utilized at points selected in various habitats of the parks. Plant flowering records and anecdotal reports compiled by the parks’ interpreters and other park staff will also be compiled and analyzed.

The above metric will serve as a proxy for the biological carrying capacity (BCC) of an ecosystem is that number of deer that the system can support over an extended period without damaging that habitat beyond its capacity to recover or without changing its character. Social Carrying Capacity (SCC) is defined by both the maximum and minimum population sizes society will tolerate. That is, society may not tolerate too many deer, but it may not tolerate too few either. SCC is also defined by the interactions between humans and a wildlife species. A SCC for deer is defined by the level of abundance and interactions acceptable to enough stakeholders such that there is a low level of deer-related issues (Minnis and Peyton 1995)
The Metroparks Wildlife Management Advisory Committee (MWMAC) originally set a general Social Carrying Capacity for the Metroparks at 20-25 deer per square mile. Many wildlife biologists and ecologists recommend a Biological Carrying Capacity of approximately 15 deer per square mile. It is also recognized that land use, vegetation and deer population levels are not uniform throughout a park and the biological carrying capacities vary throughout the park. Given both the SCC and BCC goals, the Metroparks generally recommendations are to work toward a stable goal of 15 – 20 deer per square mile.

HCMA will consider actively controlling deer in a park when:
  1. Population assessments show the density is greater than 15 - 20 deer per square mile;
  2. Flora monitoring by HCMA professional naturalists and staff indicates that deer browsing is damaging the vegetation beyond its capacity to recover;
  3. When available, biological data collected on park deer indicates that the deer population is under nutritional stress.

**Methods of Controlling Deer**
Currently, lethal removal of deer is the most practical way of controlling over abundant deer populations within the Metroparks. The MWMAC researched a number of methods for controlling deer populations in the Metroparks and concluded that non-lethal methods would not be effective in reducing deer populations given the large size of the parks, their open borders, the large numbers of deer, and the current state of technology of non-lethal methods such as immunocontraception, and sterilization. Further, the MDNR does not currently approve the use of these invasive non-lethal methods in the state. An integrated management strategy using the various forms of both non-lethal deterrents as well as the lethal removal methods that were successfully implemented in the first two years of active management at Kensington, Stony Creek and Hudson Mills Metroparks should be implemented. A combination of controlled firearm and archery hunts and sharpshooting proved to be safe, efficient and effective in decreasing deer numbers and to be acceptable politically. The continued use of volunteer services, when appropriate, to help conduct future controlled hunts will be encouraged. Modifications in methods of administering the controlled hunts and sharpshooting operations and in making personnel assignments for them, along with continued volunteer help, are expected to make the operations more effective and cost efficient.

**Plan Implementation**
The first two year’s deer culling operations at Kensington, Stony Creek and Hudson Mills Metroparks showed that deer could be safely and effectively removed from the parks while minimizing the impact on other park uses and maintaining healthy populations at smaller numbers. However, it was clear from the outset that, it is not possible to achieve deer management goals in a couple years or on a sporadic basis, and that an effective population control objective will require long-term management efforts. The deer numbers in several parks continue to remain above the desired level of 15 deer per square mile, however indications are that the remedial effect of current management efforts on the parks’ flora are very promising. Therefore, an integrated management strategy using a combination of control techniques including the mixture of lethal control methods employed should be continued to be used with the objective of reducing the population densities in any park requiring deer management to 15-20 deer per square mile. This would include using controlled hunting on specified days over the course of the fall during the statewide hunting season. These would be conducted with volunteer selected from the general public. Potential volunteers would be required to pass the shooting skills test as outlined in the current program before participating in controlled hunts.

Trained HCMA sharpshooters would be used to cull deer during the early winter months, after the statewide hunting season has closed, including parts of Kensington where hunting is not allowed due to Milford Township ordinances, as well as in other parks where plan goals have not been met earlier using controlled hunts. This combination of methods will give the flexibility needed to successfully reduce and then maintain deer numbers by allowing control operations to take place over several months.

The safety of the public, volunteers, participants and employees will remain the highest priority. All safety procedures, guidelines, State regulations and proficiency testing for volunteer participants as outlined in the current program will be strictly adhered to. Any deer removed under special permits
issued to the HCMA by the MDNR will continue to be donated to area food banks. Animal handling and processing procedures as outlined in the current program will continue. Active support from area volunteer organizations will continue to be sought to help defray the costs of processing the meat. As before, parks will be kept open to the public for general use as much as safely possible while these control measures are being implemented. All parks will continue to be monitored and active management strategies will be considered for implementation using the criteria mentioned earlier in this Management Plan. All necessary permits will be obtained from the MDNR before any deer management is implemented. Rolls and responsibilities of specific staff members, staff scheduling and processing procedures as outlined in the HCMA Deer Management Cull and Processing Procedures, 2008 shall be followed.

**Plan Evaluation**
The effectiveness of the deer management plan will be evaluated annually using the methods of analyzing stated previously. The methods used to control deer will also be evaluated and compared annually using criteria including: safety of the procedure; number of deer taken compared to the goal set for the park; cost to the HCMA per deer; number of days the park, or part of the park, is closed to other uses while control methods are implemented; the “loss rate” of deer; public reaction to the procedures, especially park users; reaction and comments by participants; and the number of volunteers and volunteer hours the method generates. Staff will develop a deer management report and report to the HCMA Board of Commissioners on a yearly basis.

**Use of Sharpshooters**
Only HCMA Police Officers are permitted as sharpshooters and only those offices specifically listed in the current MDNR Wildlife Damage Investigation and Control Permit are Authorized Sharpshooters. All procedures and protocols of the MDNR Wildlife Damage Investigation and Control Permit and the Metroparks Police Department Policies & Procedures Manual will be strictly followed. Failure to follow sharpshooter protocols and procedures, may result in the removal of the officer from the sharpshooting team and disciplinary action up to and including termination.

**Training of Sharpshooters**
Training of HCMA police officers as sharpshooters for use in deer management at the Metroparks takes place annually. The stated goals and objectives of this training are as follows:

- Safety and Operating System of the Rifle
- Safe functioning of the firearm system
- Maintenance requirements of the firearm system
- Specialized shooting skills required
- Shot placement
  - Safety is the number one concern
  - Insure no branches or obstructions are present which could deflect the shot
  - Positively identify the target
  - Confirm of the backstop and beyond
  - Consider the bullets path if the target is missed
  - The intended target is the brain cavity (think three dimensional when aiming)
  - If it’s unsafe in any way, do not take the shot

Officers are trained to treat all guns as loaded and to never point firearms at something they are not willing to shoot. They are taught to keep their fingers off the trigger and outside of the trigger guard with the safety on until they are aimed at the target and ready to shoot. Lastly, they must positively identify their target and any potential hazards behind their target. For personal safety officers must wear personal protective gear whenever using firearms.

Training to take accurate shots involves an understanding of how breathing affects one’s aim, how to properly site a target through a scope, proper technique for trigger control and the best shooting position to ensure accuracy. After learning how to properly take a shot, officers are trained in shot placement. This includes ensure a clear shooting path, where on the body to target deer, and when to and not to take a shot. Officers are responsible for the safe use of their firearm as well as its maintenance and upkeep to ensure a properly functioning firearm, which is critical to safety and
accuracy. Lastly, when training officers must prove proficiency at 25 yards, 50 yards, 100 yards, and 150 yards. If officers cannot achieve the necessary accuracy through initial training remedial work will be required.

**Shooting During Management**

Sharpshooting teams are comprised of four officers and a unit leader. Additionally, officers are assigned as a security team with the responsibility of checking the area for patrons, closing appropriate roadways, and patrolling park boundaries. The team consists of a driver, an inside spotter who is responsible for documenting activity, a tower spotter, and a shooter. These positions rotate during the course of a shift which is approximately six hours. The unit leader is responsible for directing park police officers to secure areas of the park prior to harvesting operations, assigning the shooting teams and support vehicles to the culling site and dealing with public incidents. Spotters are responsible for sighting deer. When deer are located the shooter takes position in the tower and directs the vehicle into position so that a safe and accurate shot can be taken. Each police officer is in constant radio contact with all other members of the team and the unit leader. Any team member can call off the shot if there are any questions concerning safety, shooting angles and direction, back stops, and/or animal eligibility. Special ammunition designed to disintegrate upon impact is used. All state mandated safety distances from occupied dwellings are adhered to as a minimum. Shooting is restricted to head shots to reduce animal suffering and wounding, ensuring deer remain in the park after culling. All officers should follow safety procedures listed above, properly identify targets, and ensure it is safe to shoot before culling deer. If an animal is culled it will be retrieved by a pick-up team as soon as safety allows so that all culled deer are accounted for and properly processed. All shots taken by officers during deer management operations are recorded on the HCMA Deer Management Record Sheet.

**Remedial Action**

If any officer is unable to comply with safety and program rules as they relate to deer management the following remedial actions will be taken. This policy is adopted from the Metroparks Police Handbook section 8-1, specifically sub-section N. This handbook also contains additional safety and training information that is required for all Metroparks police officers (Section 8-1 - E.1.a.i, F.1.a i-v and c.i-iii, K, and L and Section 8-2). Regarding training, qualification, and compliance (N-O) the requirements read as follows:

**N. TRAINING AND QUALIFICATION:**

1. This Department is committed to the belief that increased training enhances professionalism and decreases the likelihood of injury, to both the officer and the subject. Because of this commitment, appropriate training in the proper use of Department issued and/or authorized weapons is considered mandatory as defined in the Training Policy found elsewhere in this manual.

2. Continued proficiency in defensive tactics techniques and the use of issued/authorized weapons is recognized as a required job skill, necessary to continued employment as a police officer.

3. Failure to successfully complete the required training at the required frequencies, or inability to demonstrate proficiency in the use of any issued/authorized weapon, will result in one or both of the following administrative actions:
   
   a. The revocation of authorization to carry or use the weapon in question.
   
   b. Discipline, up to and including discharge.
   
   c. Prior to resorting to disciplinary action, the Department will take whatever reasonable steps are necessary to provide the officer with additional or remedial training so that the required level of proficiency can be achieved.

**O. COMPLIANCE:**

Violations of this policy, or portions thereof, may result in disciplinary action up to and including termination.
REFERENCES


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Methods and Options for Assessing Deer Damage and Vegetation Recovery in the Huron-Clinton Metroparks) - Courteau 1999

Vegetation Monitoring in the Metroparks: A Progress Report on Efforts to Assess Deer Damage) – Courteau 2000

A Report by the Audubon/Botanical Study Subcommittee to the HCMA Wildlife Management Advisory Committee – 1998
Appendix 1: Deer Management Cull and Processing Procedures

Introduction
The population of white-tailed deer has increased dramatically throughout southeast Michigan including the Metropark system. This growth can be attributed to many factors including the deer’s own high reproductive rate, the absence of natural predators and the restriction of open hunting on park property. At high densities, deer have placed a heavy burden on the natural communities by reducing species diversity of both plants and other wildlife as well as impairing forest regeneration. As responsible stewards and managers of the natural resources within the Metroparks, it’s imperative to maintain the natural environments that support a diversity of flora and fauna for park guests to enjoy and study today and into the future. In order to do so, a deer management plan was initiated with board approval in 2001. The goal of this plan is to manage white-tailed deer populations to maintain biodiversity within the Metroparks, while maintaining a healthy, visible deer herd, and to do so in a safe, humane and efficient manner.

Purpose
To actively manage the Metroparks white-tailed deer population using a variety of control measures in order to promote biodiversity within the park system, while maintaining a healthy visible deer herd and to do so in a safe, humane and efficient manner as outlined in the HCMA White-Tailed Deer Management Report and Proposed Policy as accepted by the HCMA Board of Commissioners, May 2001 and revised July 2015.

Scope
All HCMA Metroparks

Responsibilities

Chief of Police or designee

- To insure public safety and the safety of Metropark employees during deer management operations.
- In cooperation with the Manager of Natural Resources and Environmental Compliance, to facilitate the organization of sharp shooting activities, determine dates and times of sharp shooting and the utilization of police and park staff during culling operations.
- To insure that park facilities are secured from the public and Metropark employees who are not involved in the cull or processing operation during scheduled culling operations.
- To be responsible for all sharp shooting field operations to insure that all deer are taken in a safe and humane manner.
- To oversee sharp shooting transport teams to insure all deer are removed as to minimize any public attention to the program.
- To maintain permits for Michigan special weapons training for police staff involved in sharp shooting activities, and all other permits or certification required to maintain sharp shooting operations.

District Park Superintendent

- Schedule or assign employees as necessary for deer management operations.
- Notify park personnel of scheduled times and dates of controlled hunts, sharp shooting activities and related processing activity.
- In cooperation with the Manager of Natural Resources and Environmental Compliance, to facilitate the assistance of volunteer organizations, determine dates and times of controlled hunts and utilization of park staff during culling operations.
- In cooperation with the Chief of Police or designee, to prepare park for controlled hunts or sharp shooting activities by closing the park in order to facilitate the cull without jeopardizing public safety.
- To insure that park equipment, facilities and other required resources are available and properly equipped for deer management operations including hunter / sharp shooter support, transportation, processing and waste disposal.
- Re-schedule or reassign any employee whose work area may be adversely affected by deer management operations.
• To notify all adjacent property owners and the local municipality of the intent of the Metroparks to conduct deer management operations.
• To track all employee and equipment costs associated with deer management activities and submit that information to the Deputy Director as requested.

Manager of Natural Resources and Environmental Compliance
• To work with the Michigan Department of Natural Resources (MDNR) to establish specifications and guidelines and to secure permits each year for controlled hunts and sharp shooting operations.
• To produce population estimates / survey data to establish animal reduction goals.
• In cooperation with the Interpretive Services Manager and the MDNR, to prepare and conduct annual population surveys and collection of bio-data.
• In cooperation with the Interpretive Services Manager, to establish guidelines for and conduct vegetative surveys throughout the park system.
• To collect data, track trends, provide accounting of permits and process and prepare activity reports as required by the MDNR.
• In cooperation with the District Park Superintendents, to facilitate the assistance of volunteer organizations, determine dates and times of controlled hunts and utilization of park staff during cull operations.
• In cooperation with the Chief of Police or designee, to facilitate the organization of sharp shooting activities, determine dates and times of sharp shooting and utilization of police and other park staff during cull operations.
• To facilitate and oversee all controlled hunting and sharp shooting activities, cleaning and disposition of deer and other related activities.
• To prepare and present annual Deer Management Report to the HCMA Board of Commissioners as determined by the Director.

Interpretive Services Manager
• In cooperation with the Manager of Natural Resources and Environmental Compliance and the MDNR, to prepare and conduct annual population surveys and collection of bio-data.
• In cooperation with the Manager of Natural Resources and Environmental Compliance, to establish guidelines for and conduct vegetative surveys throughout the park system and to submit an annual report of the findings to the Manager of Natural Resources and Environmental Compliance and Deputy Director.
• In cooperation with the Manager of Natural Resources and Environmental Compliance, to provide guidelines, data and information to promote biodiversity within the park system.
• In cooperation with the Manager of Natural Resources and Environmental Compliance, develop and maintain an educational component from the culling activities, so as to help the people of southeast Michigan gain a better understanding of objectives and long term benefits of this stewardship policy.

Procedures

Scheduling
• The District Park Superintendent, in cooperation with the Manager of Natural Resources and Environmental Compliance, the volunteer sportsman organizations and as approved by the Director, will determine dates and times of controlled hunts and utilization of park staff during cull operations.
• The Chief of Police or designee, in cooperation with the Manager of Natural Resources and Environmental Compliance and as approved by the Director, will determine dates and times of sharp shooting and the utilization of police and park staff during cull operations.
• The selection and scheduling of volunteers participating in the controlled hunts will be the responsibility of the supporting volunteer organization. All matters pertaining to securing volunteers, maintaining a volunteer data base, selecting volunteers to hunt, proficiency testing of the volunteers and other related issues is the responsibility of the supporting volunteer organization.
The scheduling of police officers participating in the sharp shooting operations is the sole responsibility of the Chief of Police or designee.

The scheduling of employees as support personnel is the sole responsibility of the District Park Superintendent. Those individuals involved in hunter drop off/pickup, assist in animal recovery, animal processing and transport are considered support personnel. Support teams will be comprised of no more than two employees per transport truck for recovery and transport activities. Shooting teams and supervisors will assist in recovery and transport duties during sharp shooting activities. The use of volunteers from the sponsoring volunteer groups is encouraged during the recovery portion of the controlled hunts.

Notification

- The District Park Superintendent will notify all adjacent property owners and the local municipality of the intent of the Metroparks to conduct deer management operations.
- The District Park Superintendent will inform employees of their assigned duties for deer management operations as well as those employees whose job may be affected by the operation, no less than 24 hours in advance that a deer management operation will be taking place.

Times of Hunt

- Deer management operations will take place October thru February of each year or as otherwise allowed by the MDNR. Various methods of removal will be utilized during the controlled hunting portion of this operation. All methods, type of activity and times of hunting will follow the State of Michigan guidelines as determined by the MDNR or otherwise permitted by the MDNR. Sharp shooting activities may occur at any time within a 24-hour period and within the guidelines and limitations as stated by the Wildlife Damage Investigation and Control Permit issued by the MDNR or as otherwise permitted by the MDNR.

Processing

- Initial processing of deer will take place in heated, well lit areas. Processing teams will consist of no more than three employees. The use of volunteers from the supporting sportsman groups is encouraged. During the processing procedure, every attempt should be made to keep a safe and organized work space. Deer remains should be removed from the work space on a regular basis. All remains from the processing procedure shall be disposed of in an approved, lined waste container and shall be disposed of off-site by a regulated, licensed waste hauler in a timely manner. The District Park Superintendent shall be responsible for arranging waste removal. Those facilities connected to sanitary sewer should be washed down frequently during processing. Those facilities not connected to sanitary sewer will employ the use of plastic or other non-porous floor covering along with an absorbent material to be used liberally during the processing to insure safe working conditions. Plastic gloves and Tyvec suits (or equivalent) shall be made available to employees involved in the processing procedure.
- Washing down processing areas into storm drains is strictly prohibited.
- All antlers collected during processing will be retained by the Manager of Natural Resources and Environmental Compliance and subsequently given to the MDNR for disposal.

Transportation

- After initial processing, all deer shall be hung to cool in a cool/cold dry environment until transported to the meat processor. Transportation will take place in an approved covered trailer or a clean covered truck. Every attempt shall be made to keep the deer clean and dry during the transportation process. All deer shall be transported to the processor the following morning and/or no later than 24 hours after the animal was taken. The meat processor shall be contacted by the District Park Superintendent 24 hours in advance to arrange delivery time. Selection of a USDA approved meat processor will be the responsibility of the Manager of Natural Resources and Environmental Compliance or as permitted by the MDNR.
Quarantined Areas

- Those areas within the park system that are closed for controlled hunting, sharp shooting activities and those areas used for support/processing shall remain off limits to all members of the public and to all employees unless otherwise authorized by the Director, Chief of Police or designee, Manager of Natural Resources and Environmental Compliance or District Park Superintendent until all activities, including processing and cleanup are completed. Employees not involved in the deer management activities but are affected by the management activities taking place in their work space during regularly scheduled work time, may upon request, be reassigned to other areas of the park to perform other duties as assigned by the Park Superintendent.

Bio-Data Collection

- When required by the MDNR or Manager of Natural Resources and Environmental Compliance, bio-data will be collected during the processing procedure. It will be the responsibility of the Manager of Natural Resources and Environmental Compliance or the Interpretive Services Manager to arrange for staff or contracted personnel to collect and record such data. Bio-data will be used to help determine the success of the program, potential disease threats and general health of the deer herd. The MDNR may at times require parts of the deer to be made available to them for further disease testing. When required, those items will be gathered by the individuals collecting data, bagged in a sealable plastic container and stored with the deer awaiting transport or other suitable area away from normal maintenance activities or exposure to employees during their normal working day, until transportation can be arrange to a MDNR facility.

Miscellaneous

- It is intended that any employee involved in the deer management process does so voluntarily. It is recognized that duties assigned and the hours worked in this process can be unusual and arduous and should be undertaken by the employees own accord. It is also intended that when deer management duties are assigned, that they are considered a normal part of the employees work week and that paid overtime will not normally be available.
- At no time will photographs or digital images of any kind be allowed to be taken of the deer management process.
- Any volunteer taking part in the controlled hunts must pass a minimum proficiency test arranged by the supporting sportsman group. Results of the testing will be made available to the Manager of Natural Resources and Environmental Compliance and District Park Superintendent on request.
- Media questions about deer management should be referred to the Director who will then determine who best to respond.