



RICK SNYDER  
GOVERNOR

STATE OF MICHIGAN  
DEPARTMENT OF NATURAL RESOURCES  
LANSING



KEITH CREAGH  
DIRECTOR

January 4, 2017

Dr. Anthony DeNicola  
White Buffalo Inc.  
26 Davison Road  
Moodus, Connecticut 06469

Dear Dr. DeNicola:

Your Scientific Collector's Permit has been approved and is enclosed. This permit is issued on a three-year renewal cycle, expiring on the third March 31 after the date of issue. Unless you have specifically requested an earlier expiration; the expiration date of your permit is **March 31, 2020**.

Renewal Applications and Activity Reports will be distributed in December of 2019. An Activity/Renewal Report, summarizing your collection activities during calendar years 2017, 2018, and 2019, and a completed renewal permit application, will be required prior to the renewal of your permit. An Activity/Renewal Report form is enclosed for your information.

You will be required to report the collection **and handling of bird or mammal** specimens, living or dead, or parts thereof, as authorized by your permit. Please maintain records throughout the duration of your current permit so that you can facilitate an accurate Activity/Renewal; Report.

Feel free to contact me with any questions or concerns.

Sincerely,

Casey M. Reitz, Permit Specialist  
DNR-Wildlife Division  
Phone: 517-284-6210, Fax: 517-335-6604  
[reitzc@michigan.gov](mailto:reitzc@michigan.gov)  
[www.michigan.gov/wildlifepermits](http://www.michigan.gov/wildlifepermits)



## SCIENTIFIC COLLECTOR'S ACTIVITY/RENEWAL REPORT

*By authority of Part 401, 1994 PA 451, as amended. Failure to comply with the provisions of this Act is a violation of State Law and may result in permit revocation, fine, and/or imprisonment.*

Your current permit will expire on March 31, 2020. This report of your collecting activities for calendar years 2017, 2018, and 2019 is required and due by **February 1, 2020**. This report shall summarize your collection and handling of bird or mammal specimens, living or dead, or parts thereof, as authorized by your permit. Attach additional sheets if necessary. **Do not report the collection or handling of fish, amphibians, reptiles, or threatened/endangered species on this report.** Indicate "none" for each calendar year in which no collection activities took place. Your permit cannot be renewed without submitting this report. Retain a copy of this report for your records. **Type or print all information, except your signature.**

Name of Institution: _____ Name of Permittee: _____ Mailing Address: _____ City, State & Zip Code: _____	Permit Number: _____ Institution Telephone Number: _____ ) Permittee's Home Telephone Number: _____ ) Permittee's Work Telephone Number: _____ )
---	---

	SPECIES (Common Name Only)	Total Number Handled	DISPOSITION (Number of Specimens)				Specify Other
			In Collection	Destroyed	Released	Held Live	
2017							
2018							
2019							

**Staple completed report to application and other required attachments and Submit To:**  
 DNR WILDLIFE DIVISION  
 ATTN: Permit Specialist  
 PO BOX 30444  
 LANSING MI 48909-7944  
 Or  
 EMAIL [reitzc@michigan.gov](mailto:reitzc@michigan.gov), FAX 517-335-6604

_____ Permittee's Signature	_____ Date
--------------------------------	---------------





RICK SNYDER  
GOVERNOR

STATE OF MICHIGAN  
DEPARTMENT OF NATURAL RESOURCES  
LANSING



KEITH CREAGH  
DIRECTOR

January 4, 2017

Dr. Anthony DeNicola  
White Buffalo Inc.  
26 Davison Road  
Moodus, Connecticut 06469

Dear Dr. DeNicola:

This letter is the official attachment to your Scientific Collector's Permit (**SC 1600**). Your permit is issued in the *research category* only. In addition to any requirements and conditions listed within this attachment, all requirements and conditions listed on the front and back of the permit form and within the Information Circular for Scientific Collector's Permits shall apply to this permit.

Research Specifications:

1. The purpose of this permit is to examine different management techniques to control the overabundance of white-tailed deer in the City of Ann Arbor in Washtenaw County, Michigan.
2. A written letter of authorization from an appropriate City of Ann Arbor employee or representative must be provided to White Buffalo Inc. and to the Department of Natural Resources (DNR) Wildlife Division Permit Specialist prior to starting research activities outlined below.
3. Pre-baiting will be permissible after January 1.
4. You are authorized to capture up to 80 female white-tailed deer via immobilization darting techniques.
5. Female deer may be captured from January 22<sup>nd</sup> through January 29<sup>th</sup> in accordance with the letter of authority submitted with this application on December 27, 2016. Once captured they may be transported to a temporary veterinary surgical site for sterilization.
6. Local law enforcement, DNR law enforcement, and the local biologist must be notified at least 24 hours prior to shooting activities.
7. All female deer sterilized must be returned near the site of capture.
8. One adult doe per group may be radio-collared and all female deer sterilized will be affixed with ear tags.
9. In addition to the surgical procedure outlined in the letter of authority, additional analgesic medications must be available in order to appropriately ensure the animal's well-being should unexpected trauma occur during surgery.
10. Sharpshooting of up to 100 deer will occur beginning no earlier than January 30<sup>th</sup> and not later than February 13<sup>th</sup>.
11. All safety zone shooting requirements must be followed. Shooting may not be conducted within 150 yards of an occupied building, dwelling, house, residence,

Dr. Anthony DeNicola  
Page 2  
January 4, 2017

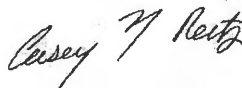
- or cabin, or other building used in connection with a farm operation, without obtaining written permission of the owner, renter, or occupant of the property.
12. All Sharpshooting protocols described in Appendix A must be followed.
  13. All proper Chronic Wasting Disease (CWD) and Tuberculosis (TB) disease protocols must be followed to prevent the spread of disease. Therefore, all deer heads must be submitted to the DNR, Wildlife Disease Lab for testing (517-336-5030) and CWD testing. Each deer must be affixed with the proper CWD disease tag. Facilitation of this process will be done by the local DNR, Wildlife Biologist Kristin Bissell (517-740-5085).
  14. All deer taken to a processor must be confirmed negative for CWD prior to distribution of meat for consumption.
  15. Monitoring will take place to determine the impact of sterilization and sharpshooting efforts on the deer population.
  16. An annual report of your activities and any preliminary findings is required by **December 31** of each year. A comprehensive final report is due **March 31, 2020**.
  17. Subpermittees include Dr. Steven Timm, Vickie DeNicola, Sam Freiderichs, Dylan Ferriera, Ryan Rodts, David Henderson, and City of Ann Arbor Municipal Staff assigned to baiting. Approval must be obtained in writing from the Permit Specialist prior to adding subpermittees.

It is not legal to keep or sell any of the parts of deer taken during this research project.

This permit does not authorize trespass. A separate *use permit* may also be required if you are working on state land or public boat launches. A use permit for state land is issued by the local land manager.

Please feel free to contact me with any questions at the number below.

Sincerely,



Casey M. Reitz, Permit Specialist  
DNR-Wildlife Division  
Phone: 517-284-6210, Fax: 517-335-6604  
[reitzc@michigan.gov](mailto:reitzc@michigan.gov)

cc: Chief Russ Mason, Ph.D., DNR Wildlife Division  
Lt. Andy Turner, DNR District 8 Law Enforcement  
Dr. Kelly Straka, DNR State Wildlife Veterinarian  
Mr. Chad Stewart, DNR Wildlife Division  
Mr. Brent Rudolph, DNR Wildlife Division  
Mr. Tim Payne, DNR Wildlife Division  
Ms. Kristin Bissell, DNR Wildlife Division



**Examining the Effectiveness of Surgical Sterilization and  
Sharpshooting as a Combined Approach for Managing  
Suburban White-Tailed Deer Populations**

**Ann Arbor, Michigan**

**27 December 2016**

**Submitted by**

**Dr. Anthony J. DeNicola**

**White Buffalo Inc.**

---



## Introduction

White-tailed deer (*Odocoileus virginianus*) overabundance and the associated conflicts are pervasive throughout the eastern US. Alternative management techniques (i.e., controlled hunting, sharpshooting, trap and relocation/euthanasia, fertility control research) have been explored from Georgia to Texas to Minnesota and back through Maine and nearly all the states contained therein. Throughout this large geographic region deer are creating both social, public safety, and ecological conflicts in suburban, corporate, and park environments. Many federal, state, and local agencies are struggling to address this ever-increasing problem. Most communities that are confronted with deer overabundance issues pursue a single dimensional approach to solve the problem. However, there are many situations where there are significant variations in development patterns that lend themselves to different solutions. We suggest that it is often optimal to use more than one method and tailor the management plan to the spectrum of potential scenarios present in a community.

In areas where hunting is not either legally or socially acceptable, but a more immediate population decline is preferred, sharpshooting methods are often chosen. Sharpshooting has been proven to be effective at rapidly reducing local deer populations and maintaining the lower densities long-term (DeNicola and Williams 2008). Sharpshooting, as defined by the use of trained professionals using culling techniques outside of permitted recreational hunting methods, can reduce local deer populations lower than what has been achieved historically using recreational hunters. Professional sharpshooting programs have been implemented throughout the US over the past 2 decades without a public safety incident. However, the effectiveness of sharpshooting can be hampered by restrictions on discharge distances from occupied dwellings, limiting access to local deer populations. In these situation trap and euthanasia or fertility control techniques have been used.

Fertility control technology has been shown to be effective for use on white-tailed deer and several other mammalian species. The general public has expressed considerable interest in this approach to managing deer, and it has promise for use on localized deer populations (Rutberg et al., 2013). The ultimate goal for this management approach is short- and/or long-term population management to minimize human-deer interactions or disease outbreaks in areas with high deer populations where hunting is limited, controlled, or prohibited and where other management tools are difficult or impossible to implement. However, when fertility control is used in isolation, it requires a longer timeframe to see significant population declines through natural attrition (Merrill et al 2003), and the cost per animal handled is 2-3 times the cost of other professional methods. Therefore, use on a larger landscape level (i.e., >2-3 miles<sup>2</sup>) can



often be cost prohibitive. In situations where lethal methods are not feasible or likely to be effective, we suggest evaluating surgical sterilization, versus vaccine technology, because it is safe for treated deer (Maclean et al. 2006, DeNicola 2013, DeNicola 2014) and is more cost effective than the all present vaccine technology in many situations (Boulanger et al. 2012, Evans et al. 2016).

In communities where there are great disparities in development density we have often recommended a combination of methods. However, deer management is very polarizing and local leadership typically votes in favor of lethal or nonlethal, rarely a combination. In a community like Ann Arbor, with a diverse development pattern, we would recommend combining methods across the community; nonlethal methods in the more densely developed areas and sharpshooting in larger undeveloped tracts. This approach should accelerate the rate of population decline, and then minimize long-term culling. To date, there are very few data on the empirical benefits of this proposed strategy. This research proposes to examine the benefits of sharpshooting and surgical sterilization in managing Ann Arbor's burgeoning deer population over a 5 year period.

## Study Area

Ann Arbor officials have voiced concerns over increasing deer vehicle collisions, risks of chronic wasting disease (CWD), and impacts to landscape and native vegetation because of a locally abundant deer population. The potential for the furtherance of these conflicts has prompted municipal officials to again consider addressing the abundance of deer.

Ann Arbor is located in central Michigan and contains approximately 28 miles<sup>2</sup>. About 40% of the total land area within the municipal boundaries contains deer habitat, primarily in Wards 1 and 2. The municipality represents one of the most challenging situations for deer managers. The community is nearing the point of being "built out" (as of the of 2010 census, there were 113,934 people, 45,634 households) with most of its land area covered by single family homes surrounded by wooded corridors. This provides excellent deer habitat and at the same time can be restrictive to the implementation of some deer management options. There is no hunting permitted within the community, and there are no non-human predators present that are capable of limiting a deer population. Given the favorable conditions, the deer population in the community has increased to a level that is incompatible with some local land uses. To date, limited management actions have been used to control the deer population; including a sharpshooting effort in winter 2016 that resulted in 63 deer culled. These site characteristics, along with deer approachability, make Ann Arbor a suitable site to conduct a combined





sharpshooting/surgical sterilization research project; using sharpshooting methods in larger undeveloped properties and surgical sterilization in areas where firearm discharge constraints prevent sharpshooting methods from being deployed (i.e., it is not possible to obtain written permission from all landowners that would need to sign off to permit the discharge of a firearm). The areas of particular concern, given the abundance of deer and density of housing, regardless of whether the 450' discharge restriction is changed in the future, are: 1) the area bounded by the Huron River to the northeast, the University of Michigan Arboretum to the northwest, Washtenaw Avenue to the southwest, Huron Parkway to the east, and 2) the area bounded by Skydale Drive to the north, Route 23 and the Huron River to the west and south, and Black Pond Woods Nature Area, Murfin Avenue/Upland Drive to the east. In these zones the housing densities are too high to either safely or effectively cull deer using sharpshooting methods.

There are limited data on the deer population size in the city limits of Ann Arbor. To date, Ann Arbor has conducted population estimates using helicopter counts over snow to assess local deer abundance. This approach can be accurate if conducted following very controlled methods with experienced personnel (Beringer et al., 1998). If the methods are not followed closely, and/or if the personnel do not have proper training and experience conducting such efforts, detection rates can drop precipitously. This can result in population estimates that are significantly lower than what is actually present. Another method for tracking deer population densities over time is through the use of indices of deer abundance. The most common indices that reflect population changes are DVCs, vegetation impacts to natural areas, and homeowner complaints. There is a direct correlation between DVCs and deer population density, and therefore, DVCs can be used as an accurate index of population changes (DeNicola and Williams 2008). If plant diversity and forest health are a priority, then a vegetation monitoring protocol should be developed and conducted annually. Some communities also actively engage the public using surveys to measure shifting perceptions relative to changing local deer densities. This research also will allow Ann Arbor to better understand population densities.

## Objectives

We would expect that surgically sterilizing >95% of a localized deer population would result in a population reduction, based on empirical findings of Rutberg et al. 2013, and published data on natural mortality and recruitment rates of female white-tailed deer in suburban environments (DeNicola et al. 2008, Grund 2011, Etter et al. 2002). Rutberg et al. 2013 conducted their research efforts on a closed population (i.e., an island), so they did not have the potential of immigration effects on population dynamics. Furthermore, there are few data available that



accurately quantify local immigration rates subsequent to management efforts on suburban deer populations for either lethal or non-lethal management actions. The rate of potential population decline will depend on the relative percentage of the population sterilized or culled combined with local mortality and immigration/emigration rates. Therefore, our primary objective is to assess the cost, feasibility, and population impacts of a very high percentage white-tailed deer capture and sterilization project in a densely developed suburban neighborhood, complemented with sharpshooting methods on adjoining open spaces, which will reduce abutting densities to minimize risks of immigration. We will quantify effort, cost, immigration/emigration rates in an open suburban population, and population size annually. Our null hypothesis is that a combine approach to managing deer in adjoining areas will not result in a greater population reduction.

Given the present restrictions on firearm discharge, and the 1000' discharge buffer around schools for culling on public property, there are several large areas where lethal methods are not an option. These include:

1. The area bounded by West Huron River Drive to the north, North Maple Road to the west, Route 14 to the south, and Bird Hills Nature Area to the east.
2. The area bounded by Skydale Drive to the north, Route 23 and the Huron River to the west and south, and Black Pond Woods Nature Area, Murfin Avenue/Upland Drive to the east.
3. The area bounded by the Huron River to the northeast, the University of Michigan Arboretum to the northwest, Washtenaw Avenue to the southwest, Huron Parkway to the east.
4. The area bounded by Route 23 to the north and east, Omlesaad Drive, Tuebingen Parkway, Leslie Park Golf Course, and Murfin Avenue/Upland Drive to the west, and Huron River to the south.

The first three areas are relatively small. The first area is on the edge of the city limit and is exposed to very high deer densities to the west with no way to address the adjoining unmanaged population. Therefore, it is not a good fit for the initial research. The next two areas are good possible areas to start the pilot surgical sterilization research given that they are bounded by areas suitable for culling, and/or areas that do not harbor high deer densities. In the future, if the discharge statute is not changed, surgical sterilization should be considered in the fourth and largest area (Figure 1). Sharpshooting methods would be employed in the larger undeveloped tracts. If the 450' restriction is eliminated for professional culling (versus "hunting"), then the areas for the respective methods may need to be reconsidered. Therefore, we consider Year 1 a pilot year to assess a preliminary surgical sterilization effort in the two previously defined areas combined with sharpshooting in adjacent 6 - 10 larger open spaces.



## Field Methods

### YEAR 1

#### Site Visit, Planning and Permitting

We will conduct two separate site visits to ensure leadership is adequately informed about the research effort and to assess the areas where we will be working. We will partner with Municipal staff to coordinate public and, possibly, private property access to minimize inconveniences to residents. Private property access throughout the community will be invaluable to the success of this program given the limited amount of public land and the 450' restriction on firearm discharge. It would be beneficial to have access to all suitable public properties.

#### Pre-baiting and Site Selection

Deer will be drawn to select areas using bait for sterilization capture and sharpshooting. Bait is important during culling to maximize discretion and safety, because of high human activity and fragmented private property access throughout much of the community. To have comprehensive access we will need ~3-4 bait sites/square mile to ensure thorough access to the entire local deer population. Any access less than this density will result in a relative reduction in harvest and capture. Access is preferably on private property to limit impacts on public land users and minimize the opportunities for those opposed to the program from interfering with field activities.

Bait should be placed out 3 weeks in advance of anticipated culling and capture efforts. All baiting should be done daily from the same vehicle at a consistent time in the late afternoon/evening with approximately 1-2 lb of corn per deer using the location. This acts as positive conditioning for the deer; they recognize the vehicle and person baiting and associate it with the appearance of food. Some vegetation that may obstruct shooting opportunities, if present, it will be thinned or pruned to ensure optimal removal conditions.

#### Capture

We will capture  $\leq 80$  female white-tailed deer of all age classes using remote immobilization (darting) techniques (Pneu-dart X-caliber dart rifle with 2cc transmitter darts) to administer 4.4 mg Telazol (tiletamine HCl + zolazepam HCl) and 2.2 mg xylazine HCl. We will capture deer over baited locations from one hour before sunset until 2 hours after sunset using stationary shooting methods (e.g., tree stand, blinds, decks, etc.). We will approach deer in a vehicle on public roadways and private roadways/properties where permission has been granted after 2100h. If possible, a police officer should accompany the capture professionals during mobile operations.



Once deer are located masks will be placed over the eyes and ophthalmic ointment will be applied to prevent ocular desiccation. Deer then will be transported to a temporary veterinary surgical sterilization site. Deer will be captured from 22-29 January 2017 to minimize difficulties of performing the sterilization procedure later in gestation.

To accomplish the objectives of a high percentage capture (>95% of females) and sterilization project with maximal efficiency (i.e., lowest cost), there should be complete access to the local population from roadways. Female deer will be captured using remote immobilization (darting) equipment from a vehicle opportunistically (after 2100 h) and through the use of bait at select locations.

One mature doe in each matrilineal group will be radio-collared ( $n = \sim 20$ ) to facilitate future capture efforts (e.g., to locate unmarked deer for subsequent capture) and to assess survival rates. All sterilized animals will be fitted with livestock ear tags labeled "Call Before Consumption – 860-790-0224." We will use Extra Large DuFlex ear-tags and modified traditional VHF radio-collars (1/3 the size of traditional deer collars (150 grams) – ~5 year battery life) to lessen the unnatural appearance of deer. We also will collect data on weight, age, and general health of the deer. Additional female deer may be captured and treated over the subsequent four years to compensate for potential immigration.

#### **Surgical Procedure**

After capture, all female deer will be premedicated with flunixin meglumine at a dosage of 1-3 mg/kg IM, and a long acting antibiotic (ceftiofur - Excede) at 3-6 mg/kg also IM. To maintain anesthesia supplemental doses of ketamine HCl may be given intravenously at dosages up to 5 mg/kg, as needed. Routine prepubic ventral midline laparotomy will be used to expose the uterine horns and ovaries. We will perform bilateral ovariectomies using a combination of clamping, electrocautery and excision for removal of the ovary, and coagulation to prevent hemorrhage. In select cases the ovarian artery will be ligated with 0 PDS suture or a titanium hemostatic clip. Routine three layer closure of the abdomen will be performed to complete the procedure. In over 600 sterilization surgeries in deer (black-tailed and white-tailed deer) we have never had a known dehiscence (DeNicola 2013A, 2013B). The suture materials and patterns support continued use, as does the use of stainless steel staples for skin closure. We have recaptured many of the previously sterilized deer and found the staples absent after only a few months.



All animals will be returned to the area where they are captured (in locations with the lowest likelihood of human disturbance during recovery), administered the reversal agent tolazoline HCl (2.0 mg/kg) intravenously, and monitored for complications with recovery.

### Sharpshooting

White Buffalo Inc.'s approach to urban deer management is specifically designed to address and avoid the most common cause of failure; creating an "educated" population that is skilled in avoiding deer management activities. Well before the first deer is euthanized, we focus on how to meet the final objective. The defining strategic characteristic of every population control effort is the management team's singular focus on preventing the remaining deer from being educated to avoid humans even as the population is rapidly reduced. An urban deer management team must remove a high percentage of a population and repeat this process for years into the future, so maintaining the naïveté of the select population is strategically paramount, and is the most important means of reducing risk of failure and minimizing long-term costs. For this standard to be met, the team must possess superior technical ability (e.g., to shoot with precision in suboptimal conditions), field intuition (e.g., to determine whether animals encountered should be engaged), and discipline (e.g., to refrain from engaging if conditions are not conducive). In summary, the behavioral characteristics of the deer at low density, and the ability to subsequently harvest them, will be shaped by events unfolding from the first day of the management activities.

Our methods are humane and address concerns for animal welfare by following the American Veterinary Medical Association's stringent guidelines for humane euthanasia of animals (AVMA 2013). We have spent the last 20 years committed to improving both technology and techniques to maximize safety and efficiency for the management of white-tailed deer (i.e., ballistics testing, bullet development, baiting techniques, adaptation of other technologies for use in deer management, including night vision scopes and suppressors). We have the best available equipment with numerous hours of hands-on use to ensure precise shot placement. This results in safe use of equipment and humane treatment of target animals. We have thoroughly tested and selected bullets, in addition to having developed specialized bullets. As a result of our extensive testing, we have found that no bullet fragments with significant size or inertia exit the target animal, therefore ensuring public safety. We have extensive experience in both lethally removing (>10,000 deer) and capturing deer (>3,000 deer) in a variety of human occupied environments without incident. We have used our discretion in the selection of shooting sites with complete satisfaction of both local/state officials and property owners.



Culling activities will be conducted over an approximate 2 week period between 30 January and 13 February 2017. Sharpshooting operations will take place from ~1500 - 2300 h each day on selected public lands and, if written permission is obtained, private lands within Wards 1 and 2 in accordance with all State and local laws and regulations. Public locations will be noticed as being closed to the public during these dates and times. Given the limited population data in the available open spaces we suggest harvesting approximately 100 deer in the first year until more detailed information can be made available.

We will use suppressed .223 caliber rifles or .22 caliber rimfire rifles for sharpshooting applications (see Appendix A). All rifles are match-grade and specially designed for sharpshooting deer. We will shoot from elevated positions to ensure a steep angle of trajectory. All deer will be shot in the center of the brain (~95%) or the cervical spine (~5%). Cervical spine shots are taken only when there is an obstruction between the shooter and the deer's brain.

#### **Carcass Removal and Donation**

Deer carcasses will be removed from cull locations no later than 2300 h. Every effort will be made to remove visual evidence of the cull and return the site to its normal appearance. Carcasses will be transported to a meat processing facility in Livingston County, Michigan each evening in a timely manner where they will be field-dressed and processed. Costs for the meat processing will be paid for by Michigan Sportsmen Against Hunger. Venison will be donated to a local food pantry. All deer taken will be tagged following MIDNR protocols and heads of all deer culled will be submitted to the MIDNR for Chronic Wasting Disease testing.

#### **Monitoring**

Population estimation procedures and survival assessment will be conducted annually proximate to capturing efforts to ensure yearling/adult males still have their antlers. Camera surveys will be the primary method to estimate the annual population size in the respective treatment areas (Jacobson et al. 1997, Weckel et al. 2011). We will divide each treatment area into 8 equally sized sections by overlaying a grid of approximately 150-acre blocks. Eight infrared-triggered, digital cameras (Moultrie White Flash) will be deployed over bait piles on properties with a high probability of deer activity within each block. Camera sites will be pre-baited daily with shelled corn for several days prior to, and during, camera deployment in January 2017. Each camera will be elevated ~2 ft off the ground, oriented north to control exposure issues, and placed ~15 ft from the center of bait. The cameras will be set to run continuously for 24 hours per day, with a preset delay of 5 minutes between pictures. Every other day during the field survey, the memory cards in the cameras will be changed to confirm the cameras are functioning properly. Depending on deer density, it will require ~1-2 weeks to obtain enough deer images (>2000) to run the statistical analysis for population estimation. All pictures that contain deer will be sorted



by site and numbered. Each picture will be closely studied, and any legible ear tag numbers will be recorded. We also will record the total number of deer, the number of unmarked deer, number of bucks, and the number of unidentifiable marked deer for each photo. From these photographic data, the total number of times each identifiable, marked deer was observed will be entered into the program NOREMARK (White 1996), along with the total number of unmarked deer, and the total number of marked deer known to be alive in the population during the survey. Having a high percentage of tagged deer will allow us to also use mark-resight estimators with the camera survey in addition to using the Jacobson method. Finally, we will determine the pre-treatment recruitment rate (doe to fawn ratio) to serve as a baseline. We also will use spotlighting surveys (three repetitions covering a predetermined spotlighting route) to assess; 1) assess the number of marked and unmarked deer, 2) determine the doe to fawn ratio, and 3) identify the sex ratio of adult deer.

If we achieve a high proportion of tagged female deer we will be able to more accurately estimate the deer population size and immigration rates in the community. Immigration will be determined by observing the number of unmarked females in the sterilization treatment area each year during capturing efforts. We also will assess survival and emigration rates by monitoring radio-collared females after each capturing phase. All incidental mortality or dispersal data will be recorded. Finally, these procedures will allow us to assess the fertility control program's effect on population demographics.

## **YEAR 2**

### **Capture and Surgical Sterilization**

Same as Year 1, with the primary effort focused on locating, capturing, and sterilizing any female immigrants or females not captured in Year 1. There is the option to expand into other developed neighborhoods based on data collected from Year 1 (e.g., #4 listed in the Objective Section).

### **Sharpshooting**

Same as Year 1, with adjustments in access based on any possible changes to the 450' firearm discharge restriction.

### **Monitoring**

As described in Year 1, with the option to adapt methods based on findings from the first year's efforts.