



## MEMORANDUM

TO: Mayor and City Council

FROM: Howard S. Lazarus, City Administrator

DATE: March 19, 2018

SUBJECT: **Winter 2018 Deer Management Program – Year Two Summary Report Submitted by White Buffalo Inc.**

REFERENCES: December 4, 2017 Memorandum to City Council regarding the Winter 2018 Deer Management Plan

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**PURPOSE:** The purpose of this memorandum is to provide City Council and the community the Year Two Summary Report submitted by White Buffalo Inc. to the Michigan Department of Natural Resources (MDNR). This report is required by the research permit to provide interim updates to the MDNR on the status of the research project. The 2018 Deer Management Program involves a number of measures and initiatives, including a resident survey and continued data collection on browse damage, which are both “in-process.” Complete results won’t be available until June/July (see timeline below).

**BACKGROUND:** The scope and implementation of the 2018 program was described in the December 4, 2017 memorandum to City Council. The program involved three strategies including education, sterilization and the lethal removal of deer. The educational program activities started in 2017 and are ongoing. The sterilization program ran from January 2 through January 6, 2018. The lethal program ran from January 8 through January 31, 2018.

### **GOALS AND OBJECTIVES:**

Attached to this memorandum is a summary of the program metrics “Measures of Success” along with their status.

#### *Lethal Removal (Culling):*

The 2018 MDNR research permit allowed for up to 250 deer to be lethally removed (culled) from the city. In January 2018, 115 deer were removed which is substantially below the permitted amount.

#### *Sterilization (Non-lethal):*

The 2018 research permit allowed up to 26 deer to be sterilized in three zones (Southern, Northern, and Eastern). Nineteen deer were captured and sterilized. One was a doe that was recaptured after a failed sterilization attempt in 2017. Seventy-two (54 in year #1 plus 18 in year #2) female deer were sterilized

during the two years. While the number of sterilized female deer is relevant for compliance with the MDNR permit, achieving 96% or more sterilization within a zone is necessary for effective population management.

- The Southern zone is estimated to have achieved 96% or more adult female deer sterilization rate.
- The Northern zone is estimated to have achieved a 70% adult female deer sterilization rate; however, only three adult females remain in this area that have not been sterilized.
- The Eastern zone had five adult female deer sterilized this year. A percentage of the population cannot be determined yet since it was the first year operating in this area.

The limited number of unsterilized females in the Southern and Northern zones should greatly reduce the recruitment rate and contribute to a population decline over time.

The study demonstrates an approximately 33% reduction in deer population in the Southern and Northern zones.

*Population (estimates):*

The helicopter flyover resulted in approximately 24% fewer deer (289 versus 220) counted within the city limits than last year. When performing population estimates, actual counts are used as the basis which are then adjusted upward based on a correction factor. The correction factor varies based on the protocol (e.g. height, speed, cross-sects, etc.) utilized during the flyover, as well as, terrain, development density, foliage, and weather. Based on observations from the 2018 survey, the correction factor utilized in the prior year is believed to have been too high. As survey data continues to be collected each year, the accuracy of the correction factor will improve. The 2018 population estimates are in the Table 4 below in the right-hand column.

**Table 4. Deer abundance determined during the helicopter survey, within delineated zones in Wards 1 and 2, with an incorporated Correction Factor (CF). See Figure 3.**

Northwest Neighborhood - Skyline (west of river)	55 X 80% CF= 69 - 4 shot = 65	1.2 mile <sup>2</sup> = 54 deer/mile <sup>2</sup>
South of River - Huron Parkway NA	12 X 80% CF= 15 - 8 shot = 7	0.5 mile <sup>2</sup> = 14 deer/mile <sup>2</sup>
North and East of River	78 X 80% CF= 98 - 18 shot = 80*	5.8 mile <sup>2</sup> = 13.8 deer/mile <sup>2</sup>
Eastern Study Area	4 X 80% CF = 5 (Folkstone)	0.8 mile <sup>2</sup> = 6 deer/mile <sup>2</sup>
Northern Study Area	~10 (4 deer observed)	1.2 mile <sup>2</sup> = 8 deer/mile <sup>2</sup>
Southern Study Area	~63 (19 deer observed)	1.6 mile <sup>2</sup> = 39 deer/mile <sup>2</sup>

\*18 deer inaccessible in the northern portion of U of M North Campus - 10.7 deer/mile<sup>2</sup> if these deer are excluded

Wards 1 and 2 are projected to have approximately 300 deer (including those within the sterilization zones) by the fall of 2018.

*Program Results:*

Most of Wards 1 and 2 may only require program maintenance going forward with the notable exception of the Skyline neighborhood and a portion of the University of Michigan’s north campus. The Southern and Northern sterilization zones will require maintenance of the untagged females, plus any possible female deer that have immigrated into the zones. Pockets of deer in Wards 3 and 4 need to be monitored

based upon program objectives. Ultimately, moving an area to maintenance levels will depend on the results of the resident survey and browse damage studies.

*Resident Survey:*

The resident survey to determine the community's views on the various aspects of the deer management program is in-process. Results will be available by May 31.

*Browse Damage Study:*

The browse damage study to determine the impact of deer browsing on public land is in-process. Results will be available in May.

*Budget Impact:*

The 2018 program budget included all costs such as contractors, city employee time, professional services, and materials/supplies. The 2018 program was initially funded at \$260k for FY 2018 and \$260k for FY2019. After the objectives for the 2018 program were finalized, \$110k was brought forward from FY2019. The resulting final budgets were \$370k (FY2018) and \$150k (FY2019). At this time, the 2018 expenditures are forecasted to be \$63k under budget with and an additional \$32k in forecasted revenue to offset expenditures. In total, the 2018 program is projected to be \$95k under the net budgeted expenditure.

In preparation for the 2019 program, staff will likely request the underrun be re-applied to FY2019 as efforts continue to achieve program objectives. Exact budget amounts won't be available until late in the fiscal year after all efforts and invoices are completed.

*Policy Advocacy:*

The State's Committee on Natural Resources is considering a bill prohibiting sterilization of game animals such as deer. At this time, the City of Ann Arbor's research project is not impacted. The MDNR would be directed to issue a recommendation after the results of the research permit study are completed.

**NEXT STEPS:**

*Resident Survey (March)* – resident survey by Michigan State University Research Center is in-process.

*Deer Browse Damage on Public Property (May)* – The results of Dr. Courteau's deer browse studies are anticipated in May.

*Resident Survey Results (May)* – results of the survey and assessment are due by May 31.

*Staff Report (June/July)* – After all the data is collected from the 2018 activities, staff will prepare a final summary report along with lessons learned and potential 2019 strategies for City Council consideration.

2 Attachments

- 1 – Year Two Summary Report (2018 Deer Research Program), White Buffalo Inc.
- 2 – 2018 Deer Management Plan – Preliminary Results



**White Buffalo Inc.**

Conserving Native Species and Ecosystems

**YEAR TWO  
SUMMARY REPORT**

**2018 Deer Research Program**

**Ann Arbor, Michigan**

**2 March 2018**

Submitted by

Dr. Anthony J. DeNicola

White Buffalo Inc.



## Executive Summary

Ann Arbor is a most challenging situation for deer managers; nearly built out and covered by single family homes surrounded by wooded corridors. It is excellent deer habitat with no hunting and no non-human predators. The directives set by the City included improving forest health/regeneration in natural areas, reduction in deer-vehicle collisions (DVCs), achieving 75% satisfaction level of residents, and gathering data to inform future management decisions.

The primary objective in 2018 was to assess the complementary effect of lethal management in larger wooded areas proximate to sterilization efforts in dense suburban neighborhoods.

Sterilization study areas were in the south (bounded by U of M Arboretum and Huron Hills Golf Course and Huron Parkway Nature Area), north (bounded by Cedar Bend Nature Area and Leslie Park Golf Course), and east (bounded by Plymouth Road, Route 23, Green Road, and Concordia University) of Wards 1 and 2. Nineteen does were tagged and sterilized by ovariectomies from 2 – 6 January 2018. One female was recaptured after a failed surgery from 2017, so only 18 new females were handled. We demonstrated ~33% reductions in both the SSA (94 to 63) and NSA (15 to 10).

Sharpshooting activities occurred from 8 – 31 January 2018, at 23 sites and 115 deer were culled. We used suppressed .223 caliber rifles, shot from elevated positions to ensure a steep angle of trajectory, and followed American Veterinary Medical Association *Guidelines for the Euthanasia of Animals* 2013. Results were: Barton/Foster 2; Bird Hills 8; Butternut (Ward 3) 6; Concordia 13; Foxfire 2; Glazier Hill 3; Huron NA 15; Leslie GC 4; Narrow Gauge 10; Newport 14; Oakwoods 2; Platt 2 (Ward 3); Traver 2; U.M. Arb 9; U.M. other 23.

Camera surveys were used to estimate the number of deer in the south study area. Using three different methods, an average estimated population in the SSA was determined to be about 63 deer (~39 deer per mile<sup>2</sup>), and >95% of the does sterilized. The doe:fawn ratio declined from 1.1 to 0.16.

A helicopter survey was conducted on 19 January 2018 using the same methods as in Year 1. The snow count detected 276 deer (220 in City limits), compared to 315 (289 in City limits) in Year 1. The detection rate used for areas outside of the sterilization study areas were based on the literature and past experience outside (80%). Using the correction factor, there were ~216 deer in Wards 1 and 2; 78 of which were in the sterilization study areas. There were ~19.6 deer/mile<sup>2</sup> on average (216 deer in ~11.1 mile<sup>2</sup>) in Wards 1 and 2. In areas with good access, excluding the northern section of U of M North Campus (18 deer) and the western



portion of the NW neighborhoods (46 deer observed in the 1000' school zone or Township), outside of the sterilization study areas there were  $\sim 12.6$  deer/mile<sup>2</sup> remaining ( $\sim 88$  deer in  $\sim 7$  mile<sup>2</sup>). Given  $\sim 60$  untreated adult females, outside of sterilization areas, we expect an additional  $\sim 70$  fawns to be recruited/added to the population next fall in Wards 1 and 2 (nearly half of these will be born in the NW neighborhood), raising the deer population in Wards 1 and 2 to about 220 ( $\sim 300$  when sterilization study areas are included) by Fall 2018. This will be  $\sim 20$  mile<sup>2</sup>.

In the future, the relative acceptance of residents in various wards, coupled with desired deer densities for forest health in natural areas, will determine how many deer to allocate to lethal versus non-lethal methods. Considering that the University will not allow sharpshooting efforts in the northern portion of North Campus this might be an area that should be considered for sterilization methods. The other area that is most problematic is the area adjacent to Skyline High School in the NW neighborhoods. Maintenance level sterilization of untagged females, and possible immigrants, also should be considered. We should be at maintenance level densities in the rest of the Wards 1 and 2, with pockets of deer in Wards 3 and 4 that should be monitored based upon stated objectives.

## INTRODUCTION

Ann Arbor is located in central Michigan and consists of approximately 27.8 miles<sup>2</sup> of total land area. 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 development pattern provides excellent deer habitat and at the same time can be restrictive to the implementation of some deer management options. This deer habitat exists primarily in Wards 1 and 2 and covers approximately 40% of the land area within the municipal boundaries. 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 city objectives. Only limited management actions had been used to control the deer population; including a sharpshooting effort in winter 2016 that resulted in 63 deer culled.

In the first year of the research (2017), we used a combination of methods to assess the impacts on the local deer population under Scientific Collectors Permit (#1600). We culled 96



deer and surgically sterilized 54 female deer. Insights garnered during the first year remained aligned with the pre-implementation assessment. In some areas of Ann Arbor capture and surgical sterilization is the best method to control deer abundance, whereas, in other areas with larger open spaces and fewer roads, sharpshooting is the most cost-effective method. Although the 450' firearm discharge restriction around occupied structures no longer exists, firearm discharge constraints proximate to schools (i.e., 1000' firearm discharge restriction near schools) continues to prevent sharpshooting methods from being deployed in several areas. There also are areas in the City with an abundance of deer that do not have suitably discreet shooting locations because they contain only small, highly visible, wooded Parks to conduct shooting operations.

The research objectives continue to be guided by directives set by the City Council; these include improving forest health/regeneration in natural areas, reduction in DVCs, and a 75% public satisfaction level of the resident in the five Wards. Meeting these objectives will require an adaptive process where annual data collection will direct future strategic use of field methods.

## STUDY AREA

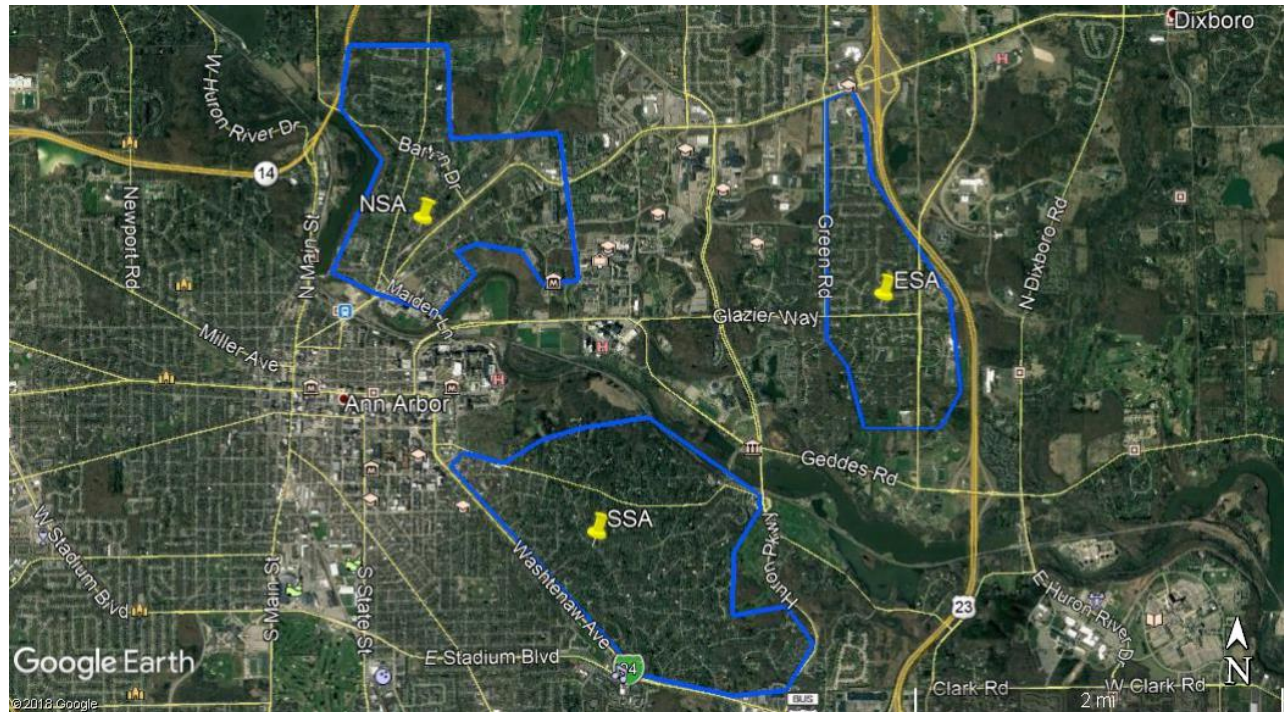
The areas of particular focus for sterilization activities, given the abundance of deer and high housing density, were: 1) the area bounded by the Huron River to the northeast, the University of Michigan Arboretum to the northwest, Washtenaw Avenue to the southwest, Huron Parkway to the east (hereafter South Study Area - SSA) 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 (hereafter North Study Area - NSA). The University of Michigan Arboretum and Huron Parkway Nature Areas served as proximate open space sharpshooting areas to the SSA. In the NSA, Cedar Bend Nature Area and Leslie Park Golf Course served as proximate open space sharpshooting areas during the first two years.

We also conducted preliminary capture and surgical sterilization efforts in a third study area (East Study Area – ESA) that was acknowledged in the original proposal as a future area that might be restricted by firearm discharge constraints. The ESA was defined by Plymouth Road to the north, Route 23 to the east, Green Road to the west, and Concordia University to the south (Figure 1).





**Figure 1.** Delineation of surgical sterilization study areas.



## METHODS

### Capture

Deer sterilization activities were conducted from 2 - 6 January 2018. We followed the operations protocol used in Year 1 and outlined in the proposal, contract, and Michigan Department of Natural Resources (MIDNR) Scientific Collection Permit #1600. Female white-tailed deer of all age classes were immobilized using projectors with 2 ml transmitter darts (Pneu-Dart Inc., Williamsport, PA, USA) to administer tiletamine/zolazepam (4.4 mg/kg) and xylazine hydrochloride (2.2 mg/kg). We approached deer in a vehicle on public roadways and private roadways/properties where permission was granted. We also darted deer over bait placed on private properties in the late afternoon. Once a dart was deployed and 15 minutes elapsed, the deer was located via radio-telemetry. Masks were placed over the eyes, and ophthalmic ointment was applied to prevent ocular desiccation. Deer were transported to a public property where a temporary veterinary surgical sterilization site was located.

All captured deer were fitted with ear tags for individual identification. The backplate of each tag was labeled "Call Before Consumption 860-790-0224." We also collected data on





weight, age, and general health of the deer. Incidentally captured male fawns were tagged at the capture location.

### **Surgical Procedure**

Upon arrival at the temporary surgical suite, all deer were premedicated with flunixin meglumine at a dosage of 2 mg/kg IM and a long-acting antibiotic (ceftiofur) at 4 mg/kg IM. Supplemental intravenous doses of ketamine HCl (2-4 mg/kg) were given as needed to maintain anesthesia. Females were sterilized with a routine prepubic ventral midline laparotomy exposing the uterine horns and ovaries. We perform bilateral ovariectomies using a Ligasure vessel sealer. Intraoperative splash blocks and direct injection of lidocaine and bupivacaine are used to give up to 8 hours pain relief in addition to the flunixin. Following ovariectomy, a routine three-layer closure of the abdomen is performed to complete the procedure using absorbable suture.

All deer were returned proximate to the capture location, in areas with the lowest likelihood of human disturbance during recovery. The reversal agent tolazoline HCL (200 mg IV and 100 mg IM) was administered, and each individual was monitored during recovery.

### **Sharpshooting**

Pre-baiting was conducted from 18 December 2017 through 7 January 2018. Sharpshooting efforts were conducted from 8 - 31 January 2018. We followed the operations protocol outlined in the proposal; 1) we use suppressed .223 caliber rifles, 2) we shot from elevated positions to ensure a steep angle of trajectory, 3) all deer were shot following AVMA guidelines for euthanizing animals with firearms. Twenty-three sites were used throughout the area of operation.

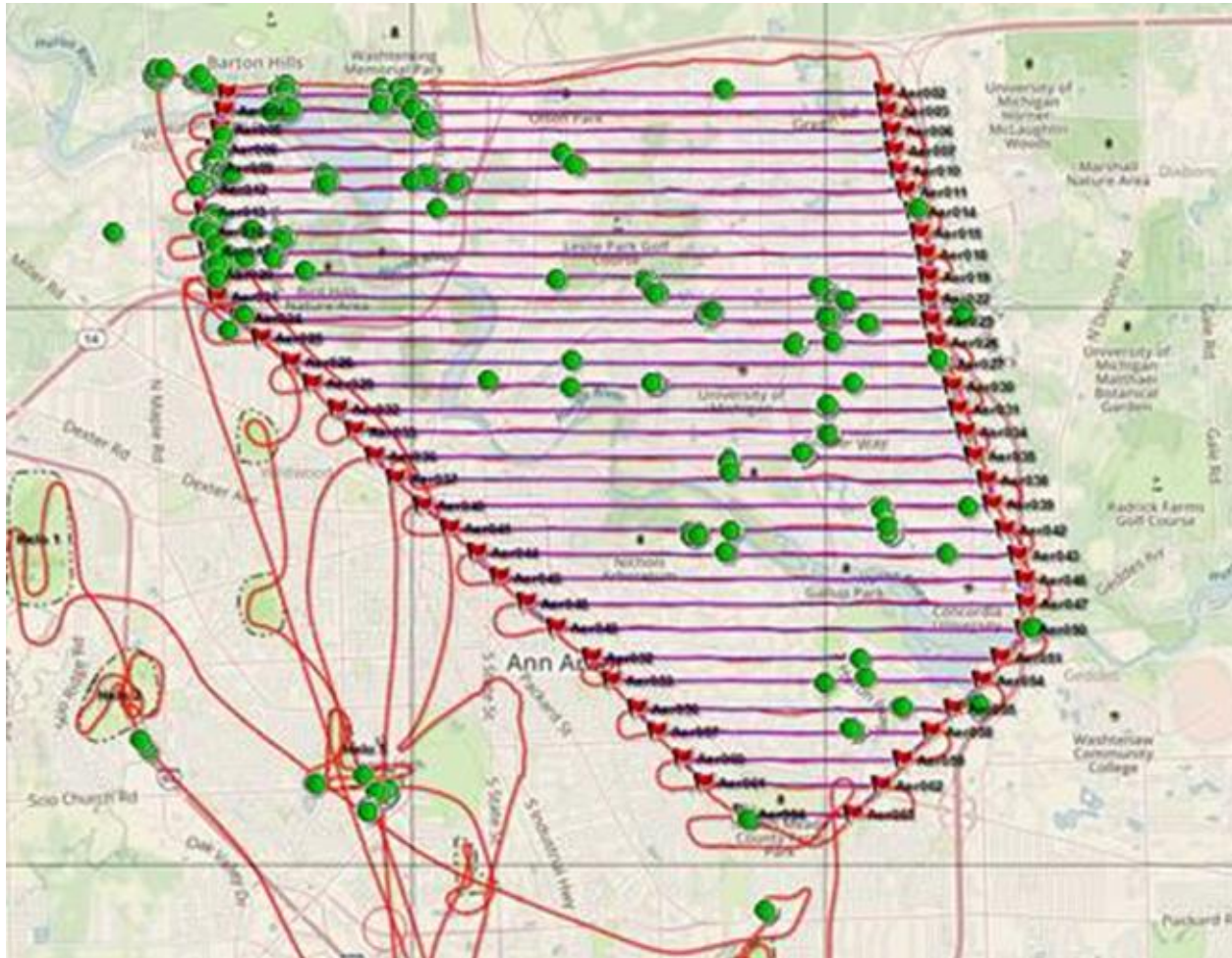
### **Helicopter Survey**

Prior to initiating the survey, transects were delineated (East-West) and entered into a GPS moving map software (ExpertGPS)(Figure 2). Transects were spaced at 200 yd intervals, which resulted in a total of 63 flight lines. On 19 January 2018, a Robinson 44 helicopter was used to fly transects at an elevation of 200-300 feet above ground level and an airspeed of 25 - 30 mph. Each observer counted all deer out to 100 yds from their respective side of the aircraft. There was a pilot and a navigator to ensure all transects were flown accurately. The navigator used a GPS system with a moving map to verify the accuracy of all transects. The number of deer detected were tallied as deer were detected along flight lines. In open forest areas, good conditions, the above methodologies produce a ~80% detection rate (Beringer et



al. 1997). Under less ideal conditions, often present in suburban landscapes, the detection rate can be significantly <50% (DeNicola, unpublished data).

**Figure 2.** Helicopter survey transects, and observations of deer, 19 January 2018.



### Camera Survey

After capture efforts were completed, a camera survey was conducted from 7 - 22 January 2018 to provide a population estimate in the SSA because the helicopter snow counts detected relatively few deer there in both years. We used Moultrie White Flash cameras (Moultrie Feeders, Alabaster, AL, USA) set on motion activated single shot with a 5-minute delay to optimize capture rates. Camera coverage of ~1/150 acres was used with one camera placed in each of 7 blocks. Each camera was elevated 0.6 m and oriented north. Cameras were



retrieved once 150-200 photos were obtained from each baited location. Each picture was closely studied, and all legible ear tag numbers were documented. We also recorded the total number of deer, the number of unmarked does, the number of bucks, the number of unmarked fawns, 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 was 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. We also used the same calculation method as Jacobson et al. (1997) to estimate population density and herd demographics. Finally, we used the camera data to determine the ratio of tagged to untagged females for the Lincoln-Petersen Estimator (LPE)(Curtis et al. 2009, Eberhardt 1969). Finally, we estimated the population based on our field observations and camera data. In summary, we used four different methods to estimate the total deer population: Jacobson's buck:doe ratios (BDR) method, LPE, program NOREMARK, and population reconstruction.

## RESULTS

### Capture and Sterilization

We captured 22 deer with remote-injection tranquilizer darts (Appendix A). Of the deer captured 19 were females (17 adults - one recapture; #43, and two fawns) and three were male fawns. All males captured were misidentified as female fawns. All of the females captured were sterilized via ovariectomy.

Females received white ear tags, and males received yellow ear tags. We expended 272 person-hours for capture and surgical sterilization activities (12.4 person-hours per female deer captured), this does not include volunteer support hours. Three radio-collared females have died since the last capture phase in January 2017; a 15% mortality rate. There were no mortalities associated with capture or the surgical procedure one-month post-handling.

### Sharpshooting

Eighteen days of fieldwork were required to achieve the harvest of 115 deer. The entire data set generated from harvested deer is represented in "Deer harvest data 8 - 31 January 2018 in Ann Arbor, MI." (Appendix B). The overall harvest demographics are summarized in Table 1. Harvest by day is summarized in Table 2. Harvest breakdown based on location is summarized in Table 3. We expended 559 person-hours for the sharpshooting activities (115 deer harvested) resulting in 4.86 person-hours per deer harvested.



There were 29 original bait sites selected, and 23 were utilized for sharpshooting as part of the 2018 Ann Arbor deer research program. Six sites were removed from the property list due to lack of consistent deer activity (Arbor Hills, Concordia 2, Olsen Park, South Pond, Stapp, and Sugarbush). Three of these sites were sat one evening each with no harvest occurring. Harvest results from specific sites ranged from a high of 15 deer to a low of zero.

**Table 1.** Sex of deer harvested in Ann Arbor, Michigan from 8 - 31 January 2018.

Age	# Male (%)	# Female (%)	# Combined
Yearling/Adult	23 (20%)	58 (50%)	81 (70%)
Fawns	19 (17%)	15 (13%)	34 (30%)
Total	42 (37%)	73 (63%)	115 (100%)

**Table 2.** The number of deer harvested by day 8 - 31 January 2018.

Date	# Harvested
1/8/18	6
1/9/18	3
1/10/18	18
1/11/18	6
1/13/18	13
1/14/18	7
1/16/18	9
1/17/18	9
1/18/18	5
1/19/18	5
1/20/18	3
1/23/18	2
1/28/18	7
1/29/18	1
1/30/18	10
1/31/18	11



**Table 3.** Deer harvest by location from 8 - 31 January 2018.

Location	# Harvested
Barton/Foster	2
Bird Hills	8
Butternut	6
Concordia	13
Foxfire	2
Glazier Hill	3
Huron NA	15
Leslie	4
Narrow Gauge	10
Newport Rd	14
Oakwoods	2
Platt Rd	2
Traver	2
U.M. Arboretum	9
U.M. Other	23

### Helicopter Survey

The snow count detected 276 individual deer, of which 220 were located within the City limits at the time the survey was conducted (all five Wards). We culled an additional 39 deer after the helicopter survey was completed, 30 of which were removed from Wards 1 and 2 (see Table 4). This count represents ~24% fewer deer, within the municipal limits than last year's helicopter survey (289 in 2017). Total counts (including those observed just outside the City limit) varied by only 12%, 315 as compared to 276, in 2017 and 2018 respectively. Flight conditions for the 2018 survey were near ideal with 3-4" of base snow, low wind speeds, and clear skies. Flight tracks indicate the pilot did an excellent job following transect lines and maintained a consistent altitude and speed. Unfortunately, for 2018 we do not have an area specific harvest/snow count comparison to more accurately determine our probable detection rates, as we used in the 2017 Cedar Bend analysis. With better conditions than in 2017, it is



likely that detection rates were ~80% (based on Beringer et al. 1997), excluding the highly developed areas in the SSA and NSA.

There were 172 deer observed in Wards 1 and 2, 19 deer observed in Ward 3 (County Farm Park and Mary Beth Doyle Park; 11 in 2017), 23 deer in Ward 4 (Pioneer High School; 8 in 2017), and six deer in Ward 5 (6 in 2017). Based on the adjusted correction factor, and population reconstruction estimates in the surgical sterilization study areas, we estimated there were ~216 deer in Wards 1 and 2; 78 of which were in the sterilization study areas on 19 January 2018 (Table 4). Therefore, there were ~19.6 deer/mile<sup>2</sup> on average (216 deer in ~11.1 mile<sup>2</sup>) in Wards 1 and 2. In areas with good access, excluding the northern section of U of M North Campus (18 deer) and the western portion of the NW neighborhoods (46 deer observed in the 1000' school zone or Township), outside of the sterilization study areas there are ~12.6 deer/mile<sup>2</sup> remaining (~88 deer in ~7 mile<sup>2</sup>).

**Table 4.** Deer abundance determined during the helicopter survey, within delineated zones in Wards 1 and 2, with an incorporated Correction Factor (CF). See Figure 3.

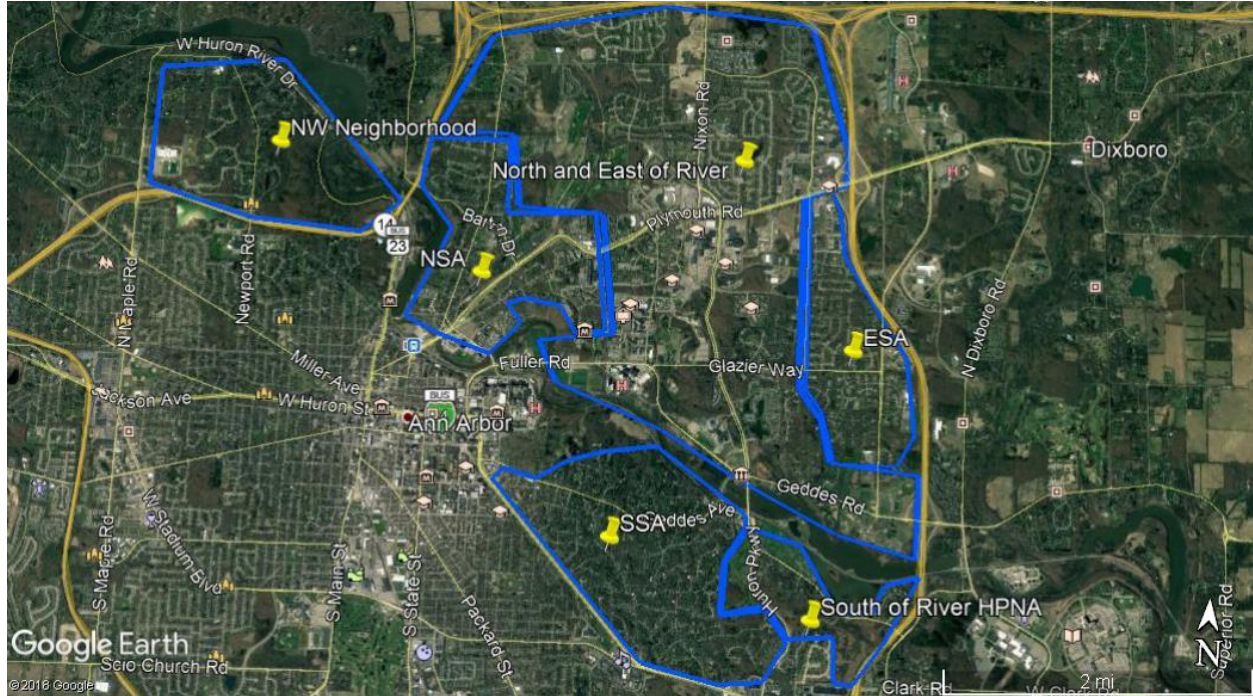
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\*18 deer inaccessible in the northern portion of U of M North Campus - 10.7 deer/mile<sup>2</sup> if these deer are excluded





**Figure 3.** Helicopter survey area covering Wards 1 and 2 in Ann Arbor, Michigan with delineated areas based on detection rates.



### Camera Survey

We obtained a total of 897 pictures from the seven baited camera sites, which included observations of 1,344 deer. There were 836 photos of tagged females as compared to 284 photos of males (Table 5). We observed 80% (39 of 49) of the tagged adult females in photos that were alive and presumed present in the study area during the survey. We also observed three of four tagged fawns (75%).

Using the Jacobson's BDR method and an adjustment for camera bias, we estimated 59 deer in the SSA; 18.7% adult males ( $n = 11$ ) and 81.3% antlerless deer (42 adult females, and six fawns = 48) (Table 6). When analyzing the photos using Jacobson's method, we examined the average number of photos of each tagged adult female as compared to the average number of photos of each individual adult male. We noticed there were 1.4 times more photos of antlered males than tagged females (e.g., greater likelihood to observe males on bait). We adjusted the number of females and fawns derived using this method with a correction factor of 1.4 to account for this camera bias. Based on observations in the field, even with the correction factor, there is a bias in the number of male photos. We have removed this method



from the pool of averaged estimators due to the obvious inaccuracies and rely on methods that are more accurate due to the high number of tagged animals.

When analyzing the pictures using the LPE (49 tagged adult females, two untagged adult females, and seven fawns = 58 antlerless deer), and adding the number of individual antlered males identified ( $\underline{n} = 11$ ), the total estimate was 69 deer.

**Table 5.** Camera survey data collected from 7 - 22 January 2018 in Ann Arbor, Michigan used for Jacobson, LPE, NOREMARK, and population reconstruction estimators.

Site	# Photos	Total Deer	Tag Adult Female	Untag Adult Female	Adult Male	Fawns
1	161	214	111	5	79	7
2	184	258	180	3	67	0
3	91	133	50	8	47	17
4	197	266	145	1	59	44
5	105	209	178	4	16	2
6	19	24	6	0	1	15
7	140	240	166	8	15	40
Total	897	1344	836	29	284	125

We ran program NOREMARK including all the tagged adult females and fawns observed in the area, whether or not the deer were observed on camera ( $n = 53$ ). If a tagged animal was missing from the camera survey in both years and was not observed during our field work, we considered it missing ( $n = 1$ ). The antlerless deer population (tagged and untagged) was estimated to be 60 (95% CI: 55-65) and adding the number of individual antlered males identified ( $\underline{n} = 11$ ), the total deer abundance was 71 in the SSA.

Using the population reconstruction method we projected a minimum of 70 deer in the SSA; 49 tagged adult female deer alive at the time of the survey, two untagged adult females, eight fawns (three female fawns - one tagged, five male fawns – three tagged), and 11 individually identified adult males. We estimate there to be 10 deer in the north zone; six tagged adult females, one tagged female fawn, and three untagged adult females. No adult males were detected in the NSA.

Using LPE, NOREMARK, and the population reconstruction methods to estimate the herd density, we found an average estimated density of  $\sim 44$  deer/mile<sup>2</sup> (SSA area =  $\sim 1.6$  mile<sup>2</sup>) (Table 6) prior to sharpshooting efforts. Seven adult males from the camera survey were culled



on proximate sharpshooting locations, so there were ~63 deer present upon completion of Year 2 field efforts. We also determined that ~96% of the adult females in the SSA (49 tagged adult females and two untagged adult females) were sterilized upon completion of the camera survey.

**Table 6.** Deer population estimates prior to sharpshooting efforts using Jacobson, LPE, NOREMARK and population reconstruction estimators for the SSA in Ann Arbor, Michigan.

Estimation Method	Estimated Parameters
<b>January 2018 survey</b>	1,344 observations
Buck:tagged doe ratio	1:2.6
Buck:untagged doe ratio	1:0.09
Tagged adult doe:fawn ratio	1:0.16
Number of antlered males	11
Ratio of tagged and untagged females in photos	836:29
<b>Population estimates (prior to sharpshooting efforts)</b>	
Buck:doe ratio method (Jacobson et al. 1997)	59
Lincoln-Petersen Estimator	69
Bowden's ratio estimator (NOREMARK)	71*
Population reconstruction (minimum number)	70

\* Adult females and fawns 60 (95% CI: 55-65), plus 11 adult males, total 71

## DISCUSSION

### Objectives and Overview

Our primary objective was to assess the complementary effect of lethal management in larger wooded areas proximate to sterilization efforts in dense suburban neighborhoods. We have demonstrated ~33% reductions in both the SSA (94 to 63) and NSA (15 to 10). In addition, there should be immediate impacts in nearly all areas that we had access with sharpshooting methods. We also have collected additional data to help the City Council move forward with future management decisions, including a second helicopter snow count and camera survey,



effort/cost projections, and further demonstration of feasibility for the respective research actions.

### **Sterilization**

We are aware of two adult females that we were not able to capture in the SSA. Based on field observations, we believe that the 49 adult does sterilized represents >96% of the adult females in this zone. There were three adult females that we did not capture in the NSA (70% capture of adult females). Unfortunately, two of the adult females were not in the NSA while we were actively capturing based on tracking the radio-collared deer they were associated with (and observed within Leslie Golf Course). After sharpshooting efforts, we estimate there to be 63 deer in the SSA and 10 in the NSA using population reconstruction. The limited number of unsterilized females in both study areas should greatly reduce the recruitment rate and contribute to continued population declines.

As a side note, adult female #43 was recaptured because she was observed with two fawns. During surgery last year (2017) the veterinarian could not find her uterus and speculated she might have prolapsed during a previous pregnancy (reported in surgery notes). She likely was not pregnant at the time, and the uterus was small and tucked in the pelvic opening. She was pregnant at the time of surgery this year.

### **Sharpshooting**

We designed an approach that included broader access for sharpshooting, based on our experiences from Year 1 and the elimination of the 450' discharge restriction. Sharpshooting impacts should be significant throughout Wards 1 and 2 with only a few locations receiving limited benefits. Areas where inadequate access was achieved include the NW neighborhoods near Skyline High School and a few select areas on the U of M campus. There also was a very large concentration of deer (23 total) near Pioneer High School in Ward 4.

The number of harvested deer increased from Year 1 (96) to Year 2 (115). However, the overall harvest efficiency decreased significantly (21 person-days, Year 1; 43 person-days; Year 2). The decreased efficiency is the result of a lack of access in some areas, direct interference with sharpshooting operations, and decreased deer density (due to previous sharpshooting efforts). The removal of the 450' firearm discharge restriction significantly increased our access in Year 2. However, compliance with the 1000' buffer zone around local schools, inability to harvest deer from unannexed Township properties, and lack of private property cooperation hindered our access to significant numbers of deer within the Ann Arbor City limits. The prime example of this access issue is the northwest section of the City. Based on



helicopter surveys from both Year 1 and Year 2, it is evident that this area contained high densities of deer. This western section of Ward 1 contains substantial numbers of unannexed Township properties, and the Township did not participate in the deer management program. The area also contains Skyline High School and Rudolf Steiner School in close proximity to each other, creating a large contiguous school zone in which sharpshooting activities were prohibited. To emphasize the problem, ~20% (42 of 220) of the deer counted in the entire Year 2 helicopter survey, and well over half of the deer counted in Ward 1, resided within this school zone and proximate Township parcels. The sharpshooting efforts in the Bird Hills Nature Area (BHNA) from Year 1 resulted in significantly decreased deer densities within the park with little evidence to suggest that deer residing in the school zone to the west are overlapping. A lack of immigration from the NW neighborhood to BHNA left only two possible sites to address this significant population of deer. A private property along Newport Road provided access to a portion of these deer outside of the school zone. We harvested 14 deer at this location, but given the overwhelming number of deer present in the area, it was not possible to address all the deer with one point of access. The Barton/Foster Nature Area was the only other site proximate. While some deer did visit this site, it was apparent that they traveled daily to this location. However, they had to navigate not only the neighborhoods but also cross West Huron River Drive and the railroad tracks. As a result, these deer were difficult to pattern as their arrivals were highly dependent on local traffic patterns, which typically subsided outside the hours of sharpshooting operations.

We experienced interference from individuals disapproving of the sharpshooting program. The disturbance created by the protests significantly impacted the efficiency of sharpshooting efforts, with 30% of sharpshooting operations affected (6 days). The protests occurred primarily on the University of Michigan campus and adjacent properties. Unfortunately, the sites centered around the University of Michigan campus also possessed the highest deer densities outside of the NW neighborhood. Sharpshooting efforts were reasonably successful at all of these sites, but interference either directly impacted sharpshooting activities or necessitated a change in strategy that resulted in decreased sharpshooting efficiency (~15% decrease in the total number of deer culled). This was particularly impactful given the limited number of days we had access to U of M property.

As expected, sites that were very successful during Year 1 sharpshooting operations showed decreased productivity (e.g., Nichols Arboretum and BHNA). At Nichols Arboretum the number of deer engaged during Year 2 was half of Year 1. Surveillance of the active bait sites within the Arboretum confirmed that all untagged individuals present on camera were removed during Year 2 sharpshooting operations.



The removal of the 450' firearm discharge requirement allowed for the placement of a more advantageous sharpshooting location within the Huron Parkway Nature Area (HPNA). The shift in site location allowed us to triple the harvest when compared to Year 1 and resulted in one of our most successful sharpshooting sites in Year 2. In addition, numerous deer were observed moving between the SSA and HPNA, and most of the untagged females and antlered males were culled. Moreover, antlered males and tagged females that frequented bait sites in the eastern edge of the SSA and HPNA are distinct from the deer that use the Arboretum. None of these males or tagged females were observed in the area north of Geddes Avenue in the SSA. Maintaining a sharpshooting site in the HPNA will be critical to minimize immigration into the eastern boundary of the SSA.

New sites in the north central and northeast regions of the city showed minimal harvest numbers as a result of naturally occurring low deer densities. Camera data, ground snow tracking, and helicopter survey observations supported this outcome. Sharpshooting activities were locally successful in the Ward 3 where access was granted, but overall impact on the deer population in the Ward was low. No sharpshooting efforts were undertaken in Wards 4 or 5.

### **Combined Method**

There were very few deer detected during the snow count (and accounting for deer harvested post-survey) proximate to any of the sterilization study areas. There were no deer remaining in the Arboretum and very few in the HPNA (SSA), Leslie Golf Course and Cedar Bend (NSA), as well as Narrow Gauge and Concordia University (ESA). This should greatly minimize any influx of untagged females into the study areas before Year 3 efforts begin.

There were no untagged adult females detected at the Traver Road site, in the NSA northwest of Plymouth Road, which is consistent with what we noted last year. The tagged females from Year 1 were present with yearling females that were not sterilized as fawns during Year 1. This resulted in a total of four yearling females present in this area. One of these individuals was successfully sterilized. Another of the untagged yearlings was culled from the Leslie Golf Course in the presence of a tagged adult female. Compared to the SSA, the NSA presents increased difficulty for darting operations as the deer tend to spend less time exposed in the neighborhoods and more time in areas only accessible by seated darting efforts. This results in a finite number of attempts to engage these deer before they become smart enough to avoid darting operations. Year 2 efforts have shown that some NSA deer will move into areas where they can be engaged by sharpshooting activities. The option to use combined methods reinforces the value of having both lethal and non-lethal approaches in some areas of the City.





Cedar Bend Nature Area was not utilized during the sharpshooting efforts for Year 2. One adult female was successfully sterilized in the area during the non-lethal effort. This area presents significant challenges for darting operations as we currently have access to a single site within this portion of the NSA. This will make it very difficult to address all of the remaining untagged females using only non-lethal means in the future. After two seated darting attempts, the deer began to adjust their behavioral patterns to avoid darting operations. Based on camera data during the non-lethal efforts and the helicopter survey, a number of deer are present on the edge of the CBNA outside of the NSA on the University of Michigan campus where sharpshooting activities have been denied. It is likely these deer are overlapping the CBNA. It will be possible to continue darting operations in the CBNA. However, it would be prudent to revisit using the CBNA as a sharpshooting site in the future to continue to complement the sterilization efforts.

### **Population Estimates - Helicopter Count and Camera Survey**

There were ~24% fewer deer (289 versus 220), within the municipal limits than last year's helicopter survey, and 39 additional deer were culled after the survey was completed. Total helicopter counts declined by only ~12% (315 versus 276), reflecting little change (actually a slight increase) in deer abundance outside the City limits in the areas sampled, but significant reductions within. Although not considered a problem at this time, deer abundance is increasing in Wards 3 and 4.

We used a different detection rate, and associated correction factor, this year outside of the sterilization study areas. The detection rate in the sterilization study areas was similar to last year (~30%; 19 deer counted and 63 deer present), resulting in consistently poor detection rates in the moderate density neighborhoods. In the study areas' type of "habitat," deer bed during the day among the homes, versus using woodlands to bed (where they are easier to detect) proximate to more densely developed neighborhoods in the rest of Wards 1 and 2 NE of the river. In 2017, we used the detection rate (35-60%) to generate a correction factor in areas that we perceived to have similar development and habitat type as the study areas. We now believe the correction factor was too high (estimated detection rate was too low, resulting in a significant over estimation of the population), based on data collected from trail cameras used during sharpshooting operations and track counts in fresh snow. The areas that we extrapolated the detection rates to are more densely housed (smaller lot sizes), and the deer appeared to bed in the open woodlots adjacent, not amongst the houses, where they were more easily seen from the helicopter. For this year's survey, we used an 80% detection rate to generate the correction factor for areas outside the sterilization study areas.



The combined camera survey estimates projected the population in the SSA to be 44 deer/mile<sup>2</sup> deer on average. Seven adult males counted in the camera survey were known to be removed during sharpshooting efforts. This leaves an estimated population in the SSA of 39 deer/mile<sup>2</sup> (16% antlered males, 73% adult females, 11% fawns). This represents a 33% decrease since 2017 (59 deer/mile<sup>2</sup> to 39 deer/mile<sup>2</sup>). Ninety-six percent of adult females were sterilized in the SSA; all that remains are two adult females and two female fawns. There have been eight mortalities between the NSA and SSA (7 DVCs and 1 (#32) euthanized after last field season), and one missing (#18 was missing from the camera survey for two years and not observed in the field).

In summary, there are ~19.6 deer/mile<sup>2</sup> on average (216 deer in ~11.1 mile<sup>2</sup>) with obvious concentrations in the Skyline School neighborhood (i.e., “NW neighborhood” in Figure 3) and the center of the U of M Campus (between Plymouth Road, Huron Parkway, Green Road, and Baxter Road - 18 deer counted). The higher densities in the SSA also increased the overall deer density.

### **Fawn Recruitment**

The doe:fawn ratio in the SSA was ~0.16 (~51 adult females – includes 49 tagged adult females, two known untagged and ~eight fawns) reflecting a marked reduction over the 2017 recruitment ratio of 1.1. We would expect to capture 8 - 12 females next year between the three sterilization study areas based on the number of untagged females (n = 5) that will reproduce, and the approximate number of untreated female fawns (~2), while incorporating the anticipated mortality over the next year.

Given the estimated number of untreated adult females (~40% of ~150 [outside of sterilization areas] = ~60 fertile adult females; see Table 4, and DeNicola et al. 2008), and a recruitment rate of 1.1 (doe:fawn from 2017), we expect an additional ~70 fawns to be recruited/added to the population next fall in Wards 1 and 2. Nearly half of these will be born in the NW neighborhood, further exacerbating the problem in that area of the City.

### **Future Management Considerations**

To best determine how many deer to allocate to lethal versus non-lethal methods in the future we will need to know the relative acceptance of residents in the various Wards and how they feel about their local deer populations. These data need to be coupled with the desired deer densities for forest health in the Nature Areas. If access is not granted by the University to allow sharpshooting efforts in the northern portion of North Campus, this might be an area that should be considered for sterilization methods. The other area that is most problematic is



the area adjacent to Skyline High School in the NW neighborhoods. Maintenance level sterilization of untagged females in the SSA and NSA, and possible immigrants, also should be considered. We should be at maintenance level densities in the rest of the Wards 1 and 2, with pockets of deer in Wards 3 and 4 that should be monitored, and/or acted upon, before they become a problem.

## **ACKNOWLEDGEMENTS**

First and foremost, this project would not have been possible without the support of the Ann Arbor City Council. In addition, we are grateful to the following individuals and organizations that provided critical support prior to and during the research project:

- City of Ann Arbor officials: Tom Crawford, Derek Delacourt, Doug Forsyth, as well as Dave Borneman and his staff
- Ann Arbor Police Chief Jim Baird and staff
- MIDNR, especially Chad Stewart and Stephen Beyer
- University of Michigan
- Robert McGee for coordinating volunteer activities and logistical support
- Dr. Katie Dyer and Matt Dyer for providing surgical support and veterinary logistics
- Kurt Sonen for assistance during the sharpshooting phase of the project



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## APPENDIX A

Deer capture data 2 - 6 January 2018 from Ann Arbor, MI.

Date	Ear Tag #	Ear Tag Color	VHF Frequency	Sex	Age	Area	Zone
1/2/18	56	White		Female	2.5	Heatherway	S
1/2/18	57	White		Female	1.5	Rock Creek	S
1/2/18	59	White		Female	3.5	Burson	S
1/3/18	55	White		Female	4.5	Penberton	E
1/3/18	61	White		Female	3.5	Geddes	S
1/3/18	62	White		Female	2.5	Geddes	S
1/3/18	3	Yellow		Male	0.5	Geddes	S
1/3/18	64	White		Female	2.5	Penberton	E
1/3/18	43	White	151.513	Female	3.5	Adare	S
1/4/18	58	White		Female	2.5	Arlington/Washtenaw	S
1/4/18	65	White		Female	2.5	Arlington/Washtenaw	S
1/4/18	14	Yellow		Male	0.5	Kenilworth	S
1/4/18	70	White		Female	1.5	Trevar	N
1/4/18	66	White		Female	4.5	Penberton	E
1/4/18	63	White		Female	5.5	Folkstone	E
1/4/18	67	White		Female	2.5	Penberton	E
1/5/18	68	White		Female	3.5	Cedar Bend	N
1/5/18	60	White		Female	6.5	Devonshire	S
1/5/18	73	White		Female	6.5+	Tibbets	N
1/5/18	74	White		Female	0.5	Tibbets	N
1/6/18	69	White		Female	0.5	Adare	S
1/6/18	16	Yellow		Male	0.5	Washtenaw	S



## APPENDIX B

Deer harvest data 8 - 31 January 2018 from Ann Arbor, MI.

Date	Tag Number	Sex	Age	Location
1/8/2018	581456	M	FAWN	LESLIE PARK GOLF COURSE
1/8/2018	581461	M	FAWN	LESLIEPARK GOLF COURSE
1/8/2018	581463	F	ADULT	LESLIE PARK GOLF COURSE
1/8/2018	581491	M	FAWN	BIRD HILLS
1/8/2018	581493	F	ADULT	BIRD HILLS
1/8/2018	581500	F	FAWN	BIRD HILLS
1/9/2018	581480	F	ADULT	PLATT ROAD
1/9/2018	581481	F	ADULT	PLATT ROAD
1/9/2018	581440	M	ADULT	NARROW GAUGE
1/10/2018	581448	M	ADULT	UM GLAZIER
1/10/2018	581449	M	ADULT	UM GLAZIER
1/10/2018	581462	M	FAWN	UM GLAZIER
1/10/2018	581479	F	ADULT	USGS
1/10/2018	581477	F	ADULT	USGS
1/10/2018	581474	M	FAWN	USGS
1/10/2018	581476	M	ADULT	USGS
1/10/2018	581478	F	ADULT	USGS
1/10/2018	581483	F	ADULT	USGS
1/10/2018	581475	F	FAWN	USGS
1/10/2018	581492	F	ADULT	NEWPORT
1/10/2018	581494	F	ADULT	NEWPORT
1/10/2018	581495	M	ADULT	NEWPORT
1/10/2018	581437	F	ADULT	NEWPORT





1/10/2018	581441	F	FAWN	NEWPORT
1/10/2018	581436	F	ADULT	NEWPORT
1/10/2018	581486	F	ADULT	NEWPORT
1/10/2018	581490	M	FAWN	NEWPORT
1/11/2018	581487	M	ADULT	MU ARBORETUM
1/11/2018	581497	M	FAWN	MU ARBORETUM
1/11/2018	581499	F	ADULT	MU ARBORETUM
1/11/2018	581498	F	ADULT	MU ARBORETUM
1/11/2018	581496	M	ADULT	MU ARBORETUM
1/11/2018	581488	F	ADULT	MU ARBORETUM
1/13/2018	581439	M	FAWN	CONCORDIA
1/13/2018	581438	F	FAWN	CONCORDIA
1/13/2018	581453	F	ADULT	CONCORDIA
1/13/2018	581455	M	ADULT	CONCORDIA
1/13/2018	581443	M	ADULT	CONCORDIA
1/13/2018	581427	F	ADULT	UM MED
1/13/2018	581489	F	ADULT	UM MED
1/13/2018	581433	M	ADULT	UM MED
1/13/2018	581435	F	ADULT	UM MED
1/13/2018	581425	F	ADULT	UM MED
1/13/2018	581430	M	ADULT	UM MED
1/13/2018	581423	F	ADULT	UM MED
1/13/2018	581434	F	FAWN	UM MED
1/14/2018	581442	F	FAWN	USGS
1/14/2018	581417	F	FAWN	UM 2 TRACK
1/14/2018	581454	F	ADULT	HURON HILLS



1/14/2018	581421	F	ADULT	HURON HILLS
1/14/2018	581414	M	ADULT	HURON HILLS
1/14/2018	581451	F	ADULT	HURON HILLS
1/14/2018	581415	F	FAWN	HURON HILLS
1/16/2018	581404	F	ADULT	NEWPORT
1/16/2018	581402	F	FAWN	NEWPORT
1/16/2018	581416	F	ADULT	NEWPORT
1/16/2018	581422	F	ADULT	NEWPORT
1/16/2018	581401	F	ADULT	NEWPORT
1/16/2018	581420	F	FAWN	NEWPORT
1/16/2018	581445	F	ADULT	GLAIZER HILL
1/16/2018	581471	F	ADULT	GLAIZER HILL
1/16/2018	581447	F	ADULT	GLAIZER HILL
1/17/2018	581424	M	FAWN	CONCORDIA
1/17/2018	581432	M	ADULT	CONCORDIA
1/17/2018	581403	F	ADULT	CONCORDIA
1/17/2018	581428	F	ADULT	CONCORDIA
1/17/2018	581429	F	ADULT	CONCORDIA
1/17/2018	581419	M	FAWN	CONCORDIA
1/17/2018	581446	M	FAWN	CONCORDIA
1/17/2018	581472	F	ADULT	TRAVER
1/17/2018	581473	M	FAWN	TRAVER
1/18/2018	581470	F	ADULT	BIRD HILLS NORTH
1/18/2018	581418	F	ADULT	BIRD HILLS NORTH
1/18/2018	581413	F	ADULT	BIRD HILLS NORTH
1/18/2018	581452	M	ADULT	HURON PARKWAY



1/18/2018	581469	M	ADULT	HURON PARKWAY
1/19/2018	581465	M	ADULT	MU ARBORETUM
1/19/2018	581467	M	ADULT	MU ARBORETUM
1/19/2018	581468	M	ADULT	MU ARBORETUM
1/19/2018	581484	F	ADULT	BARTON/FOSTER
1/19/2018	581406	M	FAWN	BARTON/FOSTER
1/20/2018	581444	F	ADULT	UM MED
1/20/2018	581464	F	ADULT	USGS
1/20/2018	581466	F	FAWN	USGS
1/23/2018	581460	F	ADULT	BIRD HILLS SOUTH
1/23/2018	581450	F	ADULT	BIRD HILLS SOUTH
1/28/2018	581012	F	ADULT	BUTTERNUT
1/28/2018	581407	F	ADULT	BUTTERNUT
1/28/2018	581011	F	ADULT	BUTTERNUT
1/28/2018	581482	M	FAWN	BUTTERNUT
1/28/2018	581014	M	FAWN	BUTTERNUT
1/28/2018	581459	M	FAWN	BUTTERNUT
1/28/2018	581485	M	FAWN	LESLIE WOODS
1/29/2018	581016	F	ADULT	CONCORDIA
1/30/2018	581426	M (shed)	ADULT	FOXFIRE
1/30/2018	581458	M (shed)	ADULT	FOXFIRE
1/30/2018	581001	F	ADULT	HURON HILLS
1/30/2018	581002	F	FAWN	HURON HILLS
1/30/2018	581003	F	ADULT	HURON HILLS
1/30/2018	581004	F	FAWN	HURON HILLS
1/30/2018	581405	F	FAWN	HURON HILLS
1/30/2018	581006	F	ADULT	HURON HILLS



1/30/2018	581013	F	FAWN	HURON HILLS
1/30/2018	581431	F	ADULT	HURON HILLS
1/31/2018	581457	F	ADULT	OAKWOODS
1/31/2018	581015	F	ADULT	OAKWOODS
1/31/2018	581005	M (shed)	ADULT	NARROW GAUGE
1/31/2018	581008	M	ADULT	NARROW GAUGE
1/31/2018	581009	M	FAWN	NARROW GAUGE
1/31/2018	581010	M	ADULT	NARROW GAUGE
1/31/2018	581017	M	FAWN	NARROW GAUGE
1/31/2018	581018	F	ADULT	NARROW GAUGE
1/31/2018	581019	F	ADULT	NARROW GAUGE
1/31/2018	581020	F	ADULT	NARROW GAUGE
1/31/2018	581021	F	ADULT	NARROW GAUGE

## 2018 Deer Management Plan - Preliminary Results

**PROBLEM:**

- Deer browsing is adversely impacting beyond the tolerance level of a portion of the City’s residents, the bio-diversity and sustainability of plants/animals/insects in the City’s natural areas.
- Deer browsing is adversely impacting beyond the tolerance level of a portion of the City’s residents, the residential and commercial gardens/ landscaping on private land.
- The number of deer/vehicle accidents averaged 62 over the past five years versus 41 over the five years before that.
- A segment of the City’s residents has a higher tolerance for deer, views them in a positive light, and is advocating for a change in the deer management program that includes non-lethal methods, education, and/or no action all.

<u>MEASURES OF SUCCESS</u>	<u>STATUS</u>
<b>Long-term Objectives:</b>	
<ul style="list-style-type: none"> <li>• Number of firearm related injuries associated with the deer management program is 0.</li> </ul>	0
<ul style="list-style-type: none"> <li>• Total number of deer/vehicle crashes reduced to 40 per year, and percent of vehicle crashes involving deer reported in the legal boundaries of the City of Ann Arbor reduced to 1.3%, assuming no major changes in total vehicle crashes.</li> </ul>	Published in June/July
<ul style="list-style-type: none"> <li>• Reduce deer browse damage in the City’s natural areas to a sustainable range of 15% to 30%, as measured by NatureWrite’s field study. This measure will be regularly re-visited to reflect the latest information available.</li> </ul>	Results available in May
<ul style="list-style-type: none"> <li>• Maintain community-based education program about the role of deer in the local ecology and identify options for residents to manage potential deer impacts on their private property.</li> </ul>	Initiated and growing
<ul style="list-style-type: none"> <li>• Community acceptance of herd impact - when 75% of surveyed residents in a Ward respond that damage to their landscape or garden plants is at an acceptable level on private lands. Recognizing there will be variability of this measure over time, a trend towards 75% is desired.</li> </ul>	Results available in May
<ul style="list-style-type: none"> <li>• Community acceptance of deer management program - when 75% of surveyed residents in a Ward respond that the City's strategy of managing the deer population is acceptable. Recognizing there will be variability of this measure over time, a trend towards 75% is desired.</li> </ul>	Results available in May

**Sterilization Program:**

<ul style="list-style-type: none"> <li>Obtain an amended permit from the Michigan Department of Natural Resources (MDNR) for a deer sterilization program.</li> </ul>	Obtained
<ul style="list-style-type: none"> <li>Sterilization of at least 98% of the female deer in the original research areas 1 and 2.</li> </ul>	Area 1: >96%
<ul style="list-style-type: none"> <li>Sterilize at least 95 percent of the female deer in a new third zone, such that the cumulative sterilizations for all three zones are not more than 80.</li> </ul>	Area 2: 70% (3 does) Area 3: Can't be determined until next year.
<ul style="list-style-type: none"> <li>Mortality rate associated with sterilization less than 2 percent.</li> </ul>	0%
<ul style="list-style-type: none"> <li>Investigate with University of Michigan if there are appropriate locations for sterilization.</li> </ul>	None for 2018
<ul style="list-style-type: none"> <li>Obtain a written update on the scientific results to-date on the sterilization efforts.</li> </ul>	Report Received

**Lethal Program:**

<ul style="list-style-type: none"> <li>Number of firearm related injuries associated with cull activities is 0.</li> </ul>	0
<ul style="list-style-type: none"> <li>Remove 250 deer.</li> </ul>	115
<ul style="list-style-type: none"> <li>Level of public park closures is acceptable to at least 75 percent of surveyed residents.</li> </ul>	Results May 31
<ul style="list-style-type: none"> <li>Coordinate with University of Michigan to increase the number of available locations for the deer management program.</li> </ul>	Achieved

**Education:**

<ul style="list-style-type: none"> <li>Review the city's "Fencing" ordinance and existing deer signage locations. Recommend and implement changes and improvements.</li> </ul>	Signs Phase I Completed. Fencing on hold.
<ul style="list-style-type: none"> <li>Develop and publish an expanded deer education component to the city's deer management website, including a deer-resistant gardening campaign.</li> </ul>	Completed
<ul style="list-style-type: none"> <li>Develop an interactive information/mapping tool.</li> </ul>	Completed
<ul style="list-style-type: none"> <li>Create and hold a public forum designed to address questions related to the city's deer management program.</li> </ul>	Considered for Spring 2018
<ul style="list-style-type: none"> <li>Establish an on-going education program.</li> </ul>	See above actions.