Appendix A: Survey Results

MILL CREEK METROPARKS

Aerial Infrared Deer Survey Report

Mill Creek MetroParks
Mahoning County, OH

Dates of aerial scans:
January 21/22 and 26/27, 2022

Introduction and Background:

Aerial infrared wildlife scans are widely regarded as the most accurate way to determine animal populations and distribution.

Infrared sensors are used to detect the body heat produced by large animals, such as deer, which is greater than the surface temperatures of their surroundings.

To minimize the effect of solar heating on the surrounding area, it is most effective to conduct an infrared survey after sunset.

In order to be able to see as much as possible, infrared wildlife scans must be done after the leaves have fallen from the trees in autumn and before the trees bud out again in the spring.

Furthermore, the winter months are preferable for conducting infrared scans as there will be a bigger temperature difference between the animals and their surroundings. Snow cover is also beneficial.

Methods:

Our infrared scan was done utilizing one of FLIR's latest and most advanced infrared cameras which has a resolution that is currently among the highest available in commercial and scientific infrared cameras.

The infrared scan was done via airplane flying at a constant altitude. Due to the varying topography of the area, the altitude above the ground varied between approximately 1,000 feet and 1,200 feet.

Fifteen (15) parks were scanned per outlines provided by the client. The total area of the parks surveyed was approximately 4,859 acres, or 7.6 square miles. The total area surveyed, including perimeter buffers (300'-400') and internal areas that were not actually part of the parks was over 8,900 acres, or 13.9 square miles.

Methods (cont'd):

The sites were irregularly shaped and individual flight plans were created to ensure complete coverage of every park, including an approximately 300'-400' buffer zone around each park.

The "central area" of the park system, consisting of Mill Creek Park, Hitchcock Woods, Huntington Woods, Mill Creek Wildlife Preserve, and Collier Preserve, were all flown together as one big area on the first night of the survey (January 21/22, 2022).

The parks to the east of the central area (McGuffey Wildlife Preserve, Yellow Creek, Springfield Forest, and Cranberry Run Headwaters) and to the west of the central area (Vickers Nature Preserve, Sebring Woods, Egypt Swamp Preserve, Sawmill Creek, Metro Parks Farm, and Hawkins Marsh), were flown individually on the second night of the survey (January 26/27).

Flight line headings (directions) for each work area were chosen based on the highest efficiency for each site. Flight lines were spaced approximately 375 feet apart. This allowed for approximately 30% overlap in the coverage from one line to the next to ensure that there were no gaps in the coverage due to wind, turbulence, or human error.

Radiometric sequences (thermal infrared "videos") were recorded continuously for each flight line at a frame rate of at least 15 frames per second. The camera was pointed straight down through an opening in the floor of the airplane. This permitted the entire survey area to be seen, unobstructed, at slightly forward and slightly backward angles (as the lens field of view is approximately 25°) in addition to being seen straight down. Analyzing the thermal signatures in multiple frames covering the entire field of view of the lens helps to differentiate deer from other objects and allows for a higher likelihood of identifying thermal signatures consistent with the presence of deer in and around large trees and in densely wooded areas.

Methods (cont'd):

Each sequence was analyzed frame-by-frame. Individual frames were thermally tuned and analyzed by a certified thermographer to identify thermal signatures consistent with the presence of deer. One hundred, fourteen (114) sequences were recorded and over 105,000 individual frames were analyzed in order to prepare this report.

Many different frames are analyzed when determining whether or not a particular thermal signature is caused by a deer. Furthermore, each frame was thermally tuned in many different ways to help differentiate a deer's signature from that of another object.

Adjacent sequences were analyzed to avoid duplicating deer counts in areas of overlap. Although deer could possibly move far enough in the time between flight lines to be mistaken for unique signatures, the likelihood of that happening is low. Deer are most active at dusk and dawn, and the scans were done well after sunset to decrease the chances for that type of error.

During the analysis, the infrared images were also compared side-by-side to "Google® Earth" imagery in order to identify natural and man-made features that may produce infrared readings that could be confused with wildlife. Items that could produce strong thermal signatures include natural items such as standing water, ice, rocks, tree trunks, and even certain types of vegetation. Man-made objects that can appear as thermal anomalies include sewer drains, electrical transformers, manhole covers, lights, and structures.

General Notes and Disclaimers:

As stated earlier, infrared scans are widely considered to be the most accurate method for counting deer. The accuracy of infrared surveys is most often quoted to be "85% or better" when done in ideal conditions.

This accuracy is accepted even though most infrared surveys only scan part of a site and then extrapolate the data to come up with the count. Although that method may yield results that are "close enough" for some purposes, Above All – Ohio does not extrapolate data from partial scans. We scan the entire site and count every thermal signature that we see that is consistent with the presence of deer. We also plot the locations as accurately as possible on Google Earth so as to get an idea of the distribution of the herds in addition to the population count.

In ideal or nearly ideal conditions, our method could potentially provide greater accuracy than the accepted norm, but we can never claim 100% accuracy in "real world" conditions. Some reasons for this are:

(1) Wildlife moves. As stated previously, deer are crepuscular animals and are most active around dusk and dawn. We generally start our surveys at least two hours after sunset to allow the deer time to become less active. Still, deer may be on the move at any time of the night and could conceivably cover enough ground be mistaken for a unique animal.

(2) The infrared scans do not actually show "deer" – they show thermal patterns and any anomaly in the pattern must be analyzed to determine whether it is likely caused by the presence of a deer or something else. Whether or not a particular thermal anomaly is a deer or something else is always a judgement call. The survey and analysis are performed utilizing high quality equipment and powerful analytical software. However, due to the limits of technology and the conditions unique to any given location within the site, the thermographer must rely on his or her background, knowledge of wildlife, knowledge of infrared science, and past experience to make the call as to whether or not a particular thermal signature resulted from the presence of a deer or not.

General Notes and Disclaimers (cont'd):

(3) Some anomalies may be due to the presence of other large mammals – horses, livestock, humans, or even smaller animals such as coyote (in some situations). For purposes of this survey, it was assumed that all signatures consistent with the presence of deer were, in fact, deer. If it is known that a particular part of the surveyed area is regularly used for livestock grazing (for example), please let me know so I can reevaluate the area(s).

(4) Our infrared scan was planned and performed to the best of our ability and knowledge with consideration to infrared science, thermography, wildlife biology, weather conditions, site geography and topography, and other conditions *at the time the work was completed.* However, this report can only be considered accurate for the dates and times of the scan. The results presented herein will be different from those of any other survey (infrared or otherwise) that may have been done in the past or may be done in the future.

Survey Details and Condition Analysis:

Geographic Data:

The areas surveyed were in Mahoning County, Ohio.

The areas surveyed were irregularly shaped but consisted of approximately 4,859 total acres within fifteen (15) distinct parks. The total area surveyed of approximately 8,908 acres includes a buffer zone around each park, roughly 300'-400' wide.

Site Conditions:

Several areas of the parks were very densely wooded. Even without leaves on the trees, thermal signatures of the deer can be masked by tree branches in densely wooded areas and very difficult to pick out. However, it is worth noting that in such heavily wooded areas, ground vegetation (food) is scarce, so deer are less likely to be present there anyway.

It was estimated that there was about 6" of snow cover in all scanned areas on both nights of the scan. It was also very cold on both nights – temperatures were 10°F and below – for the duration of the scans both nights. Winds were light and humidity levels were neither unusually high nor low.

My overall assessment is that the site physical conditions was very good and that the overall weather conditions were nearly ideal both nights. Data quality was excellent both nights. My overall assessment of the survey conditions was excellent.

Due to the previously mentioned factors, we can never guarantee total accuracy in any survey. However, I feel that these results are comfortably within the generally accepted "normal" accuracy range of 85%.

Celestial Data:

Dates and times of survey:

(1) Approximately 8:45 PM EST January 21
to approximately 12:30 AM EST January 22

(2) Approximately 8:40 PM EST January 26
to approximately 1:10 AM EST January 27

Sunset times:

(1) Approximately 5:25 PM EST, January 21, 2022

(2) Approximately 5:32 PM EST, January 26, 2022

Weather Data:

Sky condition during survey:
Clear in the vicinity of the surveyed area for the entire duration of the survey, both nights.

Temperature:
At or below 10°F for the entire duration of the survey, both nights.

Winds at time of scan:
Less than 10 mph for the entire duration of the survey, both nights.

Snow cover:
Approximately 6” at all locations, both nights.

My overall assessment of the suitability of the environmental conditions for an infrared wildlife survey is that the conditions were nearly ideal, both nights.

Review of Acquired Data:

Flight conditions were excellent during the scan with minimal wind and turbulence, both nights.

All equipment functioned as expected.

Due to variations in elevation across the site, lack of thermal contrast in some areas, and the very narrow depth of field of the infrared camera, some portions of the data were not optimally focused. However, data from all flight lines was usable.

Overlap of flight lines was good and consistent and there were no gaps in coverage noted. At the time of scan, a few flight lines appeared to be spaced farther apart than normal due to wind drift and/or human error causing the plane to be slightly off course. In these instances, additional flight lines were flown to ensure there would be no gaps in coverage.

Resolution of the imagery was calculated to be between 8” and 9” per pixel in most areas. This resolution is more than adequate to detect thermal anomalies caused by the presence of deer.

My overall assessment of the data quality is that it was excellent.

Infrared Scan Results and Discussion:

A total of 3,613 thermal infrared signatures with properties consistent with the presence of deer were identified within the fifteen (15) parks that were surveyed.

Of those signatures, 2,935 were within the various park boundaries as we were provided. The remaining 678 signatures were outside, but generally within 300'-400' of a park boundary. Animals observed within the buffer zone likely reside mainly within the parks. (Note that some signatures were a little farther away than 400', but no signature was included in the count if it was more than 500' away.)

It should be noted that if a thermal signature was within one park's surveyed area as well as within the buffer zone of an adjacent park, the signature was only counted once (for the park it was within).

Two sets of calculations are included with the report. The first set's calculations are based strictly on the number of signatures observed within the park boundaries. The second set includes the buffer zone in the area calculations and the additional signatures observed within the buffer zone.

The second set of data which includes signatures in the buffer zone is likely to be the more accurate representation of the "true" density of the population.

On the strict counts, numbers will be skewed when the park area is small and the buffer zone adds considerable acreage (percentage-wise) to the scanned area (for example, Cranberry Run, and Egypt Swamp) or the park has irregular boundaries (such as Mill Creek). The numbers can be drastically skewed when both of these conditions exist (such as Yellow Creek).

The deer densities on the whole were much higher than I have personally seen in the past. Densities around 100-150 deer per square mile are more common than the 200-300 and even higher densities observed here.

Infrared Scan Results and Discussion (cont'd):

Because the densities observed were much higher than I expected, extra time was taken to review the data. Many signatures were spot checked and given a second look to see if there may be some other explanation for the anomaly. In other cases, entire flight lines were re-analyzed from scratch and compared to the original analysis.

After evaluating the environmental and site conditions, data quality, and performing the self-imposed crosscheck of the analysis, I have a high degree of confidence that our results are at least 85% accurate and are likely to be even more accurate.

The high densities of deer may be the result of such things as minimal or no population control efforts or culling programs in place for extended periods of time; habitat that can support a large herd of deer; lack of natural predators; and, in the case of the central area parks at least, an inability of the deer to migrate out of the area as their population grows. (The parks in the central area are surrounded by residential and commercial development leaving no easy way for the animals to migrate out of the area.)

High population densities can cause serious problems such as property damage in the form of automobile accidents; health issues such as malnourished deer becoming sick; and/or safety issues such as deer becoming aggressive as they compete for food. They can also cause problems that are merely a nuisance such as feeding off of and/or destroying residents' landscaping and decorative plants in order to survive.

Note that determining any specific problems due to overpopulation, determining the overall health of the herd, determining the health of the ecosystem of the parks, or making recommendations for controlling the deer population or correcting any perceived or identified problem is beyond my area of expertise and beyond the scope this report.

Infrared Scan Results and Discussion (cont'd):

It is therefore highly recommended to review the results of this survey with wildlife management experts and personnel that are familiar with the specific parks and the deer population therein before making any decisions regarding further action.

If there are any questions regarding the data, this report, or the survey in general, please do not hesitate to contact me.

List of files and images included in report:

(1) Count Summary showing number of thermal signatures identified on a per-park basis as well as some calculations on density and habitat.

(2) Count Ranges (based on estimated accuracy) and additional density/habitat calculations.

(3) Aerial photo maps showing the location of observed thermal signatures consistent with the presence of deer (aerial images used are Copyright Google® Earth) in each park.

(4) Sample infrared imagery showing thermal anomalies consistent with the presence of deer.

Additional file delivered:

Mill Creek MetroParks 2022 Deer Survey – Final.kmz: This file is a "Google® Earth" KMZ file showing the park boundaries as provided, the approximate survey area for each park (purple outlines), and the approximate observed locations of infrared signatures consistent with the presence of deer. This file can be opened and viewed within Google® Earth.

Each marker on the result maps and included in the KMZ file indicates the number of signatures detected at each location. The observed location of the signatures is at the pointed end of the marker. For groups of deer, the pointed end of the marker was placed approximately in the middle of the group.

In some areas, the markers could be placed very accurately. However, in heavily wooded areas or areas that have little or no distinguishing land features, the placement accuracy may be lower.

A marker with “no name” indicates that the signature was observed inside the park boundary. A marker named “x” means that it was observed outside the park, but within the buffer zone. A marker named “xx” means it was outside the park and more than 500’ away from a boundary. Markers named “xx” were NOT included in any park’s count.

Side note: The marker description (such as “151-617-325-240”) is only used internally during the analysis of the data. It is in, in effect, a serial number for that particular signature which allows us to quickly find it in the infrared data sequences if needed for further review. If there are two serial numbers in the description, the signature was observed in the overlap area of adjacent flight lines and deemed to be the same thermal signature or set of signatures.

Deer Count Summary - All Parks

	Park	Park Size (acres)	Park size (sq miles)	Thermal Signatures Observed within Park Boundaries: Count	Acres per Deer	Deer per Acre	Deer per Sq Mile	Acres Surveyed	Sq Miles Surveyed	Thermal Signatures Observed within Park Boundaries plus Signatures within ~300-400' buffer: Count	Acres per Deer	Deer per Acre	Deer per Sq Mile	Ratio of Surveyed Area to Park Size
Central	Mill Creek Park	1,626	2.54	903	1.80	0.56	355	3,491	5.45	1,034	3.38	0.30	190	**2.15**
Central	Hitchcock Woods	689	1.08	429	1.61	0.62	398	1,010	1.58	497	2.03	0.49	315	1.47
Central	Huntington Woods	383	0.60	354	1.08	0.92	592	571	0.89	361	1.58	0.63	405	1.49
Central	Mill Creek Wildlife Sanctuary	482	0.75	267	1.81	0.55	355	712	1.11	342	2.08	0.48	307	1.48
Central	Collier Preserve	303	0.47	124	2.44	0.41	262	450	0.70	151	2.98	0.34	215	1.49
East	McGuffey Wildlife Preserve	78	0.12	48	1.63	0.62	394	152	0.24	70	2.17	0.46	295	1.95
East	Yellow Creek	76	0.12	80	0.95	1.05	674	274	0.43	119	2.30	0.43	278	**3.61**
East	Springfield Forest	89	0.14	69	1.29	0.78	496	207	0.32	87	2.38	0.42	269	**2.33**
East	Cranberry Run Headwaters	27	0.04	19	1.42	0.70	450	89	0.14	26	3.42	0.29	187	**3.30**
West	Vickers Nature Preserve	262	0.41	116	2.26	0.44	283	411	0.64	184	2.23	0.45	287	1.57
West	Sebring Woods	39	0.06	37	1.05	0.95	607	87	0.14	49	1.78	0.56	360	**2.23**
West	Egypt Swamp Preserve	75	0.12	54	1.39	0.72	461	247	0.39	102	2.42	0.41	264	**3.29**
West	Sawmill Creek	167	0.26	141	1.18	0.84	540	265	0.41	214	1.24	0.81	517	1.59
West	MetroParks Farm	402	0.63	197	2.04	0.49	314	654	1.02	243	2.69	0.37	238	1.63
West	Hawkins Marsh	161	0.25	97	1.66	0.60	386	288	0.45	134	2.15	0.47	298	1.79
	Totals and Averages:	4,859	7.59	2,935	1.66	0.60	387	8,908	13.92	3,613	2.47	0.41	260	1.83

Deer Count Ranges by Park - CENTRAL

(estimated accuracy of survey: 85%)

Mill Creek Park

Park Area (1,626 acres)

	Low	**Count**	High
Count:	768	**903**	1,038
Acres per deer:	2.12	**1.80**	1.57
Deer per square mile:	302	**355**	409

Surveyed Area (3,491 acres)

	Low	**Count**	High
Count:	879	**1,034**	1,189
Acres per deer:	3.97	**3.38**	2.94
Deer per square mile:	161	**190**	218

Hitchcock Woods

Park Area (689 acres)

	Low	**Count**	High
Count:	365	**429**	493
Acres per deer:	1.89	**1.61**	1.40
Deer per square mile:	339	**398**	458

Surveyed Area (1,010 acres)

	Low	**Count**	High
Count:	422	**497**	572
Acres per deer:	2.39	**2.03**	1.77
Deer per square mile:	268	**315**	362

Huntington Woods

Park Area (383 acres)

	Low	**Count**	High
Count:	301	**354**	407
Acres per deer:	1.27	**1.08**	0.94
Deer per square mile:	503	**592**	680

Surveyed Area (571 acres)

	Low	**Count**	High
Count:	307	**361**	415
Acres per deer:	1.86	**1.58**	1.38
Deer per square mile:	344	**405**	465

Mill Creek Wildlife Sanctuary

Park Area (482 acres)

	Low	**Count**	High
Count:	227	**267**	307
Acres per deer:	2.12	**1.81**	1.57
Deer per square mile:	301	**355**	408

Surveyed Area (712 acres)

	Low	**Count**	High
Count:	291	**342**	393
Acres per deer:	2.45	**2.08**	1.81
Deer per square mile:	261	**307**	354

Collier Preserve

Park Area (303 acres)

	Low	**Count**	High
Count:	105	**124**	143
Acres per deer:	2.87	**2.44**	2.12
Deer per square mile:	223	**262**	301

Surveyed Area (450 acres)

	Low	**Count**	High
Count:	128	**151**	174
Acres per deer:	3.51	**2.98**	2.59
Deer per square mile:	183	**215**	247

Deer Count Ranges by Park - EAST

(estimated accuracy of survey: 85%)

McGuffey Wildlife Preserve

Park Area (78 acres)

	Low	**Count**	High
Count:	41	**48**	55
Acres per deer:	1.91	**1.63**	1.41
Deer per square mile:	335	**394**	453

Surveyed Area (152 acres)

	Low	**Count**	High
Count:	60	**70**	81
Acres per deer:	2.55	**2.17**	1.89
Deer per square mile:	251	**295**	339

Yellow Creek

Park Area (76 acres)

	Low	**Count**	High
Count:	68	**80**	92
Acres per deer:	1.12	**0.95**	0.83
Deer per square mile:	573	**674**	775

Surveyed Area (274 acres)

	Low	**Count**	High
Count:	101	**119**	137
Acres per deer:	2.71	**2.30**	2.00
Deer per square mile:	236	**278**	320

Springfield Forest

Park Area (89 acres)

	Low	**Count**	High
Count:	59	**69**	79
Acres per deer:	1.52	**1.29**	1.12
Deer per square mile:	422	**496**	571

Surveyed Area (207 acres)

	Low	**Count**	High
Count:	74	**87**	100
Acres per deer:	2.80	**2.38**	2.07
Deer per square mile:	229	**269**	309

Cranberry Run Headwaters

Park Area (27 acres)

	Low	**Count**	High
Count:	16	**19**	22
Acres per deer:	1.67	**1.42**	1.24
Deer per square mile:	383	**450**	518

Surveyed Area (89 acres)

	Low	**Count**	High
Count:	22	**26**	30
Acres per deer:	4.03	**3.42**	2.98
Deer per square mile:	159	**187**	215

Deer Count Ranges by Park - WEST

(estimated accuracy of survey: 85%)

Vickers Nature Preserve

	Park Area (262 acres)			Surveyed Area (411 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	99	**116**	133	156	**184**	212
Acres per deer:	2.66	**2.26**	1.96	2.63	**2.23**	1.94
Deer per square mile:	241	**283**	326	244	**287**	329

Sebring Woods

	Park Area (39 acres)			Surveyed Area (87 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	31	**37**	43	42	**49**	56
Acres per deer:	1.24	**1.05**	0.92	2.09	**1.78**	1.54
Deer per square mile:	516	**607**	698	306	**360**	415

Egypt Swamp Preserve

	Park Area (75 acres)			Surveyed Area (247 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	46	**54**	62	87	**102**	117
Acres per deer:	1.63	**1.39**	1.21	2.85	**2.42**	2.11
Deer per square mile:	392	**461**	530	225	**264**	304

Sawmill Creek

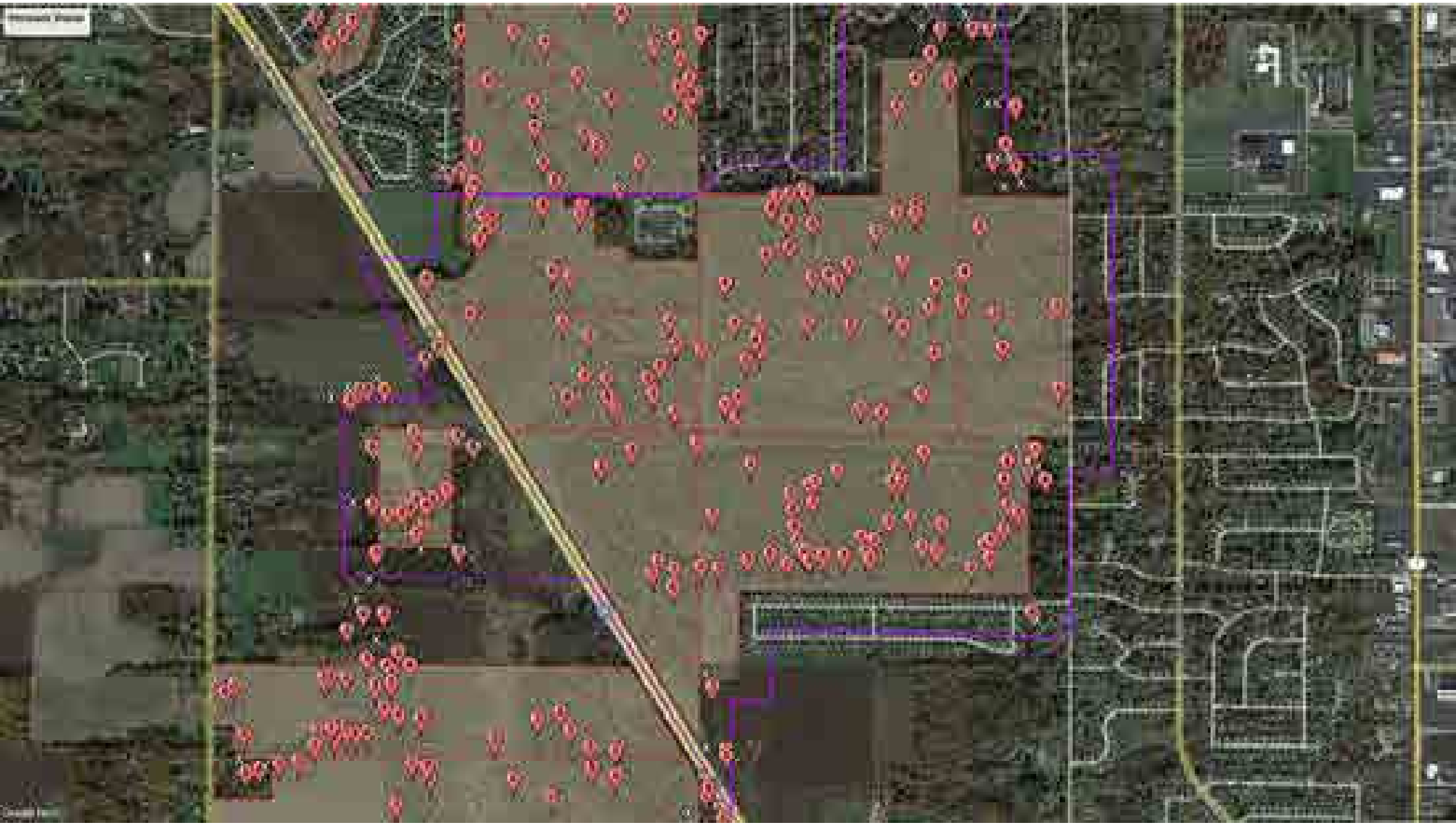
	Park Area (167 acres)			Surveyed Area (265 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	120	**141**	162	182	**214**	246
Acres per deer:	1.39	**1.18**	1.03	1.46	**1.24**	1.08
Deer per square mile:	459	**540**	621	439	**517**	594

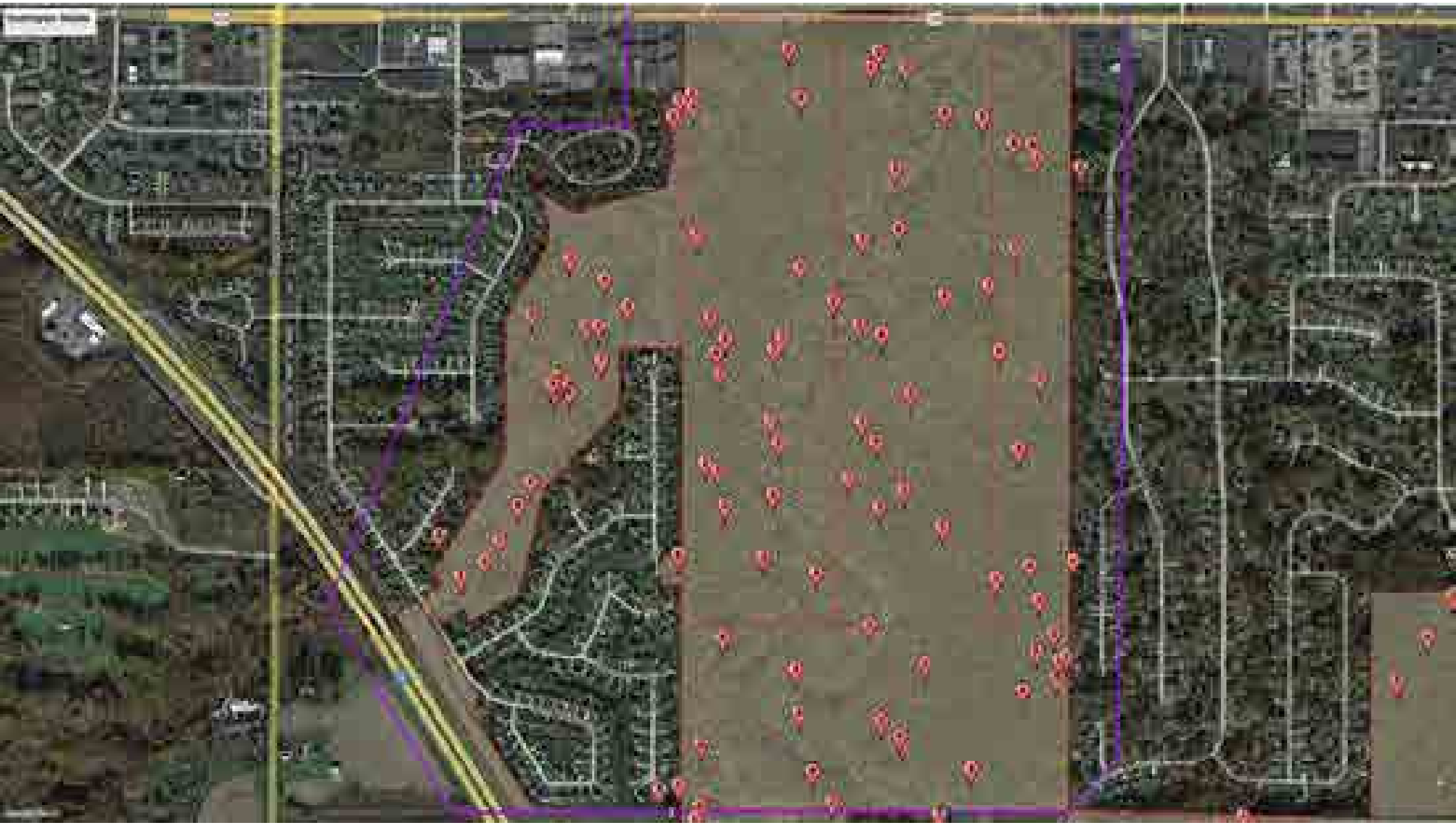
Metro Parks Farm

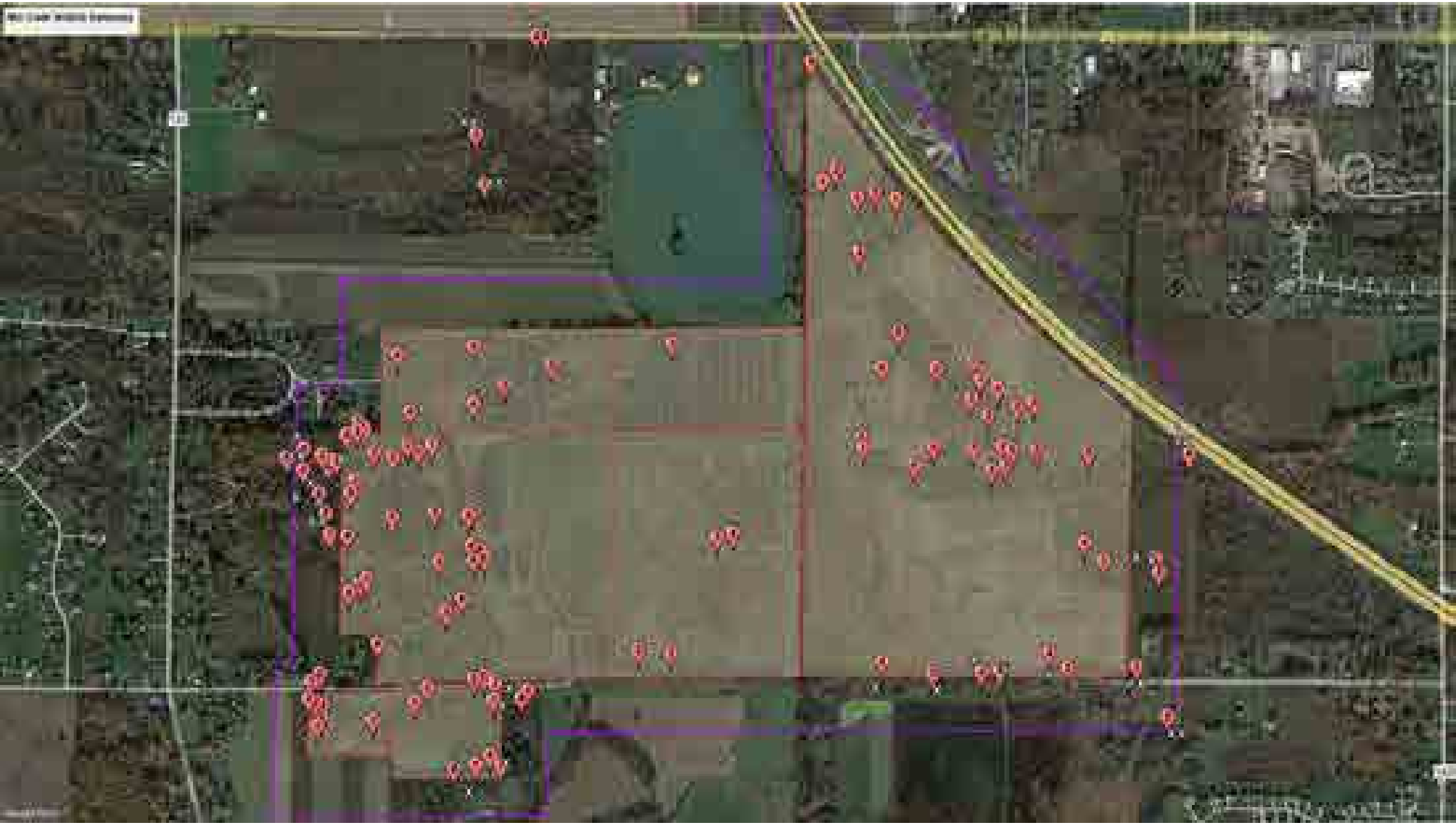
	Park Area (402 acres)			Surveyed Area (654 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	167	**197**	227	207	**243**	279
Acres per deer:	2.40	**2.04**	1.77	3.17	**2.69**	2.34
Deer per square mile:	267	**314**	361	202	**238**	273

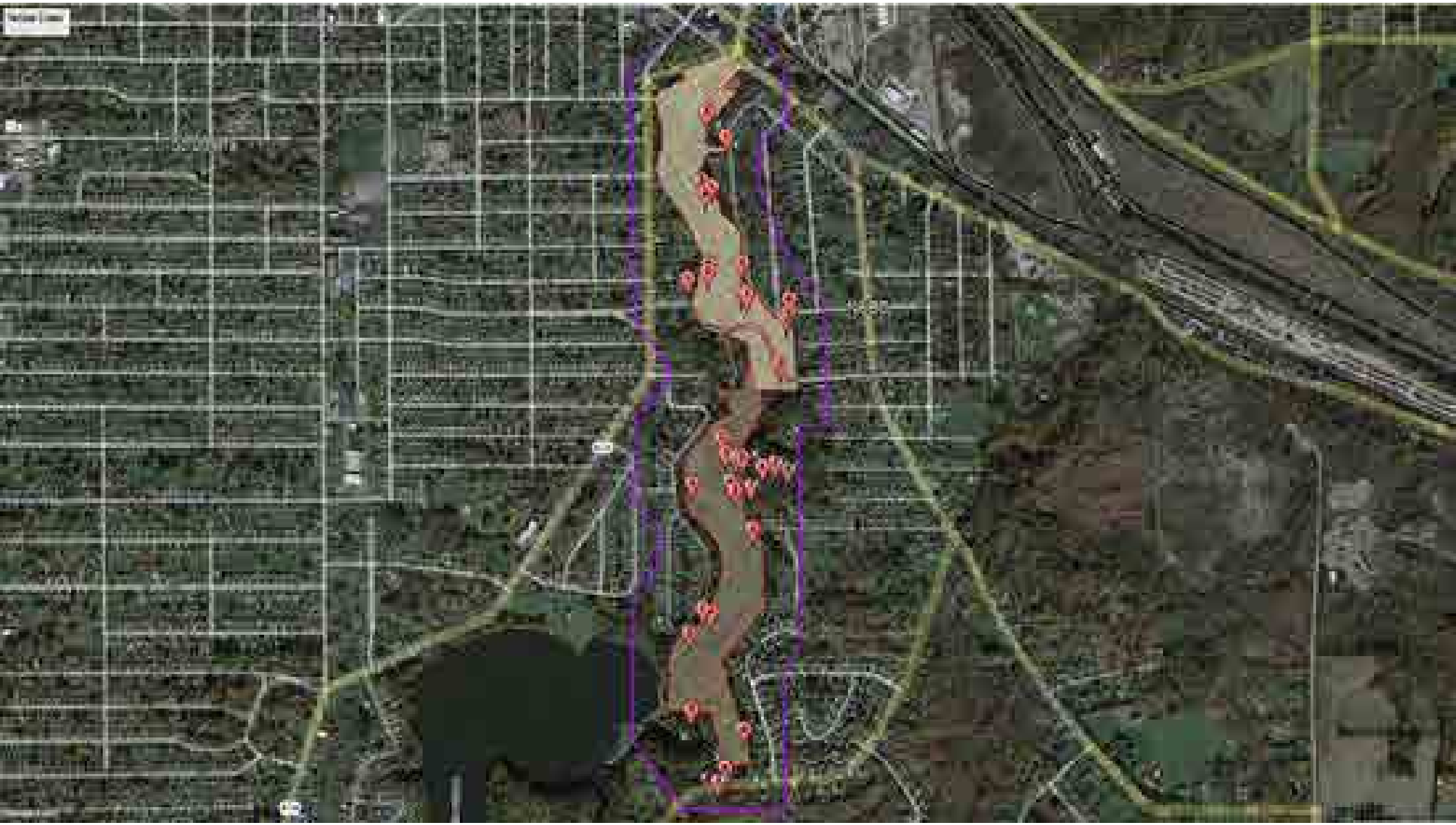
Hawkins Marsh

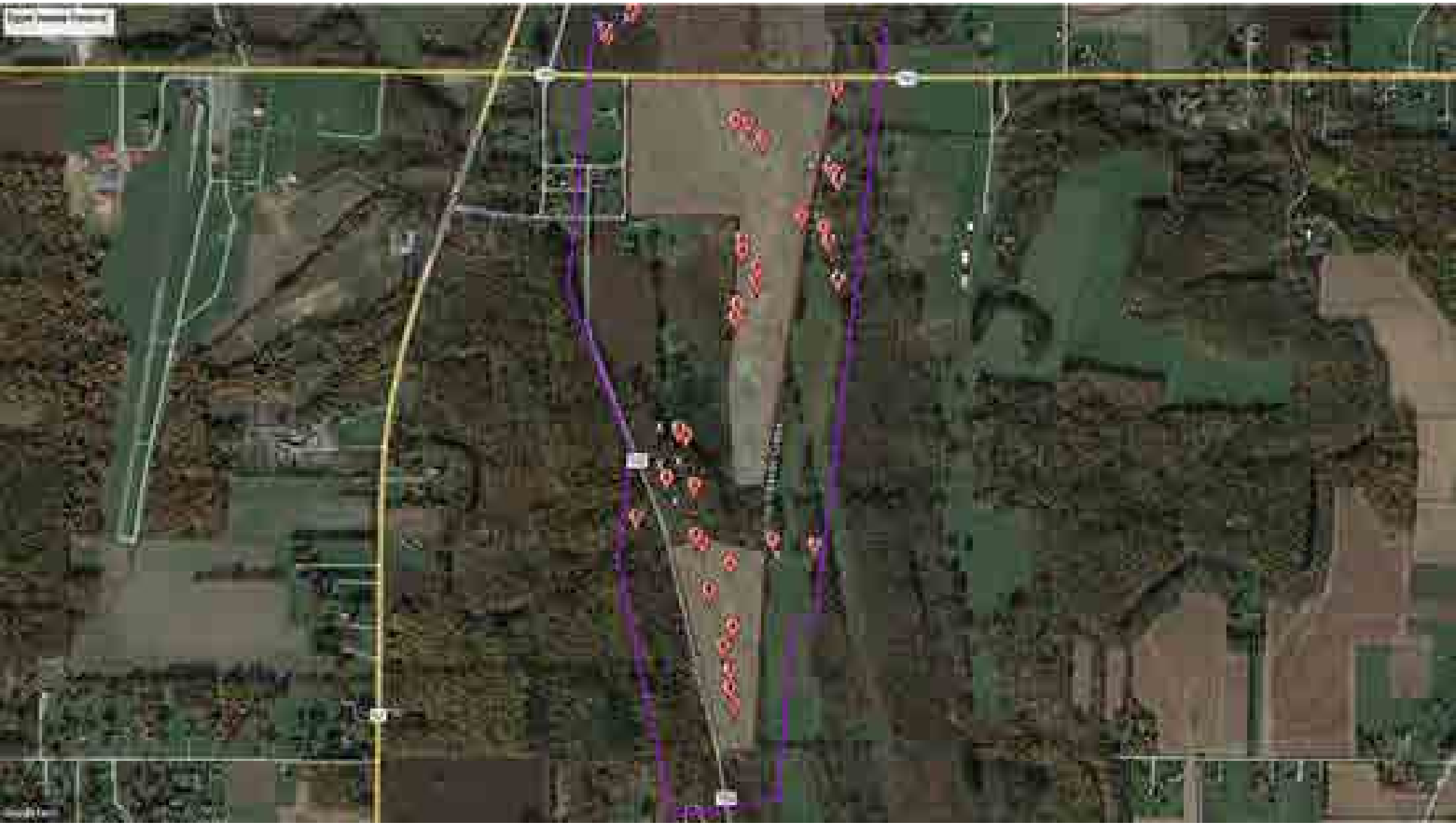
	Park Area (161 acres)			Surveyed Area (288 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	82	**97**	112	114	**134**	154
Acres per deer:	1.95	**1.66**	1.44	2.53	**2.15**	1.87
Deer per square mile:	328	**386**	443	253	**298**	342

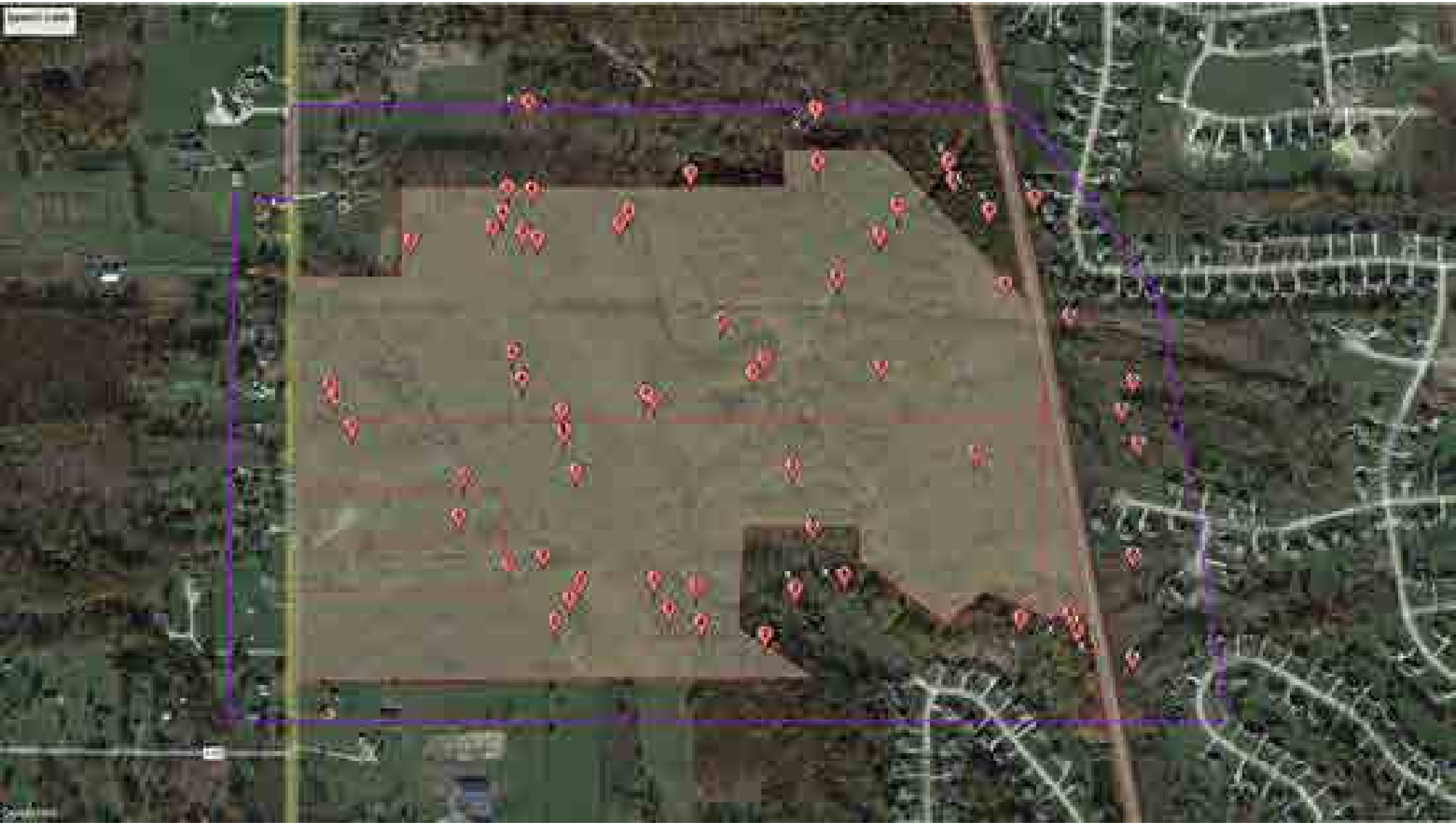








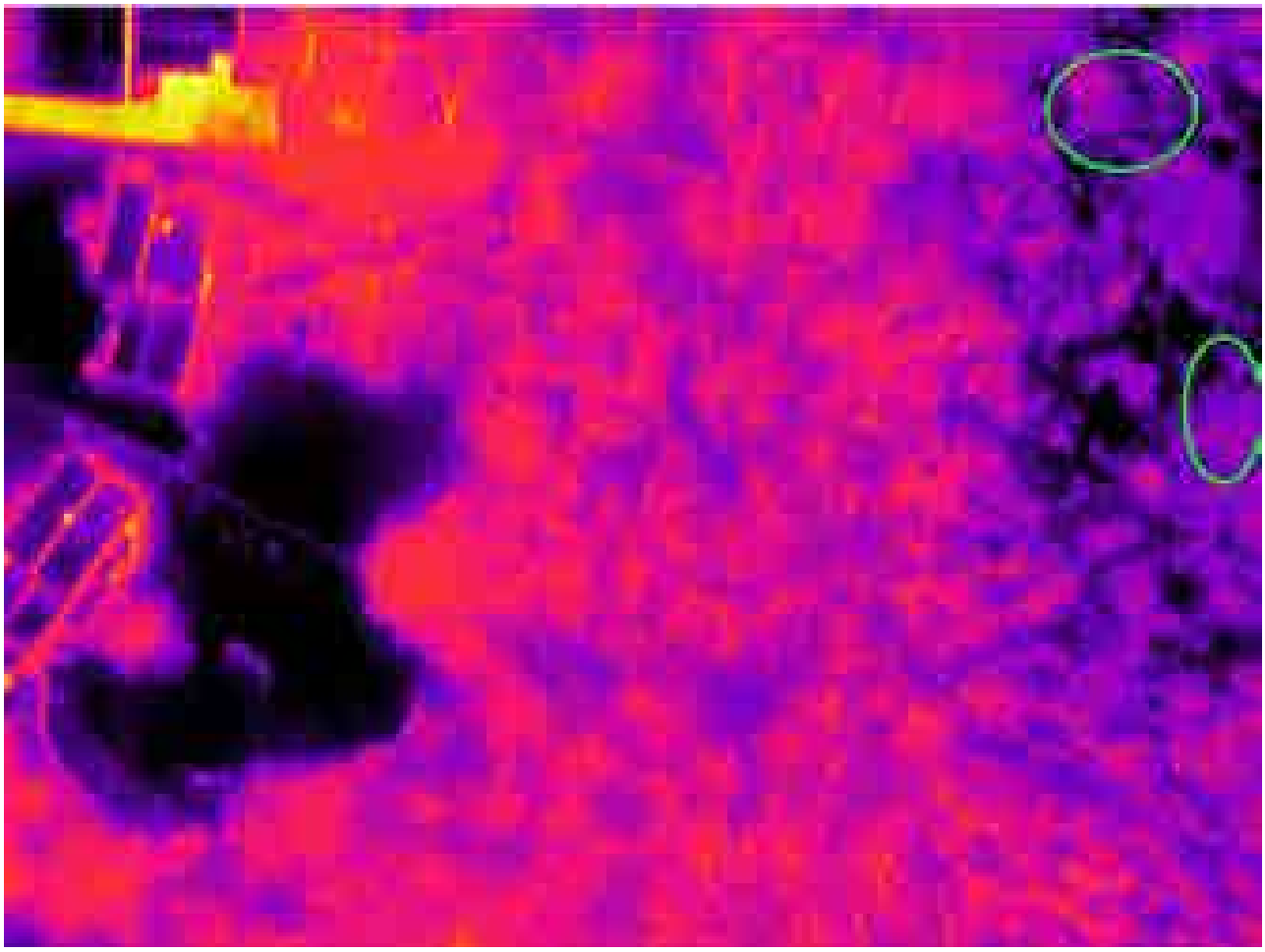


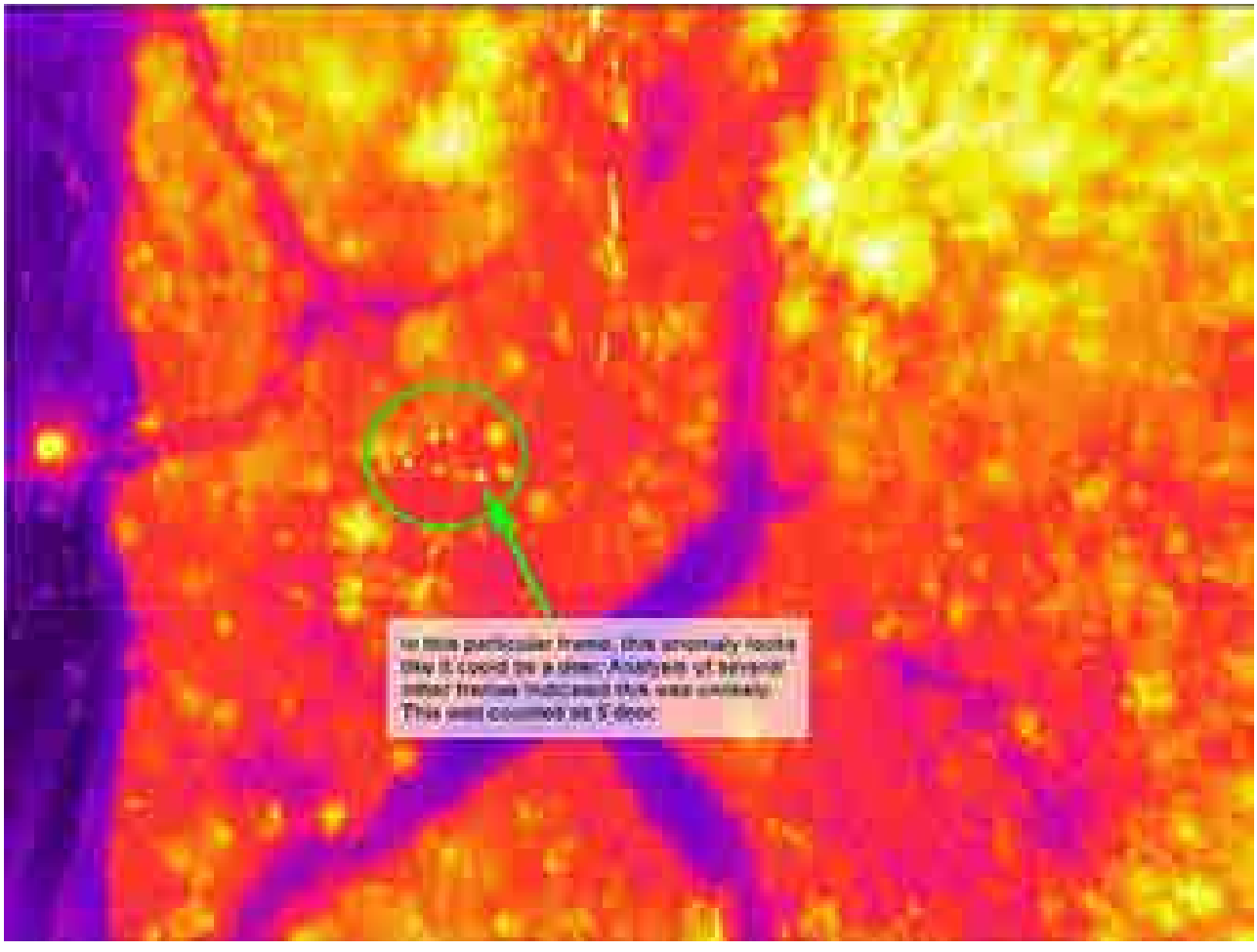


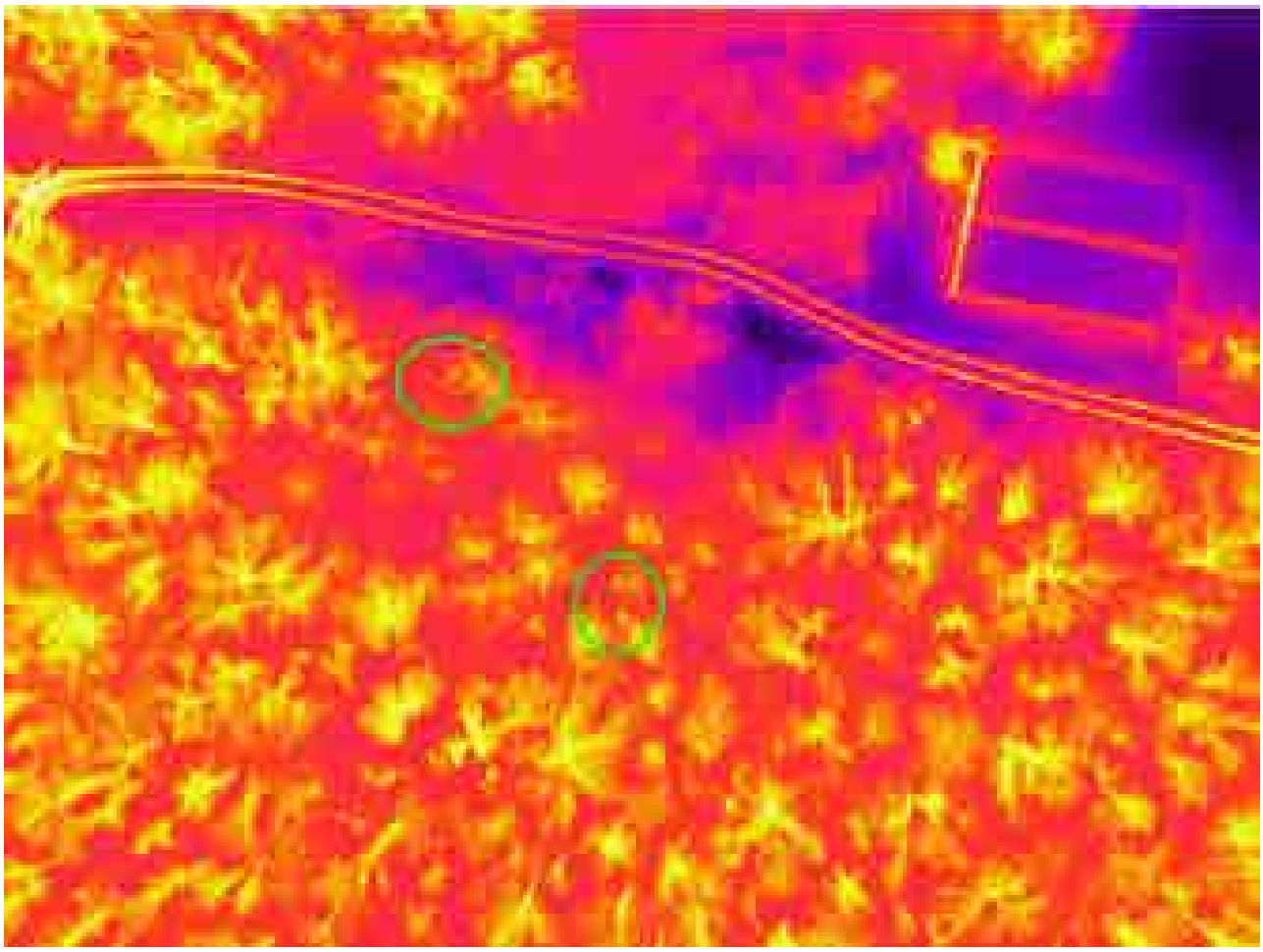
The following pages are some examples of the infrared imagery obtained. It is important to understand that determining whether any “dot” in the image is a deer or something else, many frames are analyzed and many different temperature spans are applied to the frames.

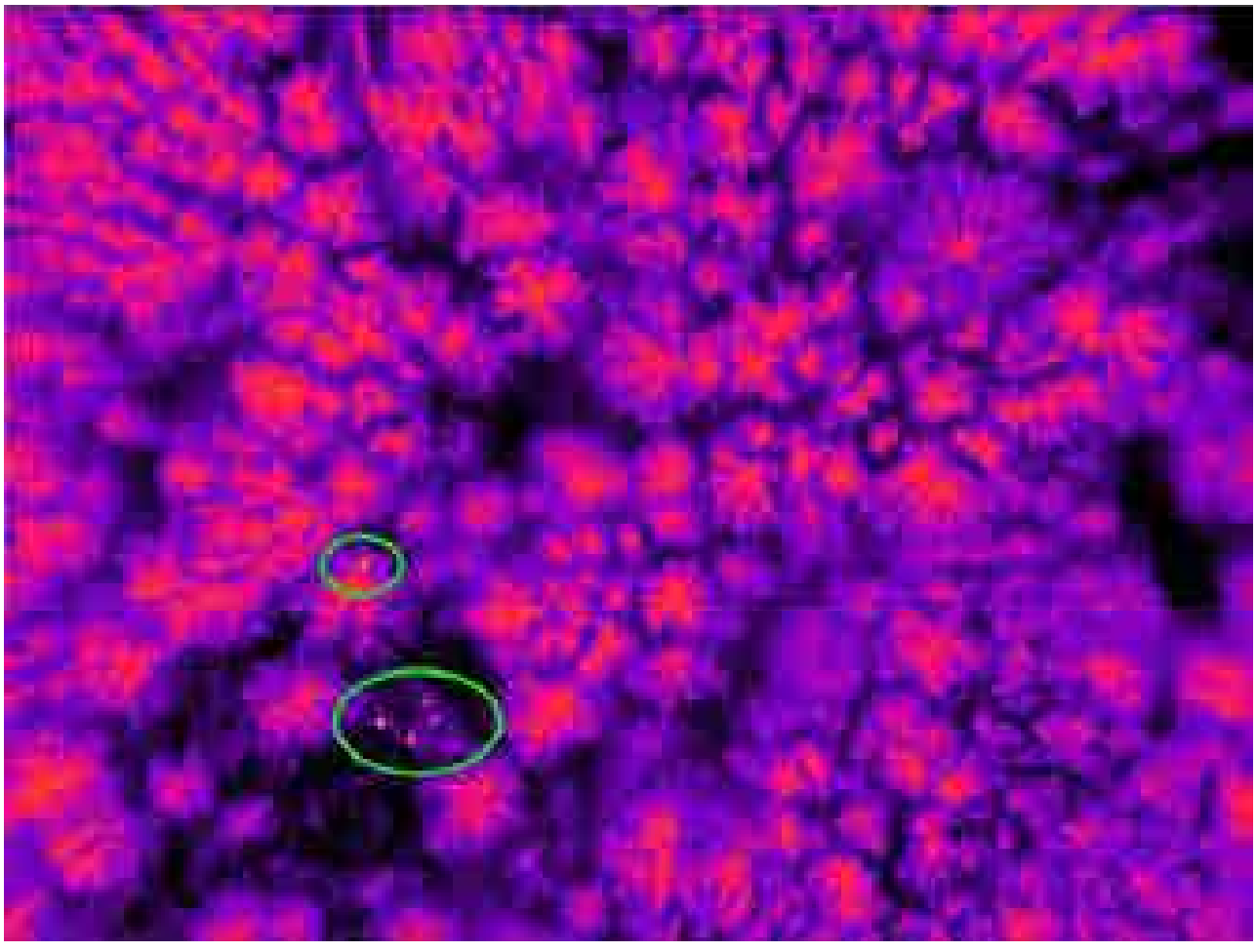
It should also be noted that anomalies can be much more easily seen in video form. It is very difficult to separate “candidate signatures” in static images.

The following images represent some of the more readily identifiable signatures in static form and even then, they may be difficult to interpret by the average viewer.









Certification:

The infrared survey was completed to the best of my ability utilizing one of the latest FLIR infrared cameras under conditions that were acceptable for this application. Acquired images were analyzed using the latest version of the “FLIR Tools+” and FLIR’s ExaminIR software.

I, a Certified Level II Thermographer, attest that I performed the scan, analyzed the acquired images, and prepared the reports. When and if necessary, I consulted with a Certified Level III Thermographer regarding any anomalies that I was not comfortable with diagnosing myself.

Please feel free to contact me with any questions you may have regarding this report or any of the conclusions found in it.

This report was prepared by:

Mike Holthouse, Certified Level II Thermographer
Above All Aerial & Specialty Photography - Ohio

White-tailed Deer Population Densities - 2022 Trail Camera Surveys
Mill Creek MetroParks
Mahoning County, Ohio

Introduction

The White-tailed Deer (*Odocoileus virginianus*) is a member of the Cervidae family (alongside Elk, Moose, Mule Deer, etc.) and serves as a keystone herbivore throughout its native range which primarily includes eastern North America. White-tailed deer have proven to be extremely adaptable, as their populations have risen exponentially since the late 20th century despite increased habitat fragmentation caused by human development. As the population of white-tailed deer on the landscape rises and the amount of available habitat is reduced, a definitive increase in negative impacts associated with the overabundance of deer has become apparent over the last several decades. While these effects can be felt across all landscapes, they are often disproportionally concentrated in urban/suburban areas including parks and municipalities.

To better understand the size and health of the deer herd located on MetroParks properties and to gauge the effectiveness of trail camera surveys for estimating population densities of white-tailed deer, Mill Creek MetroParks staff initiated survey efforts at Hitchcock Woods and the Mill Creek Wildlife Sanctuary, beginning in late July 2022.

Materials and Methods

The survey methodology discussed below was based upon the guidelines provided by researchers at the Mississippi State University Deer Ecology and Management Lab and the National Deer Association.

Site Selection

Camera locations were chosen based upon known areas of deer activity, ease of access for maintenance, and to be evenly distributed throughout the facility. Based upon available research, each camera site is based upon a 100-acre survey area.

Survey Duration

After site selection, each location was pre-baited with shelled corn (~25# per camera) for a period of seven (7) days beginning on 7/11 and concluding on 7/18 – sites were rebaited three (3) times per week on Mondays, Wednesdays, and Fridays. Photographs were taken and reviewed during the pre-baiting period to ensure proper camera placement, however, the data from this seven (7) day period was not used in the final count.

Following the pre-baiting period, the survey period was initiated and continued for fourteen (14) consecutive days beginning on 7/18 and concluding on 8/1. During this time cameras were rebaited three (3) times per week on Mondays, Wednesdays, and Fridays (~25# per camera).

Data Collection and Review

The trail cameras were programmed to take pictures 24-hours per day but would only trigger once every five (5) minutes taking one photo at a time – each photo was time and date stamped.

During the survey period, SD cards were collected from each camera site once per week (7/25 and 8/1 respectively) and the data was reviewed and categorized. Photos were separated into four (4) categories: unique bucks, total bucks, total does, and total fawns and the data from the two-week survey period was combined into the final results.

Results

Data was analyzed using the guidelines provided by the MSU Deer Lab and the National Deer Association (NDA). This methodology is based upon the number of known unique bucks photographed compared to the total number of buck pictures taken – dividing these two numbers gives you a "population factor" that can then be used to estimate the number of unique does and fawns based upon the total number of photos taken.

The data for each survey site can be seen in the figures below:

Mill Creek Wildlife Sanctuary

Hitchcock Woods

Discussion

The recommend population density of white-tailed deer is 10-20 per square mile, populations greater than often exceed the ecological carrying capacity of the landscape and can cause significant damage to native flora due to overbrowsing. With the population estimate in both study areas greatly exceeding the recommended range of 10-20 deer per square mile both properties are at a very serious risk of long-term ecological damage associated with overbrowsing. Such damage is already readily apparent within both areas, but most notably at Hitchcock Woods.

It was observed that many of the deer photographed at Hitchcock Woods appeared to be emaciated and in poor physical condition, this coupled with the very apparent browse damage witnessed onsite suggests that the population of white-tailed deer at this facility has not only exceeded the ecological carrying capacity of the land but also may be approaching biological carrying capacity. Biological carrying capacity is the population level in which a species can persist on the landscape in a sustainable fashion based upon available resources (food, water, shelter).

Overall, it was determined that utilizing the survey methodology provided by MSU and NDA was a cost effective and accurate way to monitor populations of white-tailed deer utilizing MetroParks property. It is recommended that the MetroParks continue to utilize trail cameras surveys using this methodology to better understand populations densities of white-tailed deer throughout the park system and how deer are impacting the ecosystem.

Notes

This survey effort should be considered a minimum population density at each facility and should only be considered accurate at the time of survey. Deer movements and their utilization of any given property will change throughout the season and year to year depending upon available resources (food, water, shelter).

Many of the pictures collected were of raccoons, waterfowl, songbirds, and other wildlife – the subsequent 5-minute delay likely resulted in some deer not being photographed if they passed through while the camera was inactive. With that being said, the methodology provided by MSU and NDA accounts for this possibility and it is assumed that ~80% of the deer within a 100-acre study zone will be photographed over a 14-day survey window.

Additional Resources

Conducting Camera Surveys to Estimate Population Characteristics of White-tailed Deer
http://extension.msstate.edu/sites/default/files/publications//p2788.pdf

United States Department of Agriculture
Animal and Plant Health Inspection Service
Wildlife Services

Summary of the White-tailed Deer Count in the Mill Creek MetroParks, Mill Creek Park
8 March 2021

Submitted by:
USDA APHIS Wildlife Services
6100 Columbus Avenue
Sandusky, Ohio 44870
(419) 625-9093

Table of Contents

List of Figures

The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) was requested to conduct a count of white-tailed deer (*Odocoileus virginianus*) within Mill Creek MetroParks, Mill Creek Park property. The objective of the count was to provide the MetroParks with an index of the deer population.

Study Area

Mill Creek Park is situated between State Route 224 and Interstate 680 in northeast Mahoning County. Mill Creek Park is approximately 2.4 square miles of green space surrounded by developed areas. The Mill Creek flows through the park supplying water to three lakes. Mill Creek Park is comprised of multiple hike and bike trails, natural terrain hiking trails as well as multiple outdoor recreation areas. In addition, there are two golf courses located within Mill Creek Park.

Methods

Wildlife Services utilized two observers with handheld thermal imagers to identify and count deer while driving a pre-determined route. The route was created to cover as much of the park as possible and to minimize the possibility of counting deer more than once (Figure 1). The number of deer observed as well as their approximate locations were recorded on a map of the park.

Results

The deer count occurred on 8 March 2021 between 18:30 and 21:30. A total of 39 deer were observed. An underlying assumption for many survey techniques designed to estimate deer abundance is that deer are evenly distributed across the landscape. To that end, WS used Arc GIS to approximate the total area of the park that was observed from the survey route with the thermal imaging equipment. It is estimated that 83% of the available area in the park was included in the count. Wildlife Services concludes that this count yields a range estimate of 39-47 deer within the Mill Creek Park at the time this count was conducted.

Deer observations were distributed throughout the park with 59% (n=22) occurring south of State Route 62 and 41% (n=17) located north of State Route 62. Of the 22 deer observations south of State Route 62, six occurred on or adjacent to the Mill Creek Park golf course. The remaining 16 observations occurred within proximity to residential properties. Of the 17 deer observations north of state route 62, 24% (n=4) occurred within proximity to surrounding residential properties. The remaining 11 observations 76% (n=13) of observations occurred in natural habitats within the park. Portions of the survey route included areas outside of Mill Creek Park boundaries to increase access and because of road closures within the park. No deer were counted outside of the park boundary. Figure 2 below contains a summary of the number and location of deer observed in Mill Creek Park during the WS deer count.

Discussion

The composition of roads and drivable hike and bike trails within Mill Creek Park, combined with the size of the park, were favorable to conducting a ground count for white-tailed deer using thermal imagers. In addition, weather conditions during the survey were favorable for deer movement. Deer were observed to be on their feet and actively feeding throughout the duration of the count. Deer that are active are more likely to be observed.

The results of any deer survey/counting method should be viewed as a snapshot of the deer population during the timeframe the survey was completed. White-tailed deer populations can fluctuate temporally and seasonally. Potential reasons for these fluctuations include deer movement because of weather, food availability or preference, the breeding season and as a result of human pressures (i.e. hunting).

Recommendations

White-tailed deer population estimates/counts should be interpreted in context with other quantifiable measures of deer damage such as, annual browse surveys, vegetation plots, deer exclosure plosts, etc. These indices may be used to identify specific geographical areas within Park that support higher than recommended numbers of deer or deer that may pose an elevated threat to natural resources.

Figure 1. A map showing the route (pink) in Mill Creek Park, Ohio that was used to conduct the white-tailed deer count on 8 March 2021.

Figure 2. A map depicting the approximate location and number of white-tailed deer observed during the 8 March 2021 count in Mill Creek Park, Ohio.

United States Department of Agriculture
Animal and Plant Health Inspection Service
Wildlife Services

Summary of the White-tailed Deer Count in the Mill Creek MetroParks, Mill Creek Park 15 March 2022

Submitted by:
USDA APHIS Wildlife Services
6100 Columbus Avenue
Sandusky, Ohio 44870
(419) 625-9093

Table of Contents

List of Figures

The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) was requested to conduct a count of white-tailed deer (*Odocoileus virginianus*) within Mill Creek MetroParks, Mill Creek Park property. The objective of the count was to provide the MetroParks with an index of the deer population.

Study Area

Mill Creek Park is situated between state route 224 and interstate 680 in northeast Mahoning County. Mill Creek Park is approximately 2.4 square miles in of green space surrounded by heavily developed areas. The Mill Creek flows through the park supplying water to three lakes. Mill Creek Park is comprised of multiple hike and bike trails, natural terrain hiking trails as well as multiple outdoor recreation areas. In addition, there are two golf courses located within Mill Creek Park.

Methods

Wildlife Services utilized two observers with handheld thermal imagers to identify and count deer as we drove a pre-determined route. The route was created to cover as much of the Park as possible and to minimize the possibility of counting deer more than once (Figure 1). The number of deer observed as well as their approximate locations were recorded on a map of the Park.

Results

The deer count occurred on 15 March 2022 between 19:30 and 21:30. A total of 61 deer were observed. An underlying assumption for many survey techniques designed to estimate deer abundance is that deer are evenly distributed across the landscape. To that end, WS used Arc GIS to approximate the total area of the Park that was observed from the route with the thermal imaging equipment. It is estimated that 83% of the available area in the Park was included in the count. Wildlife Services concludes that this count yields a minimum estimate of 61-73 deer within the Mill Creek Park at the time this count was conducted.

Deer observations were evenly distributed throughout the park with 53% (n=32) of the total south of state route 62 and 47% (n=29) north of state route 62. Of the 32 deer observations south of state route 62, 16 occurred on or adjacent to the Mill Creek Park golf course. The remaining 16 observations occurred within proximity to residential properties. Of the 29 deer observations north of state route 62, 69% (n=20) occurred within proximity to residential properties. The remaining nine observations (31%) occurred in natural habitats. Portions of the survey went outside of Mill Creek Park boundaries due to access points into the park. Eleven deer were counted outside of the park boundary. These observations occurred no more than 150 yards from the park boundaries. Figure 2 below contains a summary of the number and location of deer observed in Mill Creek Park during the WS deer count.

Discussion

The composition of roads and drivable hike and bike trails within Mill Creek Park, combined with the size of the park, were conducive to conducting a ground count for white-tailed deer

using thermal imagers. In addition, weather conditions during the survey were favorable for deer movement. Deer were observed to be on their feet and actively feeding throughout the duration of the count. Deer that are active are more likely to be observed.

The results of any deer survey/counting method should be viewed as a snapshot of the deer population during the timeframe the survey was completed. White-tailed deer populations can fluctuate temporally and seasonally. Potential reasons for these fluctuations include deer movement because of weather, food availability/preference, the breeding season and as a result of human pressures (i.e. hunting).

Recommendations

White-tailed deer population estimates/counts should be interpreted in context with other quantifiable measures of deer damage such as, annual browse surveys, vegetation plots, deer exclosures, etc. These indices may be used to identify specific geographical areas within Park that support higher than recommended numbers of deer or deer that may pose an elevated threat to natural resources.

Figure 1. A map showing the route (red) in Mill Creek Park, Ohio that was used to conduct the white-tailed deer count on 15 March 2022.

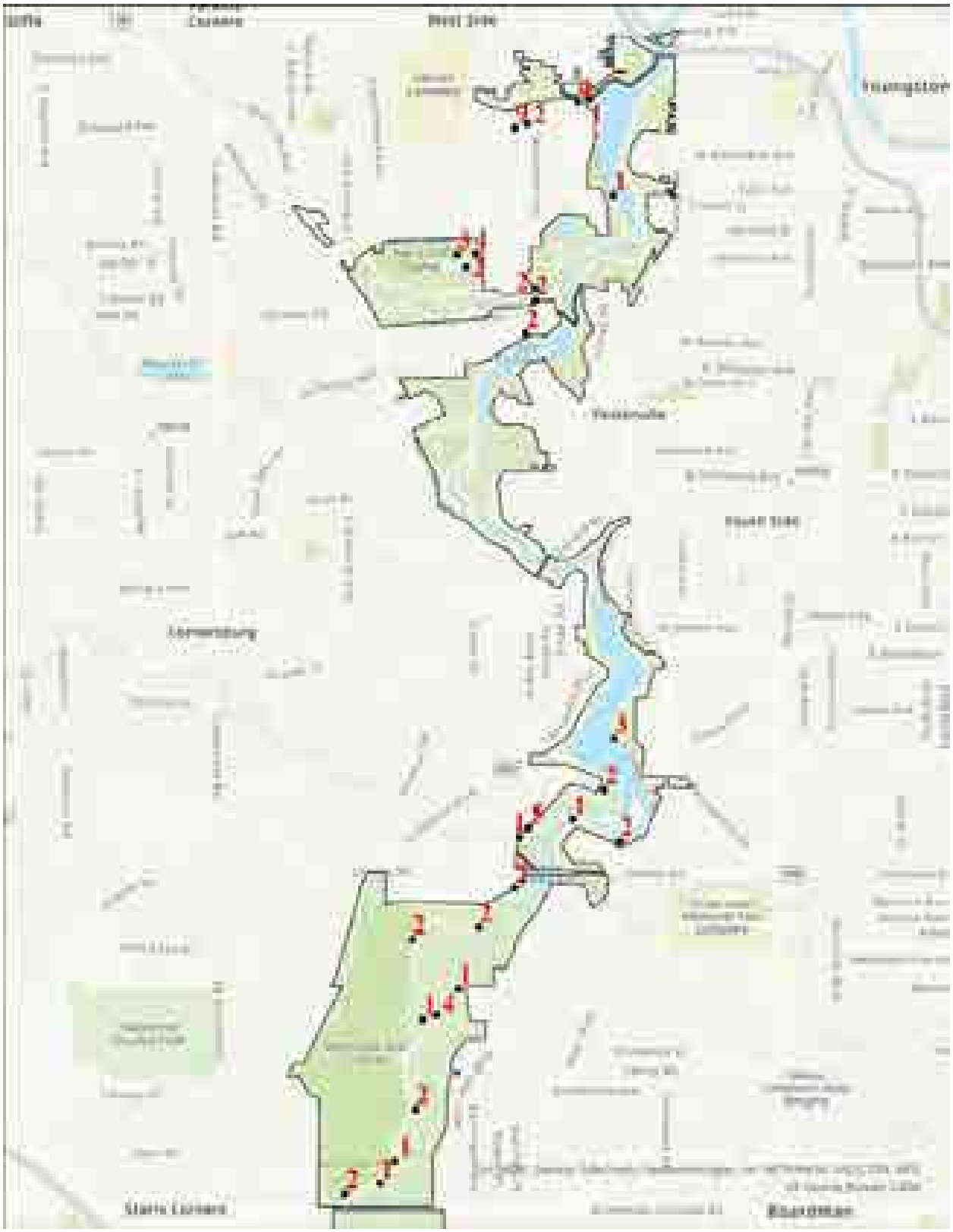


Figure 2. A map depicting the approximate location and number of white-tailed deer observed during the 15 March 2022 count in Mill Creek Park, Ohio.

Aerial Infrared Deer Count Report

Mill Creek MetroPark

10 March 2000

The Mill Creek MetroPark (Canfield, OH) was the subject of an aerial infrared (IR) deer count flight on the night of 7 February 2000. The IR imaging conditions were good, with a clear sky and light winds from the north. The surface temperature was 14 degrees Fahrenheit.

The report package includes this written report, edited VHS videotape of the count area (previously delivered), map printouts of the deer count and dispersion within and near the count area and a copy of each map in *.tif* and *.jpeg* formats on CD-ROM.

Results:

METROPARK		DATE	DEER Inside/Possible // Outside/Possible // Domestic
Mill Creek	**~1660 Ac**	**7 Feb 00**	**255 / 34+ // 42 / 0 // N/A**

Analysis Notes

Mill Creek MetroPark

The Mill Creek MetroPark is located in Canfield, Ohio. The 1660 acre park straddles US Highway 224 (W. Canfield Poland Road). The park is principally deciduous woods with a golf course north of the highway. The deer thermal signatures were generally well contrasting with the background and I estimate the count to be 80 to 90% accurate. This accuracy number is subjective, based on conditions during the flight and my experience with other counts under varying circumstances, as well as the level of difficulty in analyzing the infrared imagery during post-processing. There were a number of distractions to accurate deer counting, however, such as snow cover with deer scratchings and deer bedding down areas. These feeding and bedding marks are typically the size of a deer and are closely grouped. The feeding marks are usually in open ground, while bedding areas are often in wooded areas. When snow covered ground is disturbed by these activities, the relatively warmer underlying ground shows through and mimics a deer's thermal signature. The strength, or brightness, of the feeding or sleeping spot's thermal signature is usually weaker than an active deer but can be quite similar to a quiescent deer. On the accompanying map, such spots are gray in color and represent a 'possible' deer. The count began at 2320 on the 7th and ended one hour and twenty minutes later at 0040, 8 February. On the accompanying maps (north and south section of the park) a deer is marked as a red dot, while a gray dot indicates a possible deer or a place where a deer scratched for food or bedded down in the snow. These gray dots should be given little weight when considering the number of deer in the park.

Geographic Information System Use

If the deer count number and dispersion information is destined for a Geographic Information System (GIS), my recommended method of transferring the data into the GIS is to import the map image file and overlay/register it on an existing map of the park. Use an input device (mouse, pen, etc.) to rapidly note the location of each deer count 'dot' as a new data point. Once these data are entered as a new layer, the imported map can be discarded from GIS, leaving the new 'deer count' layer to be incorporated with other GIS data and maps.

Equipment:

A single-engine Cessna 182 airplane with a high-resolution Mitsubishi M-600 thermal imager oriented 'looking' straight down through a camera hole in the belly of the airplane was used for this count. The thermal imager video output is routed through a video encoder-decoder (VED) that labels the video with a

continuous stream of GPS-derived position, time, date, speed and altitude information. A guide to the alpha-numeric annotation seen on the accompanying videotape is appended to this report and attached to each videotape. A bar code of the same GPS alphanumeric information is recorded on the far left side of the imagery and may not be visible on a conventional TV screen. The bar-coded information is used by the VED during video playback and analysis. The annotated video imagery is recorded with a Sony GV-D900 digital video cassette recorder using mini-DV videotape capable of storing 500 horizontal lines of video information (over 50% more than the 330 lines found on conventional VHS videotape.) The mapping program used for marking the count area borders and laying out the flight lines is DeLorme's GPS Link II and Map Expert version 2.0.

Flight Methodology:

The counts were flown at an average altitude of 1500 feet above ground level. The camera view directly below the airplane from that altitude is 374 feet wide on the ground surface. Flight lines were spaced an average of 325 feet apart to allow for image overlap and 100 percent coverage of the study area. A 'bread crumb' feature of the mobile mapping software used for the flight allows me to track my flight path and helps guide me along predetermined flight lines to assure complete coverage. The recording device is normally paused during the turns outside the study area, hence the tape appears to jump from the end of one run to the beginning of the next.

Analysis Methodology:

After the flight, I analyze the videotape using a TV monitor and a computer monitor. As the videotape plays, the VED decodes the bar-coded GPS signal that was received from the GPS during the video recording. The VED recreates the original GPS signal and sends it to the computer so the mobile mapping software 'thinks' it is receiving a live signal. The mapping software shows the moving position of the airplane superimposed on a street map on the computer screen while the recorded infrared imagery of the area below the airplane is visible on the TV monitor. The GPS updates the airplane position once per second throughout the flight and at the same rate during the post-flight analysis.

To count the deer, I watch the tape in its entirety, pausing and playing it backward and forward at regular speed and in slow motion, as necessary. Generally, for each hour of tape, between three and six hours of analysis are required to complete the count. As I view the tape and note the deer, I mark them on a computer version of the maps accompanying this report. When I have viewed the entire tape, I count the dots on the map to find the number of deer in the count area. If I note large domestic animals on the computer map, I mark them with a different color dot. In these counts, red dots denote deer, gray dots (if any) denote possible deer or other unknown animal similar in size to a deer but apparently not a deer and blue dots (if any) represent domestic animals such as cows, sheep or horses. These animals are always much warmer and in the case of horses and cattle, substantially larger than any deer.

Deer usually appear as a fairly bright white dot or narrow line in the infrared imagery. In this imagery, white and lighter shades of gray represents warmer objects while black and darker shades of gray are cooler. Other white (warmest in the scene) objects that are common are roads and pavement that retain latent heat from sunshine during the day, man hole covers, street lights, house lights, fires, furnace stacks on houses, car engines that are running or have run recently, groundwater seepages, puddles, ponds, streams, rivers and large rocks and boulders in the woods. Other animals in the picture are often white or bright. Domestic animals are commonly very bright—hotter than deer, which have highly insulated coats.

In order to count deer with a high degree of confidence and accuracy, several factors have to be taken into account. Among them are deer infrared signatures, background infrared signatures, deer behavior and location. Questions I am commonly asked, and the answers I give, include the following:

Q. How do you know you are not counting the same deer twice?

Given:

- deer are not disturbed by a light plane flying more than a quarter of a mile above them,
- deer often congregate in groups of two or more—up to 20 or more in extreme cases,
- deer generally move very slowly as they graze, congregate or rest,
- deer live and act according to generally well known behaviors,
- I fly along a well documented flight path with an 'infrared view' of a known area below the aircraft that is recorded on videotape.

A. With the help of the moving map program, I can place dots representing deer on a map in their respective positions and orientation to one another quite accurately, particularly when referring to the nearby streets, intersections, rivers and streams that may be in view or recently in view on the videotape. As I analyze the tape, becoming quite familiar with the 'neighborhood' of the count area (houses, roads, hills, streams, rivers, golf courses, trails, etc.) and place the dots on the map, I recognize specific deer and groups of deer as I pass them a second and sometimes third time. For example, I may see and place a group of three deer/dots in an equilateral triangle near a trail a few seconds after passing a particular road. In the case where I first saw them they may have been on the right side of my screen. When I fly the next adjacent run, thanks to overlapping imagery, they may appear on the extreme left side of the screen. Very often, they will be in the same spot or not far from it, in the same or similar 'formation' five, ten, fifteen or even thirty minutes later. If I fly along and see a lone deer in the forest, it will still be there in the same general area when I make adjacent passes. On occasion, I will fly over a group of deer in an area, and on subsequent passes, I will see an additional deer that I did not see earlier because it may have been out of the picture, too close to another deer (appearing larger than normal—but not counted as two) or it may have been obscured by a tree or foliage on the first pass. In those cases, I add the dot to the map. In uncommon cases where deer are moving quickly, I will look for them elsewhere in the direction they were originally seen moving. If I later see deer in the vicinity and cannot recognize them as the same group, I have to make a judgment whether to count them or not.

Q. How do you know what you are seeing and counting are deer and not some other animal?

Given:
- there is usually a sizable quantity of deer in the area in which I am flying the deer count,
- there are other wild and domestic animals in the same area, usually in smaller numbers,
- deer don't climb trees,
- deer are somewhat 'brazen' in their occupation of human communities,
- domesticated animals are often corralled, fenced in, densely grouped or tethered,
- deer are notably larger than foxes, raccoons, skunks and most dogs and smaller than cows and horses,
- deer have a variety of apparent temperature ranges/thermal signatures but are nearly always cooler than common domestic animals (dogs, horses, cows, sheep),
- skunks, raccoons, and foxes appear to have warmer apparent body temperatures than deer and often look like a bright pinpoint of light in the woods, whereas a deer is larger, usually cooler and with less distinguishable edge contrast with their surroundings (i.e., they look slightly 'fuzzy' around the edges),
- deer congregate more and move less, and generally less rapidly, than small nocturnally active wild animals such as skunks, raccoons, coyotes and foxes.

A. Experience, practice and experiments with the Michigan Department of Natural Resources in counting and identifying a variety of captive animal types have given me high confidence in identifying deer in their normal forest and suburban habitats. The deer that I have difficulty identifying and counting are those that are partially hidden from view in evergreen vegetation or exhibit such a low apparent temperature (thermal signature) that I cannot see them or distinguish them sufficiently enough to identify them as deer, or even as animals. I do not count 'white dots or blobs' that I do not have a strong feeling are deer. Close examination of most infrared deer count videotapes will reveal to the viewer quite a few animals in trees or on the ground that do not appear on the deer count map. These animals are most likely

to be something other than deer. My deer counts are generally considered a minimum number, as opposed to a maximum. Some deer will go undetected in nearly every environment.

Q. How accurate is the count?

A. I don't know, I believe an average of 90% is in the ballpark, perhaps better. Conventional methods (deer-car collisions, spotlighting, pellet counts) are considered to be accurate within 30 to 40 percent—not a high number. In this method, we are looking at 100% of the area in question and under good conditions all active deer not hidden from view should be seen and counted with infrared.

Note: Viewers of the VHS videotape should be able to see most of the deer noted on the accompanying map(s) without having to pause or rewind the tape. The quality of even a first-generation VHS videotape is noticeably inferior to digital videotape and some deer may be difficult to discern. I recommend against making copies of the provided VHS tapes, since the quality will suffer substantially. I will retain the digital videotape original of this deer count for at least one year. If additional copies are required, please communicate with Davis Aviation.

Larry Davis
Kent, Ohio

davisav@sprintmail.com
(330) 677-8612

Video annotation guide:

Date	Time			Altitude MSL
ARR20799,0030:56.213,-05,9700,02157F				
0111,3910.860N,08444.2943,			74KT3,092	
	Latitude	Longitude	Grnd Speed	Course

LEGEND

- State Route
- Geo Feature
- Town, Small City
- Park
- US Highway
- Population Center
- Street, Road
- Major Street/Road
- Interstate Highway
- State Route
- US Highway
- River
- Open Water
- Contours

Scale 1:18,750 (at center)

2000 Feet

500 Meters

Mill Creek 00 - North
Mag 15.00
Sat Mar 04 18:08:48 2000

LEGEND

- Interstate, Turnpike
- Population Center
- Street, Road
- Major Street/Road
- Interstate Highway
- River
- Contours

Scale 1:18,750 (at center)

2000 Feet

500 Meters

Mill Creek '00 - South
Mag 15.00
Sat Mar 04 19:02:31 2000

White-tailed Deer Population Densities - 2023 Trail Camera Survey
Mill Creek Park
Mahoning County, Ohio

Introduction

The White-tailed Deer (*Odocoileus virginianus*) is a member of the Cervidae family (alongside Elk, Moose, Mule Deer, etc.) and serves as a keystone herbivore throughout its native range which primarily includes eastern North America. White-tailed deer have proven to be extremely adaptable, as their populations have risen exponentially since the late 20th century despite increased habitat fragmentation caused by human development. As the population of white-tailed deer on the landscape rises and the amount of available habitat is reduced, a definitive increase in negative impacts associated with the overabundance of deer has become apparent over the last several decades. While these effects can be felt across all landscapes, they are often disproportionally concentrated in urban/suburban areas including parks and municipalities.

To better understand the size and health of the deer herd located on MetroParks properties and to gauge the effectiveness of trail camera surveys for estimating population densities of white-tailed deer, Mill Creek MetroParks staff-initiated survey efforts at Hitchcock Woods and the Mill Creek Wildlife Sanctuary, beginning in late July 2022.

Materials and Methods

The survey methodology discussed below was based upon the guidelines provided by researchers at the Mississippi State University Deer Ecology and Management Lab and the National Deer Association.

Site Selection

Fifteen (15) camera locations were chosen based upon known areas of deer activity, ease of access for maintenance, and to be evenly distributed throughout the facility (see attached map). Each camera is designed to cover a 100-acre area, however there are three (3) instances of overlap between cameras this overlap is reflected in the total surveyed area (1436 acres).

Survey Duration

After site selection, a motion activated trail camera was placed at each location with shelled corn used as attractant (~25# per camera) for a period of fourteen (14) days beginning on 7/14 and concluding on 7/28 – three (3) of the sites (East Park, Chestnut Hill, and Anderson Run) where not established until 7/17 and concluded on 7/31 this provided 14 days of data for each location. Camera locations were rebaited three (3) times per week on Monday, Wednesday, and Friday of each week.

Data Collection and Review

The trail cameras were programmed to take pictures 24-hours per day but would only trigger once every five (5) minutes taking one photo at a time – each photo was time and date stamped.

During the survey period, SD cards were collected from each camera three (3) times per week (Monday, Wednesday, Friday) and the data was reviewed and categorized. Photos were separated into four (4) categories: unique bucks, total bucks, total does, and total fawns - any photos that could not identified and placed into these categories were not used in the final count.

Results

Data was analyzed using the guidelines provided by the MSU Deer Lab and the National Deer Association (NDA). This methodology is based upon the number of known unique bucks photographed compared to the total number of buck pictures taken – dividing these two numbers gives you a "population factor" that can then be used to estimate the number of unique does and fawns based upon the total number of photos taken.

In total, the 15 cameras collected 6,694 photos of white-tailed deer during the two-week survey window – once categorized, the total breakdown is as follows:

- Surveyed Area – 1436 Acres (2.24 mi^2)
- Unique Bucks – 46
- Total Buck Pictures – 1223
- Total Doe Pictures – 3917
- Total Fawn Pictures - 1554

Using these figures, the computation form provided by the National Deer Association was used to estimate the total population, sex ratios, and deer densities within the surveyed areas – the results are as follows (see attached data sheet):

Total Estimated Population – 281 (51 Bucks, 165 Does, 64 Fawns)

- Doe to Buck Ratio – 3.24
- Fawn to Doe Ratio – 0.39
- Acres per Deer – 5.11
- Deer Density per Square Mile - 125

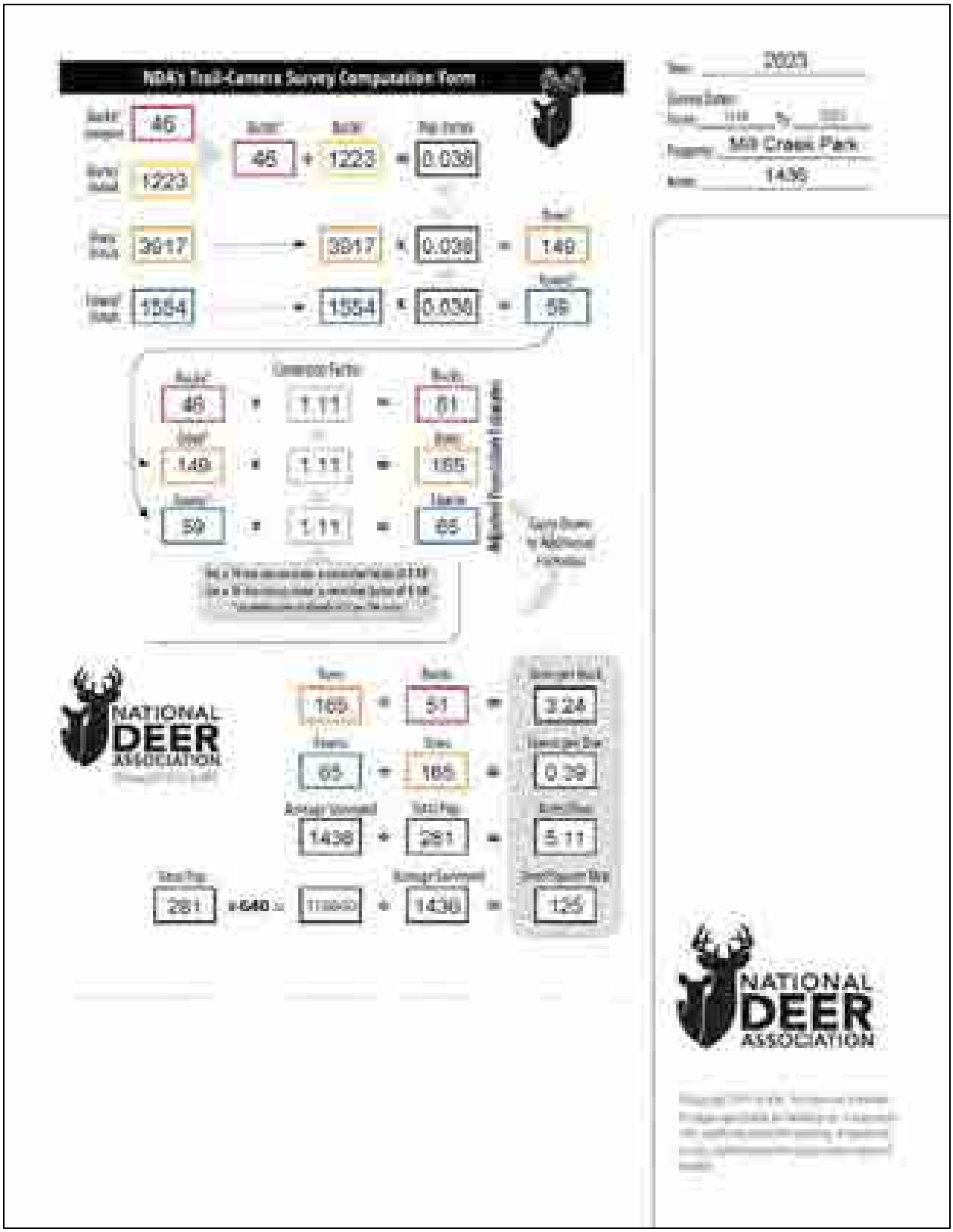
<u>Survey Accuracy</u>

This survey effort should be considered a minimum population density and should only be considered accurate at the time of survey. Deer movements and their utilization of any given property will change throughout the season and year to year depending upon available resources (food, water, shelter).

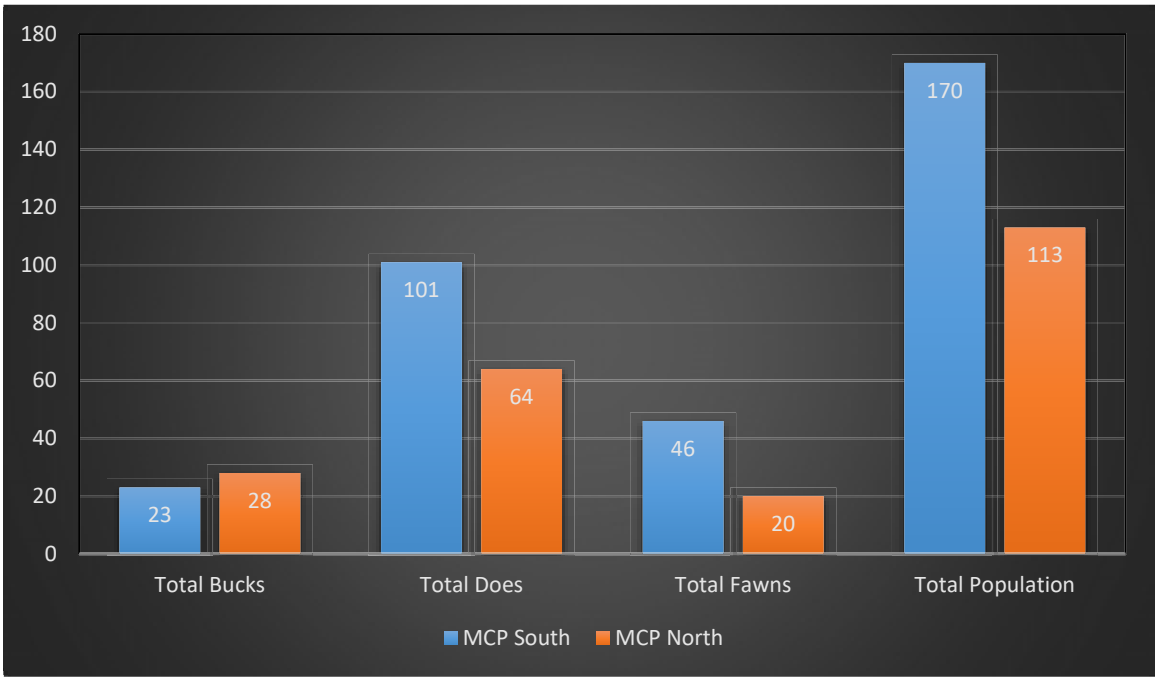
Based upon research from MSU Deer Lab, we know that trail cameras are 90% effective at documenting deer within 100 acres over the course of a 14-day survey period, this is supported by the fact that buck movement between cameras was very limited. Only 7 of the 46 (15%) unique bucks documented during the survey were seen on multiple cameras, the most notable example was travel between Chestnut Hill and East Park which is reasonable to expect based upon the two cameras overlapping in coverage (see attached map).

If we assume that deer are evenly distributed across the landscape, based upon the density estimate of 125 deer/mi^2 an adjusted estimate for the entirety of Mill Creek Park (1,626 acres or 2.54 mi^2) would be 318 deer within park boundaries. Furthermore, using the same assumption we can extend the survey area to include an approximate ~300-400' buffer beyond park boundaries (3,491 acres or 5.45 mi^2) the estimated total population would rise to 681 deer. Again, deer movement varies greatly throughout the year based upon food sources, weather conditions, breeding, etc. Factors such as emigration, immigration and deer distribution during different times of year in relation to MetroParks boundaries are largely unknown at this time.

MCP Trail Camera Data Sheet 2023



Mill Creek Park Deer Densities North vs. South of Midlothian Blvd.



To aide in determining management decisions relating to the 2023 targeted removal program, the data was also separated into two (2) sets which represent Mill Creek Park north of Midlothian Blvd. and Mill Creek Park south of Midlothian Blvd. As seen in the graph above, the distribution of antlered bucks was fairly even throughout the park, however, the number of does and fawns were notably higher in the southern section.

In terms of total estimated population, the southern section of Mill Creek Park was 33.5% higher as compared to the northern section. Higher deer densities in the southern portions of the park can be confirmed by staff observations and other survey methods employed by the MetroParks.

Discussion

Research tells us that the recommended population density of white-tailed deer is 10-20 per square mile, populations greater than this often exceed the ecological carrying capacity of the landscape and can cause significant damage to native flora due to overbrowsing. As documented by this study, the number of unique antlered bucks alone exceeds ecological carrying capacity (51 bucks/2.24 mi^2 = 23 bucks per mi^2) – when the entire population is considered (125 deer/mi^2) estimates greatly exceed carrying capacity, further demonstrating the need for active management of deer populations within Mill Creek Park.

Evidence of extensive ecological damage caused by overbrowsing is readily apparent throughout the Park with distinct browse lines and little to no understory regeneration are commonplace – this can be seen visually but is also support through ecological survey work conducted in June of 2023 that be found on the MetroParks' website (https://www.millcreekmetroparks.org/white-tailed-deer-in-mill-creek-metroparks/).

Notes

Many of the pictures collected were of raccoons, birds, and other wildlife – the subsequent 5-minute delay likely resulted in some deer not being photographed if they passed through while the camera was inactive. With that being said, the methodology provided by MSU and NDA accounts for this possibility and it is assumed that ~90% of the deer within a 100-acre study zone will be photographed over a 14-day survey window.

It is recommended that for futures surveys, cameras be programmed to take 2 or 3 pictures bursts on the same 5-minute timer. This will increase the labor demand when counting and sorting photos but will provide more information when identifying deer.

Additional Resources

Conducting Camera Surveys to Estimate Population Characteristics of White-tailed Deer
http://extension.msstate.edu/sites/default/files/publications//p2788.pdf

MILL CREEK METROPARKS

Mill Creek Park
Trail Camera Survey
July 2023

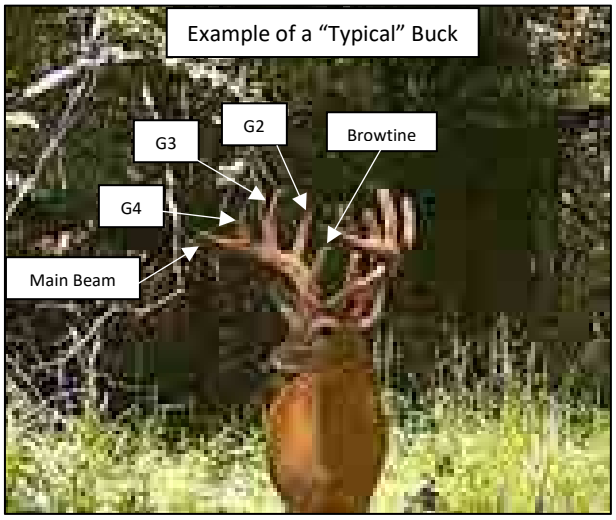
2023 Trail Camera Survey – Mill Creek Park
Unique Buck Master List

The following list represents the forty-six (46) unique bucks that were documented during the 2023 trail camera survey conducted in Mill Creek Park (July 2023). Distinguishing unique bucks from one another and tracking the number of times a unique buck is pictured throughout the survey period is critical to successfully utilize trail cameras to estimate localized populations of white-tailed deer on a property.

To determine if bucks were indeed unique, the following metrics were considered:

- Number of Points
- Antler Configuration
- Body Markings
- Body Characteristics

To articulate differences between individual bucks, terms such as typical vs non-typical may be used to describe differences in antler configuration and individual points may be referenced – see examples below.



Buck 1 – West Golf #1

8 Points, Typical, Symmetrical, Distinct Markings on Body

Buck 2 – West Golf #2

2 Points, Unbranched, Right Antler Widens Near Top

Buck 3 – West Golf #2

Typical, 8 Points, Left Browtine Longer Than Right, Short G3s on Both Sides, Mark on Right Side of Body – Visually Similar to Buck #1

Buck 4 - East Park, Chestnut Hill

Non-Typical, 8 Points, Right Browtine is Split, 3 Points on Right Side, 4 on Left Side

Buck 5 – East Park

Typical, 8 Points, Short G3s on Both Sides, Narrow Width

Buck 6 – East Park, Chestnut Hill

Typical, 7 Points, 3 Points on Right Side, 4 on Left, Marking on Back Leg Right Side

Buck 7 – NPWL #2

6 Points, 4 on Left, 2 on Right, No Browtine on Right Side, Very Short G3 on Left Side, Left Main Beam Increases in Mass Towards the Terminal Point

Photo Taken in Person on 8/4/23 – Was Not Included in Survey Calculations

Buck 8 – East Newport

Typical, 8 Points, Width Just Past Ears, Symmetrical, Short Browtines

Buck 9 – East Newport

Typical, 8 Points, Short G3s on Both Sides, Antlers Pointed Up and Outwards

Buck 10 – East Newport

5 Points, Small Brow Tine on Right Side, Small Extra Point on Outside of Right Main Beam

Buck 11 – East Newport

Typical, 9 Points, Split on Left G2, Left G3 Longer than G2

Buck 12 – Axe Factory

Typical, 8 Points, Left Side of Rack Taller than Right, Bald Spot Across Shoulders, Black Warts on Chest/Back

Buck 13 – West Golf #1

Typical, 12 points, Right G2 Split, Left G2 Curves Backwards

Buck 14 – Axe Factory

Wide, 10 Points with Long Brow Tines that Curve Outwards

Buck 15 – Axe Factory

Non-Typical with Drop Tine on Left Side

Buck 16 – Axe Factory

Typical, 9 Points, Extra Point on Left G2, Brow Tines Almost Touch

Buck 17 – Axe Factory

6 Points with Browtines, Black Wart on Left Side of Body

Buck 18 – Axe Factory

5 Points, 3 Points on Right, 2 on Left w/ Browtines

Buck 19 – Axe Factory

6 Points, 2 Points on Left + Browtine, 3 on Right

Buck 20 – Axe Factory

5 Points, No Browtines, 3 Points on Left, 2 on Right

Buck 21 – Slippery Rock

Non-Typical, Left Antler Curves Down Towards Eye

Buck 22 – Slippery Rock

Typical, 9 Points, 5 Points on Left, 4 on Right

Buck 23 – Slippery Rock

Typical, 7 Points, 4 Points on Left, 3 on Right, Broken/Damaged Right Brow Tine

Buck 24 – Slippery Rock

Typical, 8 Points, Shorter G3 on Right Side, Extra Point on Right Antler Base

Buck 25 – Slippery Rock

Typical, 8 Points, Short Browtines, Very Small G3s on Both Sides ~1” or Less

Buck 26 – Slippery Rock/Calvary Run

Typical, 8 Points, Brow Tines Spread Far Apart ~10-12”, Short G3s on Both Sides

Buck 27 – Birch Hill

4 Points, 2 Points on Each Side, No Brow Tines

Buck 28 – Bears Den

6 Points, 2 Points on Right Plus Browtine, 3 on Left, No Browtine

Buck 29 – Anderson Run

6 Points, Very Short G2 and G3 Tines, No Visible Brow Tines

Buck 30 – Chestnut Hill, East Newport

Non-Typical, 8 Points with Long Split Brow Tine on Right Side

Buck 31 – Chestnut Hill, East Park

Spike ~3”, Damaged Left Eye in Night Vision

Buck 32 – Chestnut Hill, East Newport

Typical, 8 Points, Short G3s on Each Side, White in Color

Buck 33 – Anderson Run

5 Points, 3 on Left with Brow Tine, 2 on Right, Brow Tine on Left, Visually Similar to Buck #4, See Difference in BT (Right Side vs. Left) and No Extra Point on Right Main Beam

Buck 34 – Anderson Run

Typical, 8 Points, Tall Browtines, Left Browtine Slightly Longer, Dark Spot (Wart) in Right Ear

Buck 35 – Anderson Run

Typical, 8 Points, Width Past Ears, Short G3 on Right Side

Buck 36 – Birch Hill

4 Points, Browtines + Main Beam on Each Side

Buck 37 – Anderson Run

~10” Spike with Small Brow Tine on Right

Buck 38 – West Golf #1

3 Points, Beams Point Outwards – Visually Similar to Buck #2, On Camera at Different Locations within 2 Minutes See WG #2 Photo 18 on 7/19 and WG#1 Photo 26 on 7/19

Buck 39 – West Golf #1 and #3

6 Points, 2 on Left, 2 on Right + Browtines on Each Side

Buck 40 – West Golf #1

3 Points, 2 on Right, 1 on Left, Visually Similar to Buck #37 see Difference in BT (Left vs. Right).

Buck 41 – East Golf

Typical, 7 Points, 4 on Right, 3 on Left with Split on Left G2

Buck #42 – NPWL #2, East Newport

8 Points, Main Beam/G3 on Left Side Unique Curvature, Mark on Left Side of Body Behind Front Shoulder

Buck 43 – East Golf

5 Points, 2 on Left, 3 on Right, No Visible Brow Tines

Buck #44 – Slippery Rock

8 Points, Distinct Marks on Back and Right Side of Body – Visually Similar to Buck #24, See Differences in Length of Right G3, Lack of Extra Point on Right Antler Base, and Difference in Body Markings.

Buck #45 – West Golf #1

Typical, Symmetrical, 10pts, Width Past Ears

Buck #46 – Calvary Run

Spike – Visually Similar to Buck #31, However No Damage to Left Eye in Night Vision.

Aerial Infrared Deer Survey Report

Mill Creek MetroParks
Mahoning County, OH

Dates of aerial scans:
January 21/22 and February 18/19, 2024

Above All Aerial & Specialty Photography • Ohio
P.O. Box 1283 Medina, OH 44258

In Cleveland: 216.619.7979 In Medina: 330.441.4916
Toll Free: 877.AIR.PIX.8 (877.247.7498) Toll Free Fax: 877.AIR.PIX.5 (877.247.7495)

Introduction and Background:

Aerial infrared wildlife scans are widely regarded as the most accurate way to determine animal populations and distribution.

Infrared sensors are used to detect the body heat produced by large animals, such as deer, which is greater than the surface temperatures of their surroundings.

To minimize the effect of solar heating on the surrounding area, it is most effective to conduct an infrared survey after sunset.

In order to be able to see as much as possible, infrared wildlife scans must be done after the leaves have fallen from the trees in autumn and before the trees bud out again in the spring.

Furthermore, the winter months are preferable for conducting infrared scans as there will be a bigger temperature difference between the animals and their surroundings. Snow cover is also beneficial.

Methods:

Our infrared scan was done utilizing one of FLIR's highest resolution infrared cameras

The infrared scan was done via airplane flying at a constant altitude. Due to the varying topography of the area, the altitude above the ground varied between approximately 1,200 feet and 1,400 feet.

Fifteen (15) parks were scanned per outlines provided by the client. The total area of the parks surveyed was approximately 4,859 acres, or 7.6 square miles. The total area surveyed, including perimeter buffers (approximately 300'-400' beyond the parks' boundaries) and internal areas that were not actually part of the parks was over 8,700 acres, or 13.6 square miles.

Methods (cont'd):

The sites were irregularly shaped and individual flight plans were created to ensure complete coverage of every park, including the approximately 300'-400' buffer zone around each park.

The "central area" of the park system, consisting of Mill Creek Park, Hitchcock Woods, Huntington Woods, Mill Creek Wildlife Preserve, and Collier Preserve, were all flown together as one big area on the first night of the survey (January 21/22, 2024). Also flown on the first night were four (4) of the smaller sites in areas east and west of the central areas. These sites were Cranberry Run, Springfield Forest, Egypt Swamp, and Sebring Woods.

The six (6) remaining outlying parks - McGuffey Wildlife Preserve, Yellow Creek, Vickers Nature Preserve, Sawmill Creek, Metro Parks Farm, and Hawkins Marsh - were flown individually on the second night of the survey (February 18/19, 2024).

Flight line headings (directions) for each work area were chosen based on the highest efficiency for each site. Flight lines were spaced approximately 400 feet apart. This allowed for approximately 30% overlap in the coverage from one line to the next to ensure that there were no gaps in the coverage due to wind, turbulence, or human error.

Radiometric sequences (thermal infrared "videos") were recorded continuously for each flight line at a frame rate of at least 15 frames per second. The camera was pointed straight down through an opening in the floor of the airplane. This permitted the entire survey area to be seen, unobstructed, at slightly forward and slightly backward angles (as the lens field of view is approximately 25°) in addition to being seen straight down. Analyzing the thermal signatures in multiple frames covering the entire field of view of the lens helps to differentiate deer from other objects and allows for a higher likelihood of identifying thermal signatures consistent with the presence of deer in and around large trees and in densely wooded areas.

Methods (cont'd):

Each recorded sequence was analyzed frame-by-frame. Individual frames were thermally tuned and analyzed by a certified thermographer to identify thermal signatures consistent with the presence of deer. Ninety-six (96) sequences were recorded and approximately 84,300 individual frames were analyzed in order to prepare this report.

Many different frames are analyzed when determining whether or not a particular thermal signature is caused by a deer. Furthermore, each frame was thermally tuned in many different ways to help differentiate a deer's signature from that of another object.

Adjacent sequences were analyzed to avoid duplicating deer counts in areas of overlap. Although deer could possibly move far enough in the time between flight lines to be mistaken for unique signatures and therefore double counted, the likelihood of that happening is very low. Furthermore, there is an equal probability that the deer could move far enough between flight lines to be missed altogether and not be counted at all. Deer are most active at dusk and dawn, and the scans were done well after sunset to decrease the chances for that type of error.

During the analysis, the infrared images were also compared side-by-side to "Google® Earth" imagery in order to identify natural and man-made features that may produce infrared readings that could be confused with wildlife. Items that could produce strong thermal signatures include natural items such as standing water, ice, rocks, tree trunks, and even certain types of vegetation. Man-made objects that can appear as thermal anomalies include sewer drains, electrical transformers, manhole covers, lights, and structures.

General Notes and Disclaimers:

As stated earlier, infrared scans are widely considered to be the most accurate method for counting deer. The accuracy of infrared surveys is most often quoted to be "85% or better" when done in ideal conditions.

This accuracy is accepted even though most infrared surveys only scan part of a site and then extrapolate the data to come up with the count. Although that method may yield results that are "close enough" for some purposes, Above All – Ohio does not extrapolate data from partial scans. We scan the entire site and count every thermal signature that we see that is consistent with the presence of deer. We also plot the locations as accurately as possible on Google Earth so as to get an idea of the distribution of the herds in addition to the population count.

In ideal or nearly ideal conditions, our method could potentially provide greater accuracy than the accepted norm, but we can never claim 100% accuracy in "real world" conditions. Some reasons for this are:

(1) The biggest source of error is that the infrared scans do not actually show "deer" – they show thermal patterns and any anomaly in the pattern must be analyzed to determine whether it is likely caused by the presence of a deer or something else. Whether or not a particular thermal anomaly is a deer or something else is always a judgement call. The survey and analysis are performed utilizing high quality equipment and powerful analytical software. However, due to the limits of technology and the conditions unique to any given location within the site, the thermographer must rely on his or her background, knowledge of wildlife, knowledge of infrared science, and past experience to make the call as to whether or not a particular thermal signature resulted from the presence of a deer or not.

(2) Some thermal anomalies may be due to the presence of other warm-blooded animals – horses, livestock, humans, and even smaller animals such as coyote and bear. For purposes of this survey, it was assumed that all signatures consistent with the presence of deer were, in fact, deer. If it

General Notes and Disclaimers (cont'd):

is known that a particular part of the surveyed area is regularly used for livestock grazing (for example), please let me know so I can reevaluate the area(s).

(3) Although not a large source of error, wildlife does move. As stated previously, deer are crepuscular animals and are most active around dusk and dawn. We generally start our surveys at least two hours after sunset to allow the deer time to become less active. Still, deer may be on the move at any time of the night and could conceivably cover enough ground to either be counted twice or missed altogether.

(4) Our infrared scan was planned and performed to the best of our ability and knowledge with consideration to infrared science, thermography, wildlife biology, weather conditions, site geography and topography, and other conditions *at the time the work was completed.* However, this report can only be considered accurate for the dates and times of the scan. The results presented herein will be different from those of any other survey (infrared or otherwise) that may have been done in the past or may be done in the future.

Survey Details and Condition Analysis:

Geographic Data:

The areas surveyed were in Mahoning County, Ohio. The areas surveyed were irregularly shaped but consisted of approximately 4,859 total acres within fifteen (15) distinct parks. The total area surveyed of approximately 8,717 acres includes a buffer zone around each park, roughly 300'-400' wide.

Site Conditions:

Several areas of the parks were very densely wooded. Even without leaves on the trees, thermal signatures of the deer can be masked by tree branches in densely wooded areas and very difficult to pick out. However, it is worth noting that in such heavily wooded areas, ground vegetation (food) is scarce, so deer are less likely to be present there anyway.

It was estimated that there was about 2" of snow cover in all scanned areas on both nights of the scan. It was also below freezing on both nights – temperatures were approximately 15°F and below on the night of January 21/22 and approximately 29°F and below on the night of February 18/19 – for the duration of the scans both nights. Winds were less than 10mph and humidity levels both nights were slightly high for winter (~70% Jan 21/22, ~60% Feb 18/19).

My overall assessment is that the site physical conditions were very good and that the overall weather conditions were very good both nights. Data quality was excellent both nights. My overall assessment of the survey conditions was very good.

Due to the previously mentioned factors, we can never guarantee total accuracy in any survey. However, I feel that these results are comfortably within the generally accepted "normal" accuracy range of 85%.

Celestial Data:

Dates and times of survey:

(1) Approximately 9:05 PM EST January 21
to approximately 1:35 AM EST January 22

(2) Approximately 10:15 PM EST February 18
to approximately 12:45 AM EST February 19

Sunset times:

(1) Approximately 5:25 PM EST, January 21, 2024

(2) Approximately 5:59 PM EST, February 18, 2024

Weather Data:

Sky condition during survey:
Clear skies on Jan 21/22; partly cloudy on Feb 18/19.

Temperature:
At or below freezing for the entire duration of the survey, both nights. (15°F and below Jan 21/22; 29°F and below Feb 18/19)

Winds at time of scan:
Less than 10 mph for the entire duration of the survey, both nights.

Snow cover:
Approximately 2” at all locations, both nights.

My overall assessment of the suitability of the environmental conditions for an infrared wildlife survey is that the conditions were very good, both nights.

Review of Acquired Data:

Flight conditions were excellent during the scan with some wind (approximately 5 to 10 mph) but minimal turbulence, both nights.

All equipment functioned as expected.

Due to variations in elevation across the site, lack of thermal contrast in some areas, and the very narrow depth of field of the infrared camera, some portions of the data were not optimally focused. However, data from all flight lines was usable.

Overlap of flight lines was good and consistent and there were no gaps in coverage noted.

Resolution of the imagery was calculated to be between 10" and 12" per pixel in most areas. This resolution is more than adequate to detect thermal anomalies caused by the presence of deer.

My overall assessment of the data quality is that it was very good.

Infrared Scan Results and Discussion:

A total of 1,864 thermal infrared signatures with properties consistent with the presence of deer were identified within the fifteen (15) parks' survey areas.

Of those signatures, 1,417 were within the various park boundaries as we were provided. The remaining 447 signatures were outside, but within 400' of a park boundary. Animals observed within the buffer zone likely reside mainly within the parks.

Pins for thermal signatures observed in the buffer zone were placed in Google Earth and were labeled "x" (as opposed to pins within the park boundaries that have no label). Note that although some pins were placed in Google Earth to identify signatures that were more than 400' from the closest park boundary (labeled "xx"), the signatures were NOT included in the counts.

It should be noted that if a thermal signature was within one park's surveyed area as well as within the buffer zone of an adjacent park, the signature was only counted once (for the park it was within).

Two sets of calculations are included with the report. The first set's calculations are based strictly on the number of signatures observed within the park boundaries. The second set includes the buffer zone in the area calculations and the additional signatures observed within the buffer zone.

The second set of calculations which includes signatures in the buffer zone is likely to be the more accurate representation of the "true" density of the population.

Infrared Scan Results and Discussion (cont'd):

It should be noted that the higher the ratio of surveyed area to park size, the more skewed the "acres per deer," "deer per acre," and "deer per square mile" calculations will be. When the ratio of surveyed area to park size is greater than ~2.0, a small difference in the count can result in a large difference in animal density. Specifically:

- Very small parks such as Cranberry Run and Sebring Woods (and really, any park less than 0.5 square miles / 320 acres) are so small, that the deer per square mile calculations are extremely unreliable.

- Calculations for parks that have very irregular boundaries (such as Mill Creek) can also be skewed higher due to extrapolation.

- Calculations can be drastically skewed when a park is both small and has irregular boundaries (such as Yellow Creek).

In all of these situations, a small difference in the number of deer observed can result in large variations in the calculations.

Overall, the density of deer in all of the parks was very high, even when taking these things into consideration. It is not uncommon to see densities in the 100-150 deer per square mile range in this area of the country, but most of the parks here were even higher.

Conclusions:

Results of this survey must be reviewed with wildlife management experts and personnel that are familiar with the specific parks and the deer population therein to determine any specific reasons for, or problems due to, deer overpopulation; to determine the overall health of the herd; to determine the health of the ecosystem of the parks; or to make any decisions regarding further action.

If there are any questions regarding the data, this report, or the survey in general, please do not hesitate to contact me.

List of files and images included in report:

(1) Count Summary showing number of thermal signatures identified on a per-park basis as well as some calculations on density and habitat.

(2) Count Ranges (based on estimated accuracy) and additional density/habitat calculations.

(3) Aerial photo maps showing the location of observed thermal signatures consistent with the presence of deer (aerial images used are Copyright Google® Earth) in each park.

Additional file delivered:

Mill Creek MetroParks 2024 Deer Survey – Final.kmz: This file is a "Google® Earth" KMZ file showing the park boundaries as provided, the approximate survey area for each park (purple outlines), and the approximate observed locations of infrared signatures consistent with the presence of deer. This file can be opened and viewed within Google® Earth.

Each marker on the result maps and included in the KMZ file indicates the number of signatures detected at each location. The observed location of the signatures is at the pointed end of the marker. For groups of deer, the pointed end of the marker was placed approximately in the middle of the group.

In some areas, the markers could be placed very accurately. However, in heavily wooded areas or areas that have little or no distinguishing land features, the placement accuracy may be lower.

A marker with “no name” indicates that the signature was observed inside the park boundary. A marker named “x” means that it was observed outside the park, but within the buffer zone. A marker named “xx” means it was outside the park and more than 400’ away from a boundary. Markers named “xx” were NOT included in any park or buffer zone count.

Side note: The marker description (such as “151-617-325-240”) is only used internally during the analysis of the data. It is in, in effect, a serial number for that particular signature which allows us to quickly find it in the infrared data sequences if needed for further review. If there are two serial numbers in the description, the signature was observed in the overlap area of adjacent flight lines and deemed to be the same thermal signature or set of signatures.

2024 Deer Count Summary - All Parks

	Park	Park Size (acres)	Park size (sq miles)	Thermal Signatures Observed within Park Boundaries: Count	Acres per Deer	Deer per Acre	Deer per Sq Mile	Acres Surveyed	Sq Miles Surveyed	Thermal Signatures Observed within Park Boundaries plus Signatures within ~300-400' buffer: Count	Acres per Deer	Deer per Acre	Deer per Sq Mile	Ratio of Surveyed Area to Park Size
Central	Mill Creek Park	1,626	2.54	565	2.88	0.35	222	3,170	4.95	781	4.06	0.25	158	1.95
Central	Hitchcock Woods	689	1.08	255	2.70	0.37	237	1,010	1.58	325	3.11	0.32	206	1.47
Central	Huntington Woods	383	0.60	118	3.25	0.31	197	568	0.89	124	4.58	0.22	140	1.48
Central	Mill Creek Wildlife Sanctuary	482	0.75	181	2.66	0.38	240	708	1.11	213	3.32	0.30	193	1.47
Central	Collier Preserve	303	0.47	72	4.21	0.24	152	459	0.72	83	5.53	0.18	116	1.51
East	McGuffey Wildlife Preserve	78	0.12	11	7.09	0.14	90	159	0.25	15	10.60	0.09	60	**2.04**
East	Yellow Creek	76	0.12	22	3.45	0.29	185	281	0.44	24	11.71	0.09	55	**3.70**
East	Springfield Forest	89	0.14	21	4.24	0.24	151	209	0.33	44	4.75	0.21	135	**2.35**
East	Cranberry Run Headwaters	27	0.04	7	3.86	0.26	166	76	0.12	19	4.00	0.25	160	**2.81**
West	Vickers Nature Preserve	262	0.41	30	8.73	0.11	73	404	0.63	48	8.42	0.12	76	1.54
West	Sebring Woods	39	0.06	20	1.95	0.51	328	102	0.16	23	4.43	0.23	144	**2.62**
West	Egypt Swamp Preserve	75	0.12	14	5.36	0.19	119	256	0.40	28	9.14	0.11	70	**3.41**
West	Sawmill Creek	167	0.26	22	7.59	0.13	84	276	0.43	34	8.12	0.12	79	1.65
West	MetroParks Farm	402	0.63	53	7.58	0.13	84	637	1.00	64	9.95	0.10	64	1.58
West	Hawkins Marsh	161	0.25	26	6.19	0.16	103	402	0.63	39	10.31	0.10	62	**2.50**
	Totals and Averages:	4,859	7.59	1,417	3.43	0.29	187	8,717	13.62	1,864	4.68	0.21	137	1.79

Overall for all parks

Estimated survey accuracy: **85%**

Count:	1417	thermal signatures within parks
Site size:	4,859	park acres
Site size:	7.59	park sq miles

Count:	1864	total thermal signatures
Site size:	8,717	acres surveyed
Site size:	13.62	sq miles surveyed

Estimated ranges:

	Low	**Count**	High
Total:	1204	1417	1630
Park acres per deer:	4.0	3.4	3.0
Deer per park square mile:	158.6	186.6	214.7

Estimated ranges:

	Low	**Count**	High
Total:	1584	1864	2144
Surveyed acres per deer:	5.5	4.7	4.1
Deer per surveyed square mile:	116.3	136.9	157.4

2024 Deer Count Ranges by Park - CENTRAL

(estimated accuracy of survey: 85%)

Mill Creek Park

	Park Area (1,626 acres)			Surveyed Area (3,170 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	480	**565**	650	664	**781**	898
Acres per deer:	3.39	**2.88**	2.50	4.78	**4.06**	3.53
Deer per square mile:	189	**222**	256	134	**158**	181

Hitchcock Woods

	Park Area (689 acres)			Surveyed Area (1,010 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	217	**255**	293	276	**325**	374
Acres per deer:	3.18	**2.70**	2.35	3.66	**3.11**	2.70
Deer per square mile:	201	**237**	272	175	**206**	237

Huntington Woods

	Park Area (383 acres)			Surveyed Area (568 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	100	**118**	136	105	**124**	143
Acres per deer:	3.82	**3.25**	2.82	5.39	**4.58**	3.98
Deer per square mile:	168	**197**	227	119	**140**	161

Mill Creek Wildlife Sanctuary

	Park Area (482 acres)			Surveyed Area (708 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	154	**181**	208	181	**213**	245
Acres per deer:	3.13	**2.66**	2.32	3.91	**3.32**	2.89
Deer per square mile:	204	**240**	276	164	**193**	221

Collier Preserve

	Park Area (303 acres)			Surveyed Area (459 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	61	**72**	83	71	**83**	95
Acres per deer:	4.95	**4.21**	3.66	6.51	**5.53**	4.81
Deer per square mile:	129	**152**	175	98	**116**	133

2024 Deer Count Ranges by Park - EAST

(estimated accuracy of survey: 85%)

McGuffey Wildlife Preserve

	Park Area (78 acres)			Surveyed Area (159 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	9	**11**	13	13	**15**	17
Acres per deer:	8.34	**7.09**	6.17	12.47	**10.60**	9.22
Deer per square mile:	77	**90**	104	51	**60**	69

Yellow Creek

	Park Area (76 acres)			Surveyed Area (281 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	19	**22**	25	20	**24**	28
Acres per deer:	4.06	**3.45**	3.00	13.77	**11.71**	10.18
Deer per square mile:	157	**185**	213	46	**55**	63

Springfield Forest

	Park Area (89 acres)			Surveyed Area (209 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	18	**21**	24	37	**44**	51
Acres per deer:	4.99	**4.24**	3.69	5.59	**4.75**	4.13
Deer per square mile:	128	**151**	174	115	**135**	155

Cranberry Run Headwaters

	Park Area (27 acres)			Surveyed Area (76 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	6	**7**	8	16	**19**	22
Acres per deer:	4.54	**3.86**	3.35	4.71	**4.00**	3.48
Deer per square mile:	141	**166**	191	136	**160**	184

2024 Deer Count Ranges by Park - WEST

(estimated accuracy of survey: 85%)

Vickers Nature Preserve

	Park Area (262 acres)			Surveyed Area (404 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	26	**30**	35	41	**48**	55
Acres per deer:	10.27	**8.73**	7.59	9.90	**8.42**	7.32
Deer per square mile:	62	**73**	84	65	**76**	87

Sebring Woods

	Park Area (39 acres)			Surveyed Area (102 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	17	**20**	23	20	**23**	26
Acres per deer:	2.29	**1.95**	1.70	5.22	**4.43**	3.86
Deer per square mile:	279	**328**	377	123	**144**	166

Egypt Swamp Preserve

	Park Area (75 acres)			Surveyed Area (256 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	12	**14**	16	24	**28**	32
Acres per deer:	6.30	**5.36**	4.66	10.76	**9.14**	7.95
Deer per square mile:	102	**119**	137	60	**70**	81

Sawmill Creek

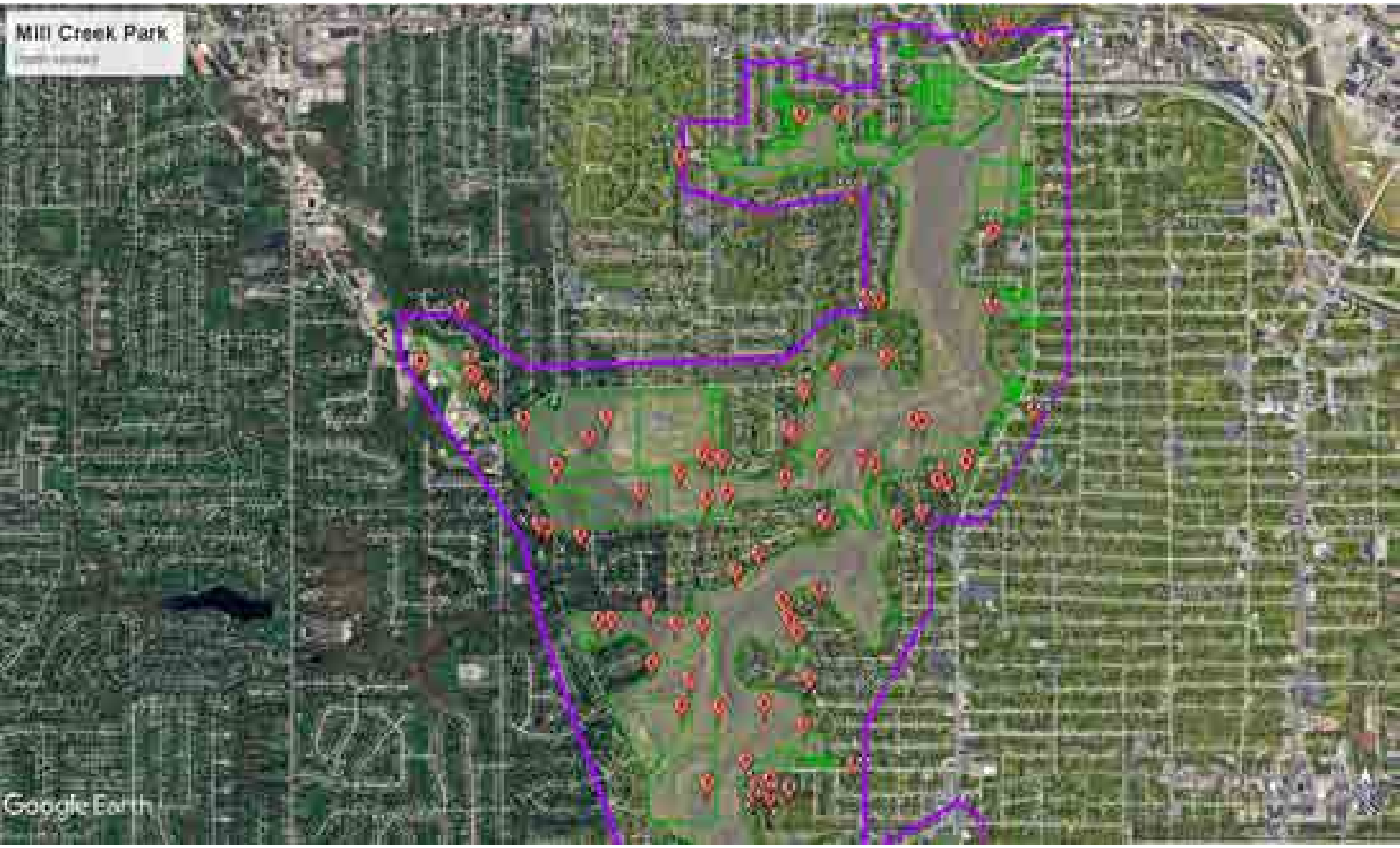
	Park Area (167 acres)			Surveyed Area (276 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	19	**22**	25	29	**34**	39
Acres per deer:	8.93	**7.59**	6.60	9.55	**8.12**	7.06
Deer per square mile:	72	**84**	97	67	**79**	91

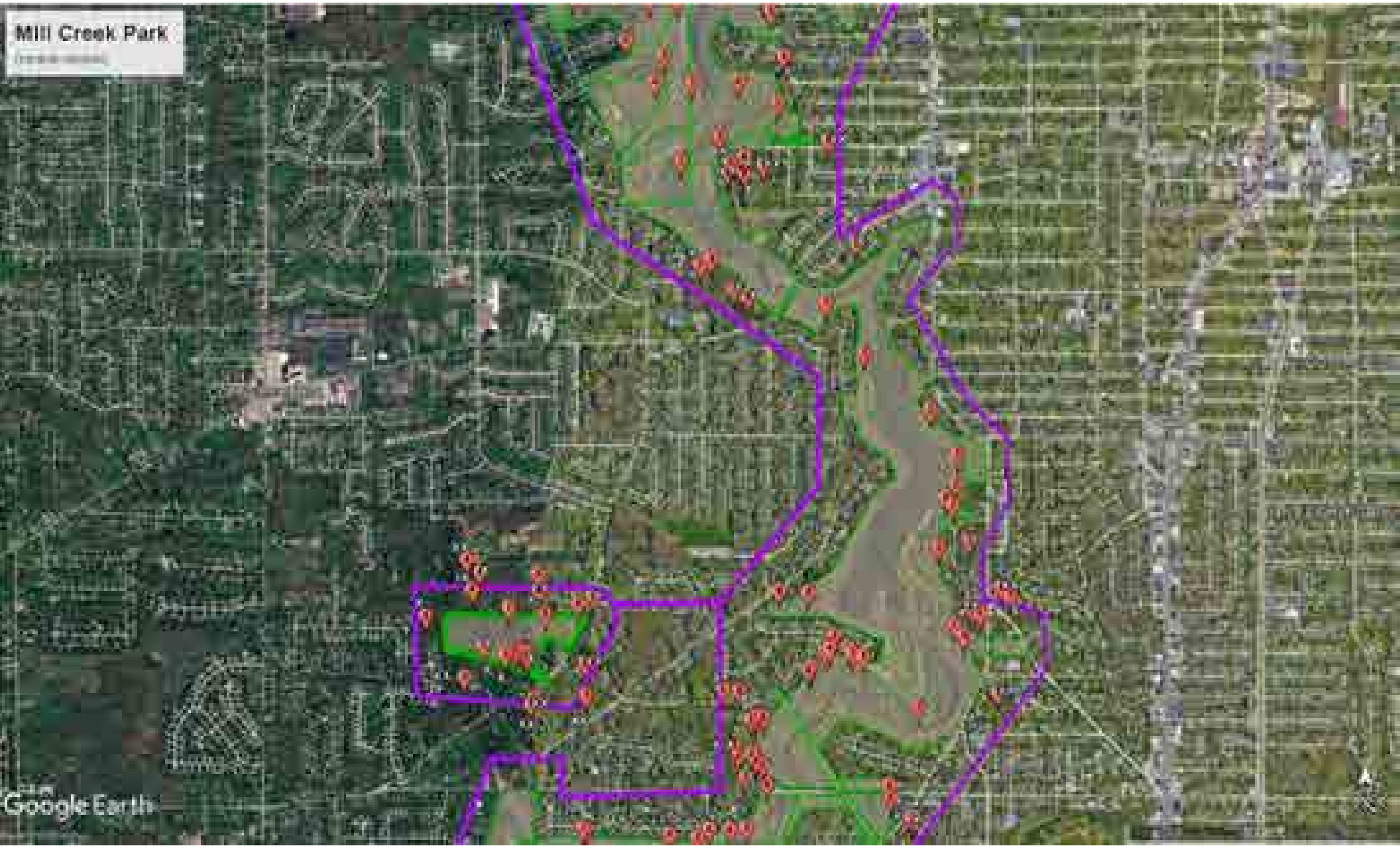
Metro Parks Farm

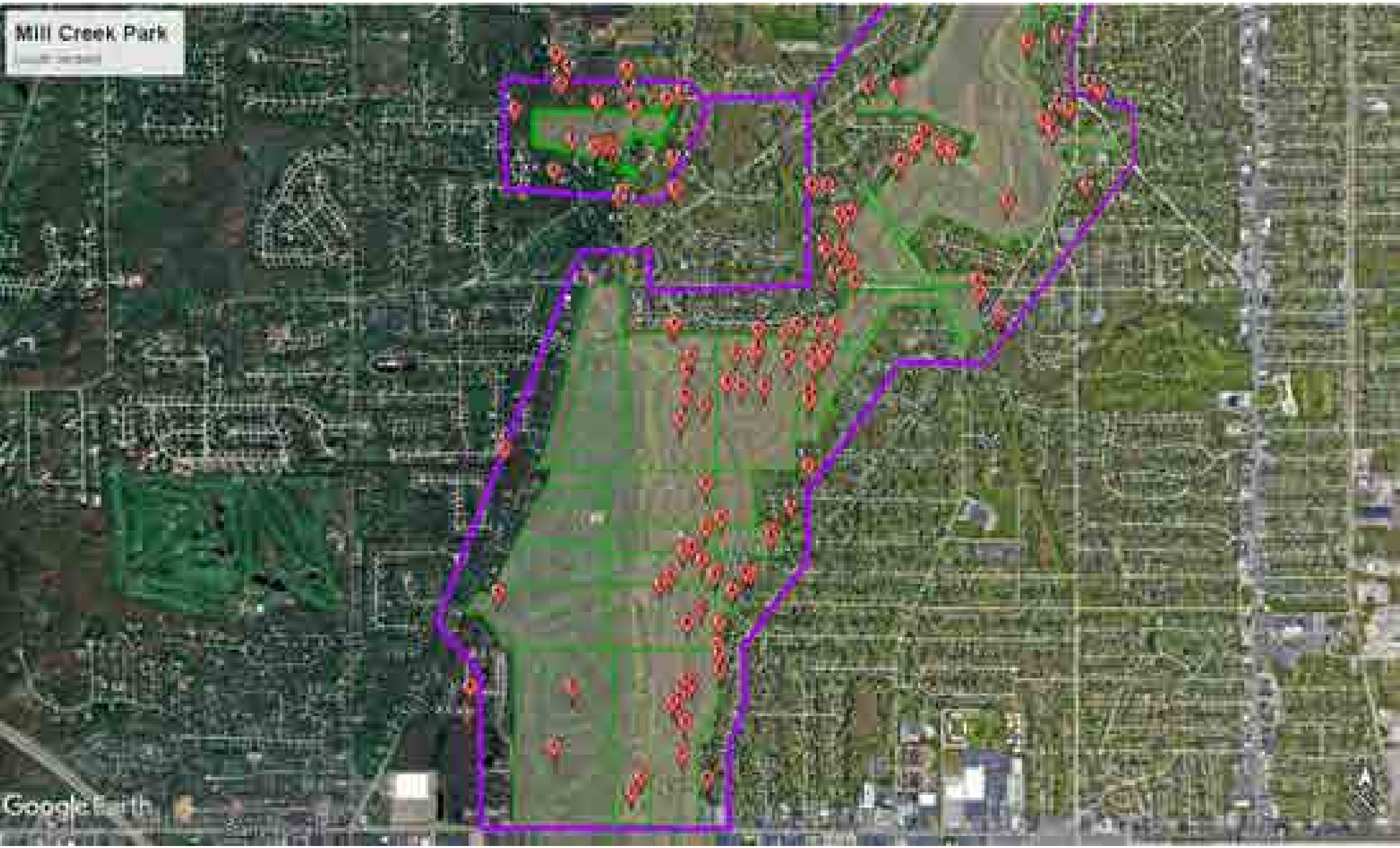
	Park Area (402 acres)			Surveyed Area (637 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	45	**53**	61	54	**64**	74
Acres per deer:	8.92	**7.58**	6.60	11.71	**9.95**	8.65
Deer per square mile:	72	**84**	97	55	**64**	74

Hawkins Marsh

	Park Area (161 acres)			Surveyed Area (402 acres)		
	Low	**Count**	High	Low	**Count**	High
Count:	22	**26**	30	33	**39**	45
Acres per deer:	7.29	**6.19**	5.38	12.13	**10.31**	8.96
Deer per square mile:	88	**103**	119	53	**62**	71


Mill Creek Park
Google Earth

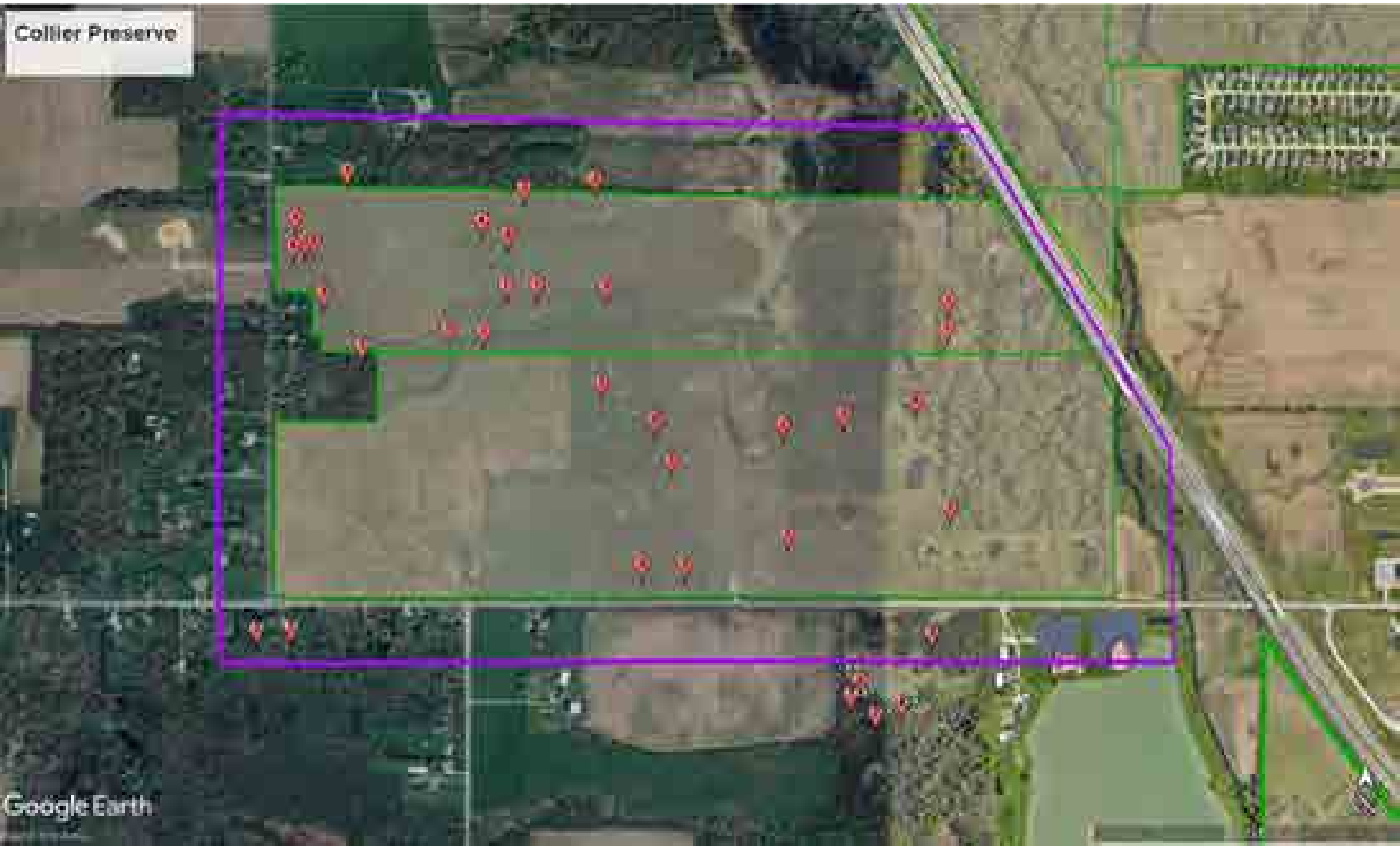

Mill Creek Park
Google Earth


Mill Creek Park
Google Earth

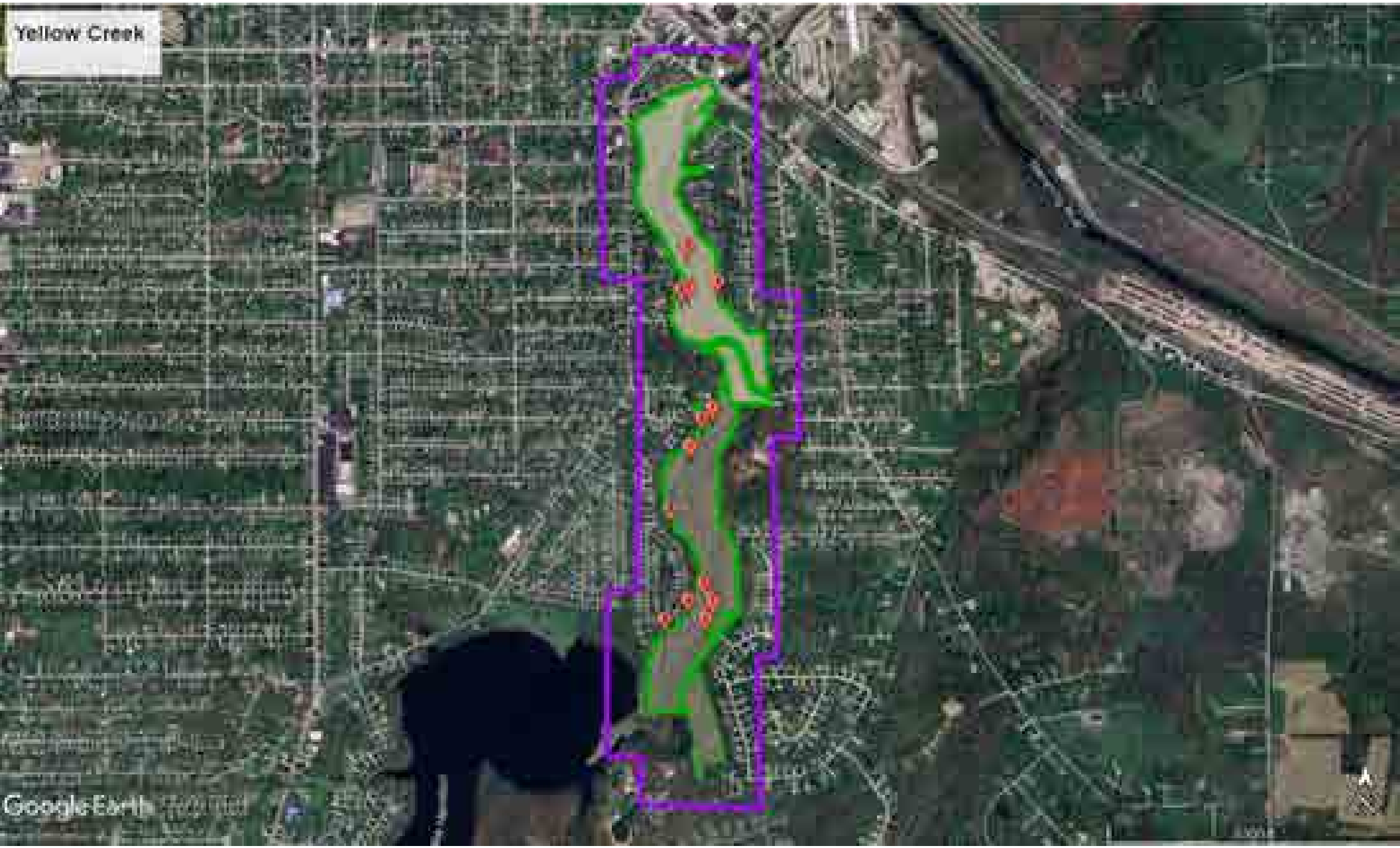

Hitchcock Woods
Google Earth


Huntington Woods
Google Earth


Mill Creek Wildlife Sanctuary
Google Earth


Collier Preserve
Google Earth


McGuffey Wildlife Preserve
Google Earth

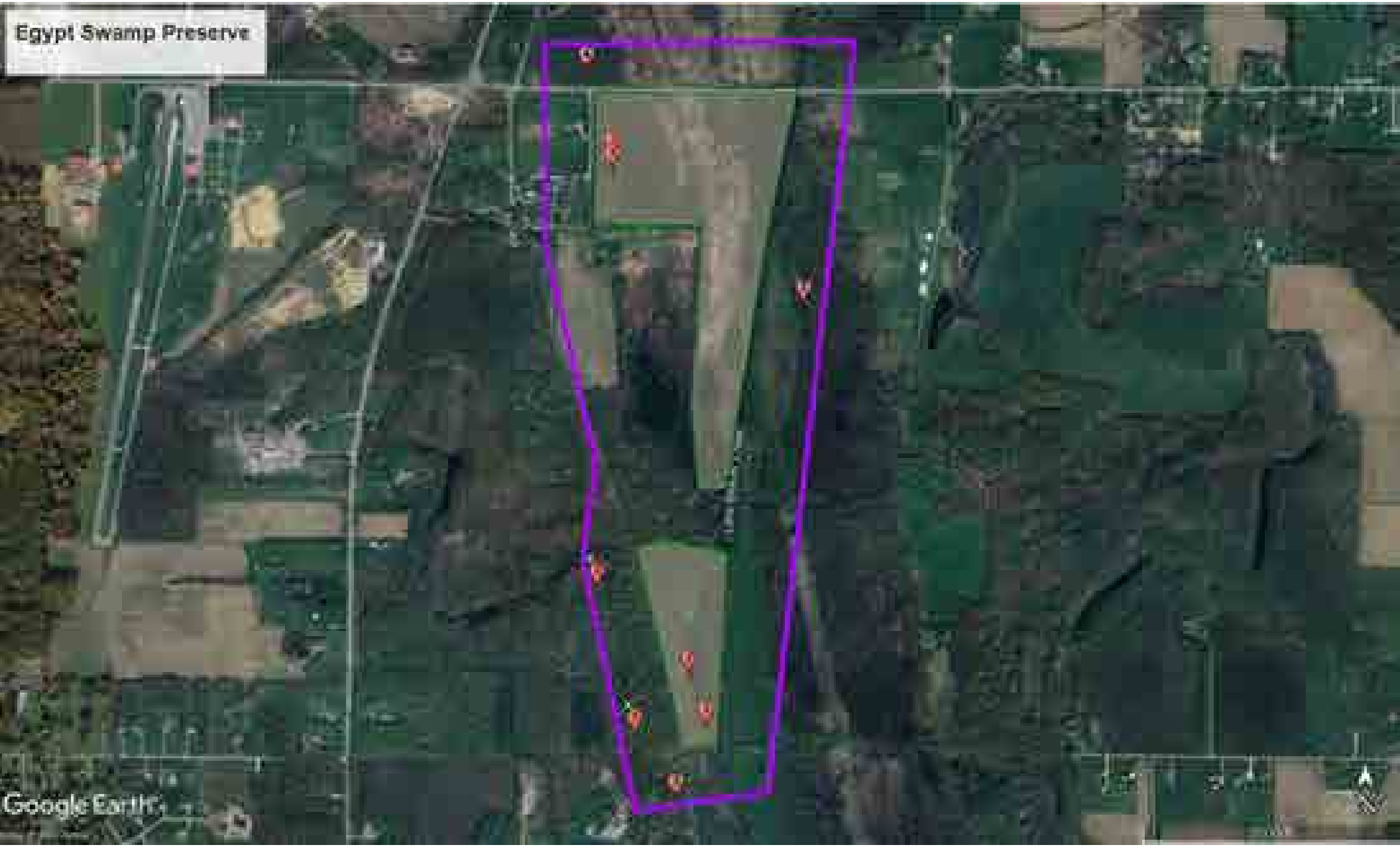

Yellow Creek
Google Earth


Springfield Forest
Google Earth


Cranberry Run Headwaters


Vickers Nature Preserve
Google Earth


Sebring Woods
Google Earth


Egypt Swamp Preserve
Google Earth


Sawmill Creek
Google Earth


MetroParks Farm
Google Earth


Hawkins Marsh
Google Earth

Certification:

The infrared survey was completed to the best of my ability utilizing one of the latest FLIR infrared cameras under conditions that were acceptable for this application. Acquired images were analyzed using the latest version of the "FLIR Tools+" and FLIR's ExaminIR software.

I, a Certified Level II Thermographer, attest that I performed the scan, analyzed the acquired images, and prepared the reports. When and if necessary, I consulted with a Certified Level III Thermographer regarding any anomalies that I was not comfortable with diagnosing myself.

Please feel free to contact me with any questions you may have regarding this report or any of the conclusions found in it.

This report was prepared by:

Mike Holthouse, Certified Level II Thermographer
Above All Aerial & Specialty Photography - Ohio

White-tailed Deer Population Densities - 2024 Trail Camera Survey
Mill Creek Park
Mahoning County, Ohio

Introduction

The White-tailed Deer (*Odocoileus virginianus*) is a member of the Cervidae family (alongside Elk, Moose, Mule Deer, etc.) and serves as a keystone herbivore throughout its native range which primarily includes eastern North America. White-tailed deer have proven to be extremely adaptable, as their populations have risen exponentially since the late 20th century despite increased habitat fragmentation caused by human development. As the population of white-tailed deer on the landscape rises and the amount of available habitat is reduced, a definitive increase in negative impacts associated with the overabundance of deer has become apparent over the last several decades. While these effects can be felt across all landscapes, they are often disproportionally concentrated in urban/suburban areas including parks and municipalities.

The purpose of this survey effort was to better understand the current size, structure, and health of the deer herd located within Mill Creek Park and help shape management decisions moving forward into the fall.

Materials and Methods

The survey methodology discussed below was based upon the guidelines provided by researchers at the Mississippi State University Deer Ecology and Management Lab and the National Deer Association.

Site Selection

Fifteen (15) camera locations were chosen based upon known areas of deer activity, ease of access for maintenance, and to be evenly distributed throughout the facility (see attached map). Each camera is designed to cover a 100-acre area, however there are three (3) instances of overlap between cameras this overlap is reflected in the total surveyed area (1436 acres).

Survey Duration

After site selection, a motion activated trail camera was placed at each location with shelled corn used as attractant (~25# per camera) for a period of fourteen (14) days beginning on 8/5 and concluding on 8/19. Camera locations were rebaited three (3) times per week on Monday, Wednesday, and Friday of each week.

Data Collection and Review

The trail cameras were programmed to take pictures 24-hours per day but would only trigger once every five (5) minutes taking one photo at a time – each photo was time and date stamped.

During the survey period, SD cards were collected from each camera on the Friday of each week and the data was reviewed and categorized. Photos were separated into four (4) categories: unique bucks, total bucks, total does, and total fawns - any photos that could not identified and placed into these categories were not used in the final count.

Results

Data was analyzed using the guidelines provided by the MSU Deer Lab and the National Deer Association (NDA). This methodology is based upon the number of known unique bucks photographed compared to the total number of buck pictures taken – dividing these two numbers gives you a "population factor" that can then be used to estimate the number of unique does and fawns based upon the total number of photos taken.

In total, the 15 cameras collected 3,951 photos of white-tailed deer during the two-week survey window – once categorized, the total breakdown is as follows:

- Surveyed Area – 1436 Acres (2.24 mi^2)
- Unique Bucks – 42
- Total Buck Pictures – 753
- Total Doe Pictures – 2197
- Total Fawn Pictures - 1001

Using these figures, the computation form provided by the National Deer Association was used to estimate the total population, sex ratios, and deer densities within the surveyed areas – the results are as follows (see attached data sheet):

Total Estimated Population – 246 (47 Bucks, 137 Does, 56 Fawns)

- Doe to Buck Ratio – 2.91
- Fawn to Doe Ratio – 0.45
- Acres per Deer – 5.84
- Deer Density per Square Mile – 110

*Equipment malfunctions occurred during week 1 of the survey at the Bears Den camera location, and during the second week 2 at the Calvary Run location resulting in no pictures being collected. This negatively impacted the total number of pictures collected, therefore, would also have impacts to the end result particularly in the northern data set.

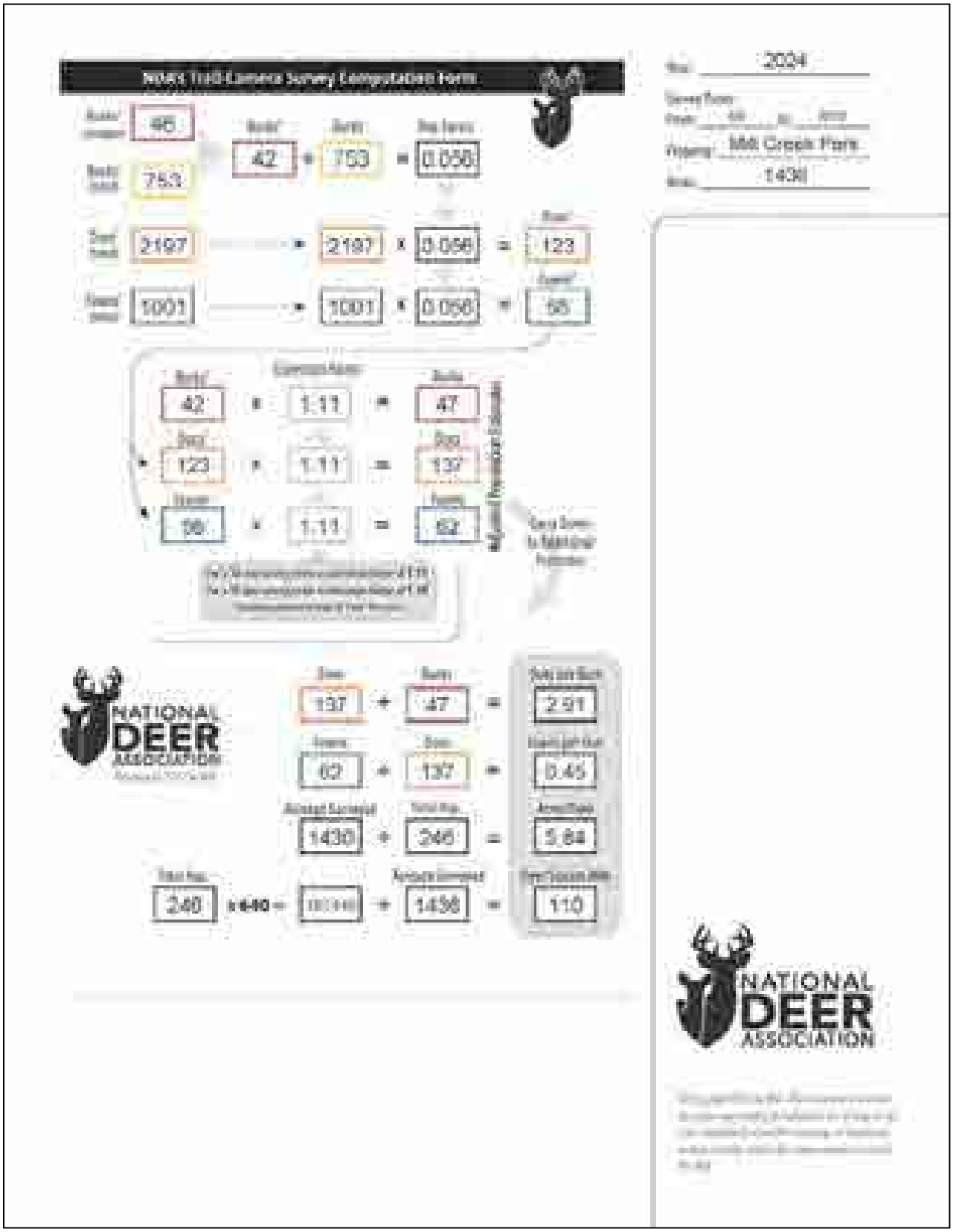
<u>Survey Accuracy</u>

This survey effort should be considered a minimum population density and should only be considered accurate at the time of survey. Deer movements and their utilization of any given property will change throughout the season and year to year depending upon available resources (food, water, shelter).

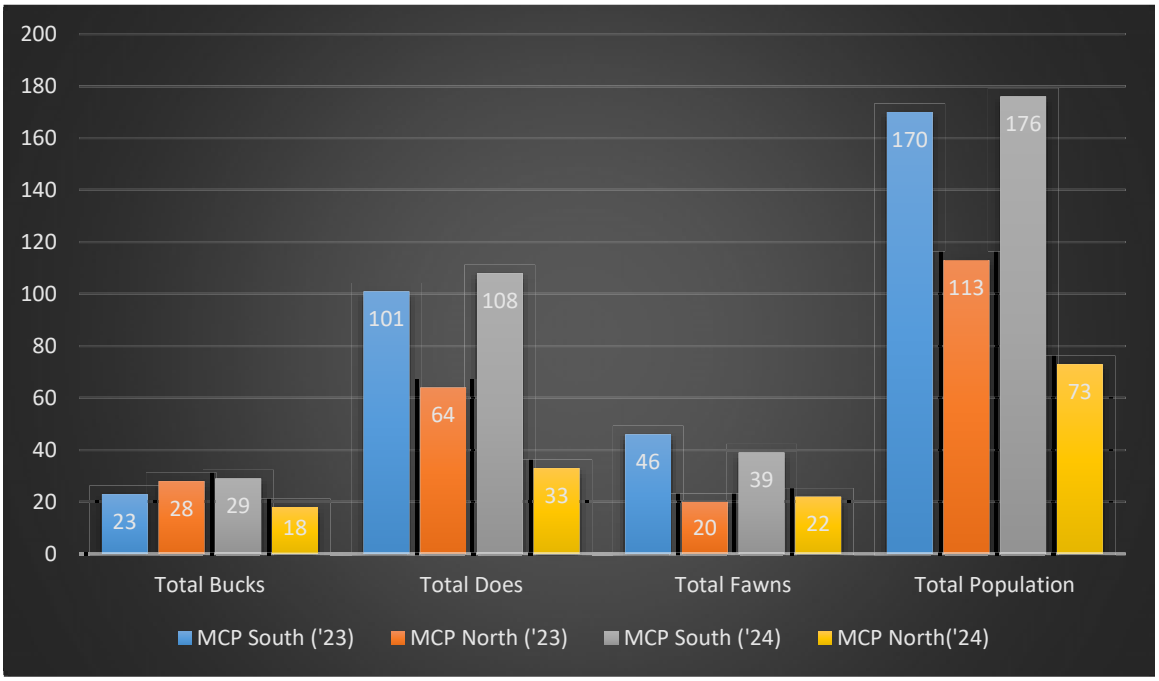
Based upon research from MSU Deer Lab, we know that trail cameras are 90% effective at documenting deer within 100 acres over the course of a 14-day survey period, this is supported by the fact that buck movement between cameras was very limited.

If we assume that deer are evenly distributed across the landscape, based upon the density estimate of 110 deer/mi^2 an adjusted estimate for the entirety of Mill Creek Park (1626 acres or 2.54 mi^2) would be 279 deer within park boundaries. Furthermore, using the same assumption we can extend the survey area to include an approximate ~300 - 400' buffer beyond park boundaries (3491 acres or 5.45 mi^2) the estimated total population would rise to 599 deer. Again, deer movement varies greatly throughout the year based upon food sources, weather conditions, breeding, etc. Factors such as emigration, immigration and deer distribution during different times of year in relation to MetroParks boundaries are largely unknown at this time.

MCP Trail Camera Data Sheet 2024



MCP Deer Densities North vs. South of Midlothian Blvd. 2023-2024



*Both equipment malfunctions (Bears Den & Calvary Run) are located in the northern section of the park, therefore, any errors in population estimation would be more exaggerated when looking solely at the 2024 northern data set.

To aide in determining management decisions relating to the 2024 targeted removal program, the data was also separated into two (2) sets which represent Mill Creek Park north of Midlothian Blvd. and Mill Creek Park south of Midlothian Blvd. As seen in the graph above, the distribution of antlered bucks was fairly even throughout the park, however, the number of does and fawns were notably higher in the southern section in both years. Additionally, the graph shows that the overall population estimate for the southern section of the Park is largely unchanged from 2023-2024, despite the removal of 38 deer in 2023 (37 antlerless, 1 antlered), indicating the need for continued and increased management effort in this area.

Discussion

The recommended population density of white-tailed deer is 10-20 per square mile, populations greater than this often exceed the ecological carrying capacity of the landscape and can cause significant damage to native flora due to overbrowsing. As documented by this study, the number of unique antlered bucks alone exceeds ecological carrying capacity (47 bucks/2.24 mi^2 = 21 bucks per mi^2) – when the entire population is considered (110 deer/mi^2) estimates greatly exceed carrying capacity, further demonstrating the continued need for active management of deer populations within Mill Creek Park.

Evidence of extensive ecological damage caused by overbrowsing is readily apparent throughout the Park with distinct browse lines and little to no understory regeneration are commonplace – this can be seen visually but is also support through ecological survey work conducted in 2023 and 2024 that be found on the MetroParks' website (https://www.millcreekmetroparks.org/white-tailed-deer-in-mill-creek-metroparks/).

Notes

Many of the pictures collected were of raccoons, birds, and other wildlife – the subsequent 5-minute delay likely resulted in some deer not being photographed if they passed through while the camera was inactive. With that being said, the methodology provided by MSU and NDA accounts for this possibility and it is assumed that ~90% of the deer within a 100-acre study zone will be photographed over a 14-day survey window.

It is recommended that for futures surveys, cameras be programmed to take 2 or 3 pictures bursts on the same 5-minute timer. This will increase the labor demand when counting and sorting photos but will provide more information when identifying deer.

Additional Resources

Conducting Camera Surveys to Estimate Population Characteristics of White-tailed Deer
http://extension.msstate.edu/sites/default/files/publications//p2788.pdf

United States Department of Agriculture
Animal and Plant Health Inspection Service
Wildlife Services

Summary of the WS Helicopter Survey for White-tailed Deer in Mill Creek Metro Parks
9 January 2025

Submitted by:
USDA APHIS Wildlife Services
6100 Columbus Avenue
Sandusky, OH 44870
(419) 625-9093

Table of Contents

List of Figures

Introduction

The United States Department of Agriculture, Wildlife Services (WS) program was requested to conduct a helicopter survey of the white-tailed deer (*Odocoileus virginianus*) population across several properties managed by the Mill Creek Metro Parks (MCMP). The objective of the survey was to provide MCMP with an index of the deer population on and directly adjacent to their properties.

Survey Area

The MCMP properties included in the survey were the Mill Creek Park, Huntington Woods, Hitchcock Woods, Collier Preserve, and the Mill Creek Wildlife Sanctuary. A 1,500-ft buffer surrounding each park or preserve was incorporated into the survey design (Figure 1). The total area to be surveyed was approximately 14 square miles.

Methods

The helicopter survey was conducted using adjacent transects that were 200 meters apart (Figure 1). The survey crew consisted of an observer and a pilot. The pilot and the observer worked together to count deer. The number of deer observed, and their approximate locations were recorded using the Environmental Systems Research Institute (ESRI) QuickCapture application. (Figure 1).

Results

The MCMP survey was conducted on 9 January 2025. Flights occurred between 9:22 and 11:10. The helicopter began on the northern end of the eastern-most transect and worked towards the west. In total, 157 white-tailed deer were observed (Figure 1). Slightly over half (54%, N=84) of all deer observations were located south of State Route 224 (Figure 1).

Discussion

Visual surveys using observers in a helicopter provides a relatively simple and efficient means to surveying large areas. Inherent with these types of surveys is variability in detection rates or the ability to observe an animal. To estimate a more complete count, correction factors based on detection rates are often used. Many factors can influence detection rates (observers, habitat, weather, etc.). Snow cover is often considered essential for conducting visual counts with a helicopter in northern latitudes with forested habitat. Even with snow cover, detection rates using observers and a helicopter vary, ranging from 41%-99% (Rice and Harder 1977, Stoll et al. 1991, Beringer et al. 1998). The Ohio Division of Wildlife (ODW) currently recommends using a detection rate of 78.5% when conducting helicopter surveys with snow cover (ODW per. comm.).

Survey weather conditions were near optimal with uniform snow accumulation around four inches. Using a range of detection rates for similar habitat as described in the literature (75%-80%) and with which is consistent with the ODW detection rate (78.5%), the WS helicopter

survey is corrected to yield a range; of 196-209 white-tailed deer present within the area flown for the MCMP survey.

Recommendations

Wildlife Services recommends that MCMP continues to periodically use aerial surveys to evaluate other techniques being used to estimate deer populations in and around their properties. Regardless of the technique used, population estimates, and general locations of deer should be interpreted in conjunction with other quantifiable measures of deer damage (Morellet et al. 2007) such as, impacts to natural resources and human health and safety to aid in refining future deer management goals and objectives.

Literature Cited

Beringer, J., L. P. Hansen, and O. Sexton. 1998. Detection rates of white-tailed deer with a helicopter over snow. *Wildlife Society Bulletin* 26:24–28.

Morellet, N., Gaillard, J-M., Hewison, A.J.M., Ballon, P., Boscardin, Y., Duncan, P., Klein, F. & Maillard, D. 2007: Indicators of ecological change: new tools for managing populations of large herbivores. *Journal of Applied Ecology* 44(3): 634-643.

Rice, W.R. and Harder, J.D. 1977. Application of multiple aerial sampling to a mark recapture census of white-tailed deer. *Journal of Wildlife Management*. 41(2): 197-206.

Stoll, R.J., Jr., McClain, M.W., Clem, J.C. and Plageman, T. 1991: Accuracy of helicopter counts of white-tailed deer in western Ohio farmland. *Wildlife Society Bulletin*. 19(3): 309-314.

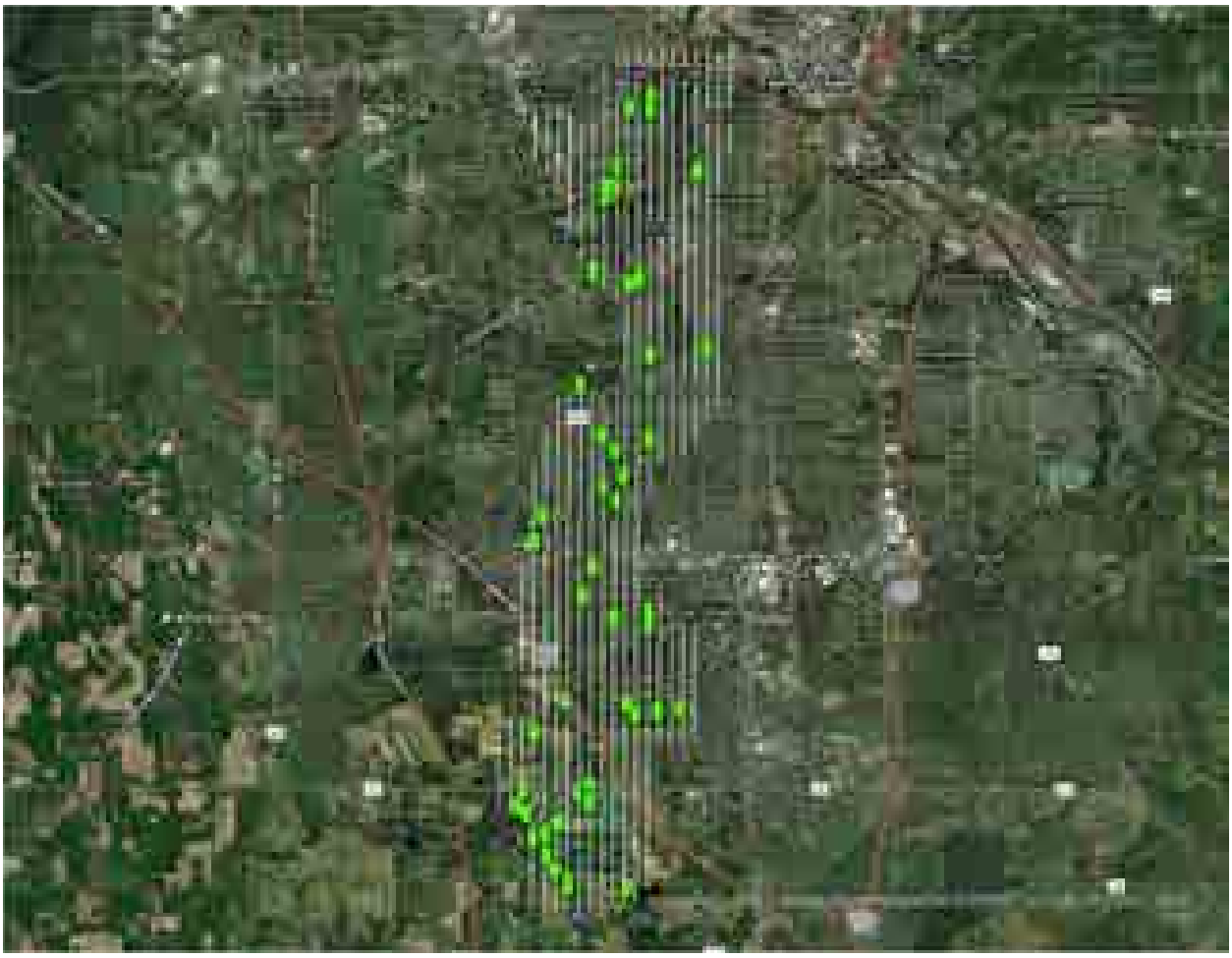


Figure 1. Flight transects used to conduct the helicopter survey of white-tailed deer on 9 January 2025. Green pins and white numbers indicate the approximate location and quantity of deer observed.

Appendix B: Ecological Survey Results

Assessment of Forest Regeneration in Mill Creek Park, Huntington Woods, and Hitchcock Woods

June 2023

Introduction:

By definition, forest regeneration is the process that allows a forest to replace and sustain itself in the long-term through the establishment and survival of seedlings and saplings that replace mature canopy trees as they die, either by natural causes or by large disturbance events such as windstorms, wildfire, or disease.

Healthy forest regeneration is a crucial component to forest management to ensure the long-term sustainability of our forest ecosystems for future generations.

Forest regeneration can be influenced by a number of variables such as habitat disturbance, invasive species introduction, disease, and herbivory by ungulates such as white-tailed deer.

While white-tailed deer are known as generalist herbivores, feeding on a wide range of woody and herbaceous plant growth, they are also preferential in their feeding habits which can negatively influence forest regeneration when populations exceed ecological carrying capacity.

In the case of Mill Creek MetroParks, the ecological effects of white-tailed deer overabundance such as distinct browse lines, stunted forest regeneration, and low species diversity have been anecdotally noted in some areas for over two decades, however, the effects of overbrowning have not previously been quantified.

Objectives:

To evaluate current conditions related to forest regeneration based upon seedling and sapling abundance/height and track changes through time in response to management changes such as deer management, invasive species treatment, and/or habitat manipulation.

Methods:

<u>Plot Description</u>

Survey plots (1-acre in size) were distributed throughout Mill Creek Park, Huntington Woods, and Hitchcock Woods where space allowed. Within each survey plot, five (5) microplots were established (6’ radius circle). The placement of microplots was standardized, with one microplot placed at the center of each 1-acre survey plot, additional plots were established at a distance of 60’ from the center point in four directions.

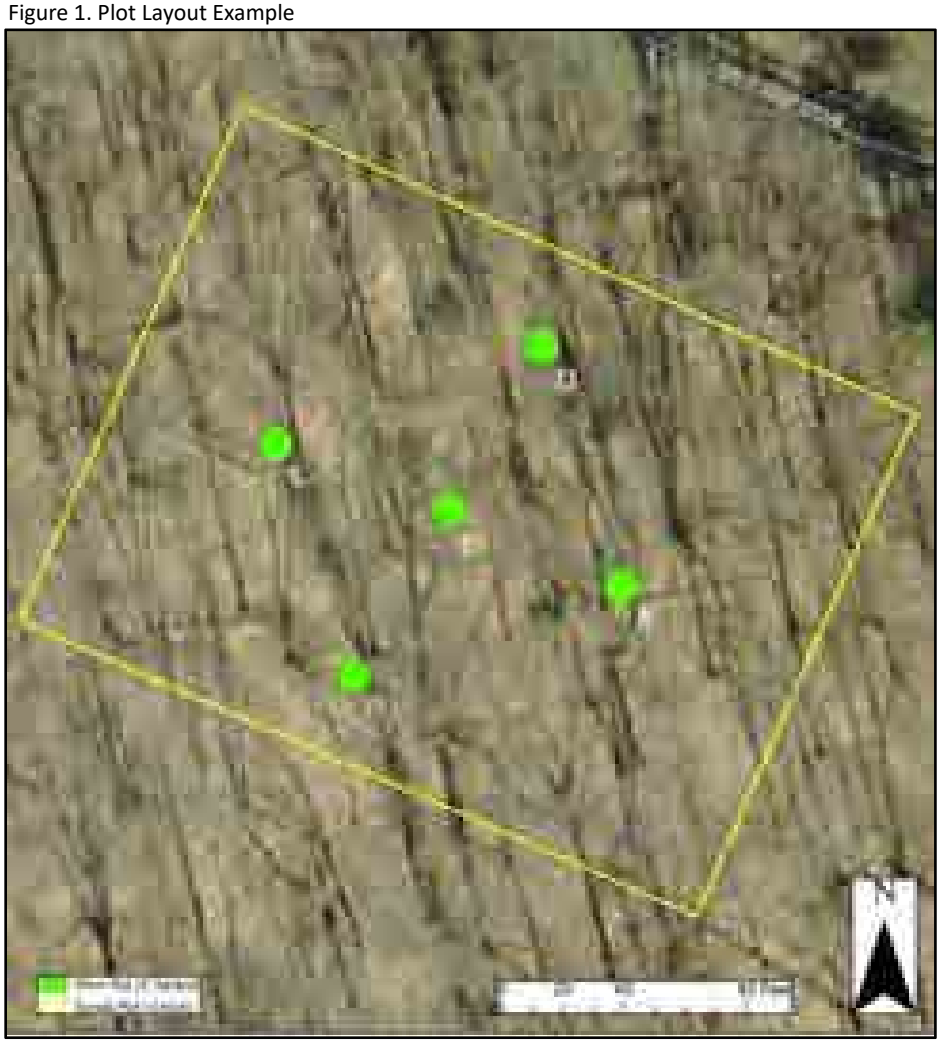
Plot Selection

Survey plots were established in upland hardwood sites with varying degrees of canopy closure (0%-95%). Sites with a lower prevalence of invasive species and desirable light availability were preferred when available to assess forest regeneration under the best possible circumstances given current site conditions. All plot locations were free of human caused disturbance such as logging, prescribed fire, or other active management.

If any of the following conditions are present at the predetermined 60' spacing, the microplot center point will be adjusted to the nearest suitable location:

- Obstructions such as rocks, downed trees, mature trees, roadways, or open water hinder the establishment of the microplot and/or subplot.
- The proposed plot location is located on a slope greater than 70%.
- The proposed plot location is dominated by large invasive shrubs (<75% coverage).

Figure 1. Plot Layout Example



Once microplots are established they are affixed with a permanent stake. These plots will be used to gauge changes in forest regeneration on an annual basis, but may also be used to examine other metrics such as winter browse damage and/or spring ephemeral wildflower abundance.

Data Collection

For the purposes of assessing forest regeneration, all woody vegetation less than 4.5" DBH located within each microplot was identified and categorized based upon size class. Woody vegetation was separated into five (5) size classes: <6", 6-12", 1-3', 3-5', and 5'+ with each size class being assigned a weighted score which reflects the survivability of each size class and it's value in terms of forest regeneration.

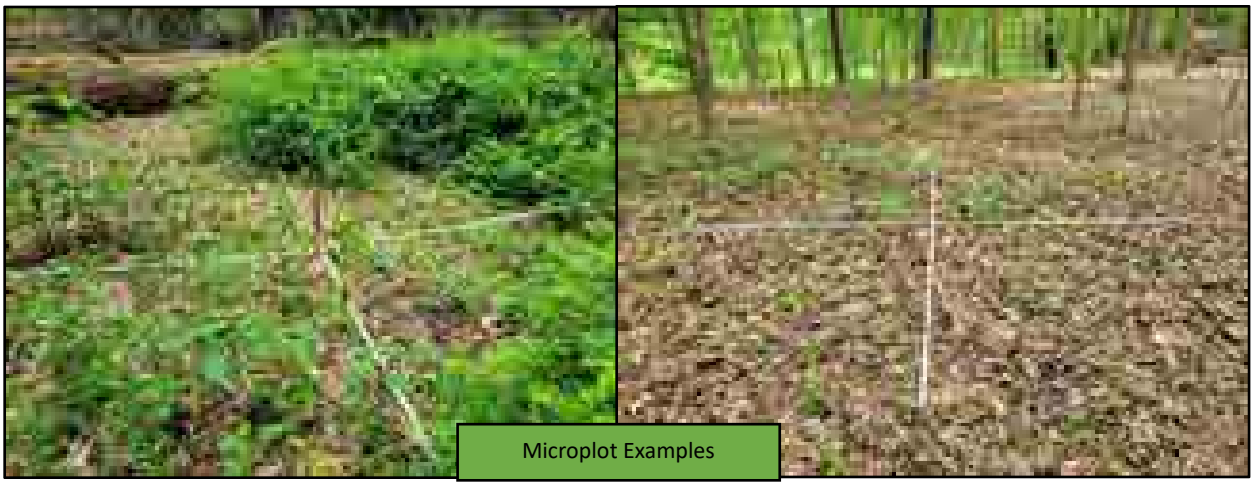
Additionally, percent canopy closure was assessed at the center point of each microplot, and photographs were gathered depicting both current plot conditions and canopy closure.

To provide a control, data was also collected from the deer exclosure located in Hitchcock Woods, which was first constructed in the year 2000 but was not refurbished and fully functional until 2018. The exclosure is 18x18' (324 sq ft) and has ~80% canopy closure directly above but is adjacent to a sizeable light gap to the south.

Figure 3. MCMP Forest Regeneration Scoring Chart

Size Class	Score
0-6"	0
6-12"	1
1-3'	2
3-5' Native Sub-Canopy or Shrub Species	7.5
3-5' Native Canopy Species	15
5'+ Native Sub-Canopy or Shrub Species (<4.5" DBH	15
5'+ Native Canopy Species (<4.5" DBH)	30

- Invasive species are noted but not assigned a positive score.
- Trees showing outward signs of disease or severe damage are scored at half value.
- Ash spp. will not be assigned a positive score due to their lack of long-term viability, caused by the emerald ash borer.
- Each microplot is assessed individually, a score of 150 points or greater signifies that plot as sufficiently stocked for forest regeneration.



Microplot Examples

Results:

22 survey plots (110 microplots) were established throughout Mill Creek Park, Huntington Woods, and Hitchcock Woods the results are as follows:

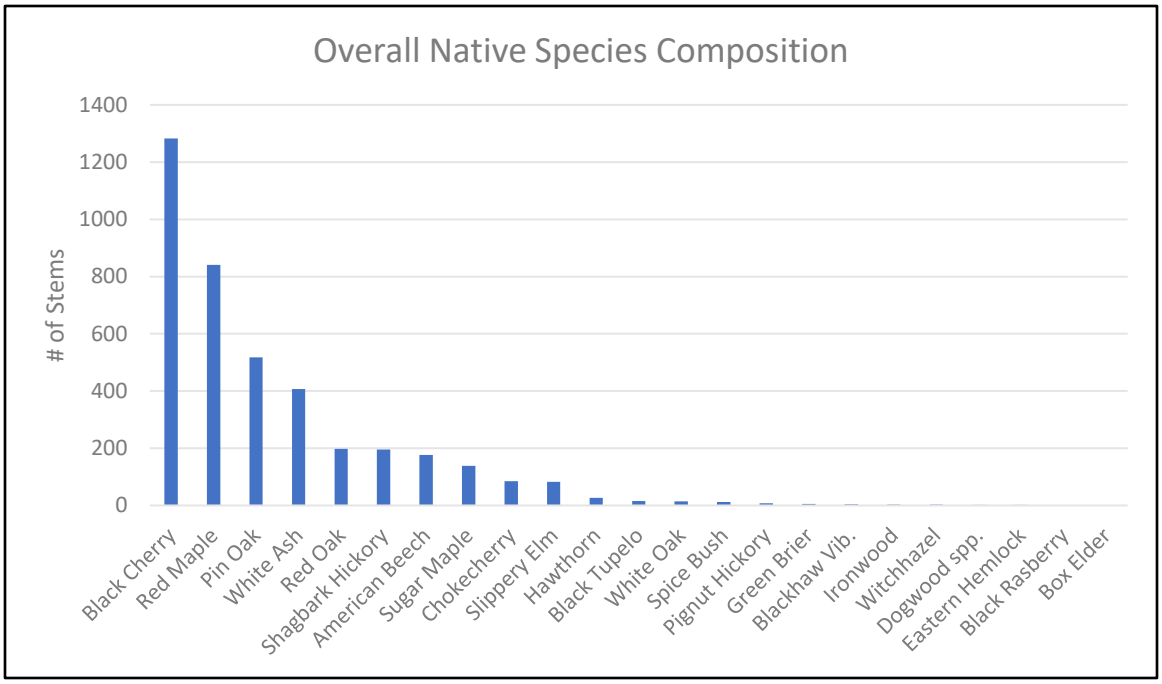
Species Composition and Diversity

In total, 4,446 woody stems were surveyed of those, a total of 22 native species and 8 invasive species were documented – native species accounted for 90% of the total stems surveyed (plots with <75% invasive shrub cover were excluded).

Of the 22 native species identified black cherry (*Prunus serotina*) and red maple (*Acer rubrum*) occurred with the most frequency and in combination account for 53% of all native woody stems. This is not surprising as these species typically have dense seeding rates, fast growth, and are tolerant to a wide range of soil conditions, often times making them the first canopy species to repopulate disturbed areas.

Other prominent species include pin oak (*Quercus palustris*), white ash (*Fraxinus americana*), red oak (*Quercus rubra*), shagbark hickory (*Carya ovata*), American beech (*Fagus grandifolia*) , sugar maple (Acer saccharum), and slippery elm (*Ulmus rubra*). Other species such as box elder (*Acer negundo*), eastern hemlock (*Tsuga canadensis*), and dogwood (*Cornus spp.)* occurred very infrequently in only 1 or 2 microplots. Of the 22 native species documented, only 11 (50%) were present in the 3-5’ and 5’ size class.

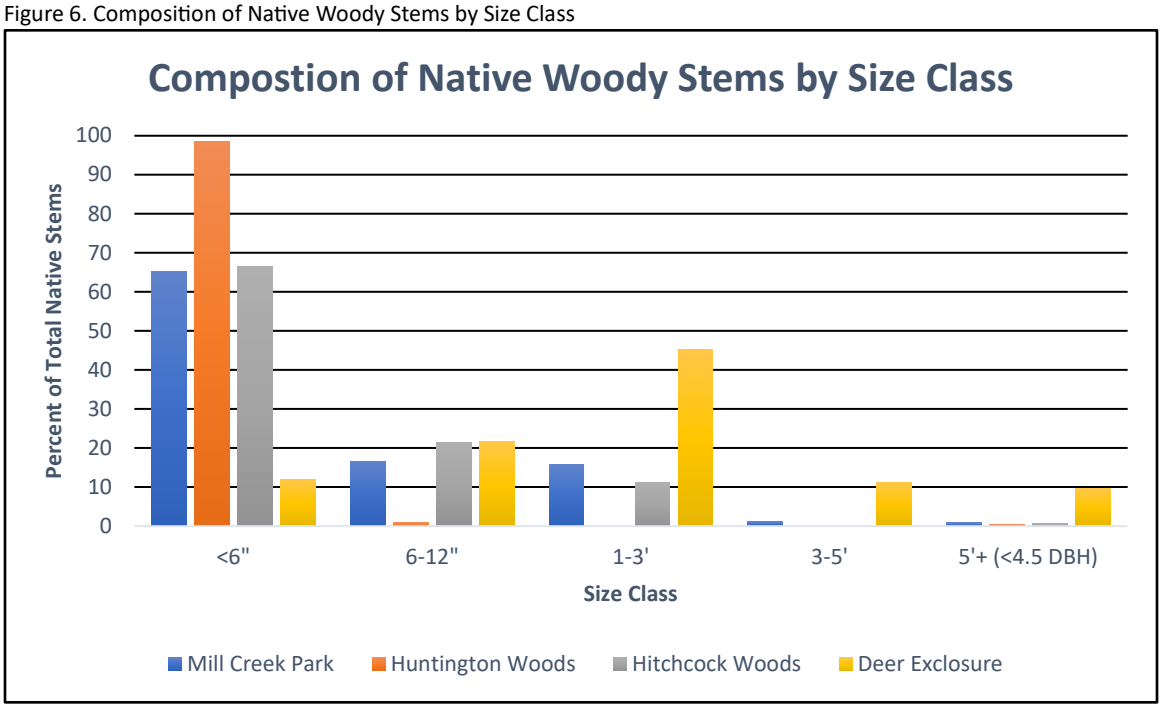
Figure 5. Overall Native Species Composition



Native Woody Stems by Size Class

As stated above, woody stems were separated into five (5) size classes the following data depicts the size class breakdown of woody stems found in all three (3) survey areas and the Huntington Woods deer exclosure.

Figure 6. Composition of Native Woody Stems by Size Class



The results show that overwhelmingly the <6” size class as the most abundant in areas unprotected from deer browsing, overall 75% of all native woody stems surveyed were less than 6” in height. In general, the larger size classes (3-5’ and 5’+) were absent from the unprotected survey areas and accounted for only 1.4% of the total stems surveyed.

On the contrary, in the Hitchcock Woods deer exclosure all size classes were well represented with 45% of stems being found in the 1-3’ size class.

Size Class: <6” (Germinant)

Woody stems less than 6” are considered “germinants” and were by far the most common size class documented– this size class represented 75% of all native woody stems surveyed with black cherry and red maple occurring most frequently. This size class is comprised of newly germinated trees – this is considered a very vulnerable size class with survivability being influenced by many variables such as sunlight availability, soil condition, weather, and herbivory.

Size Class: 6-12” (Small Seedling)

Woody stems from 6-12” are considered “small seedlings” and are typically 0-1 years old, however, this can vary widely based upon species and growing conditions. This size class accounted for 13% of all native woody stems surveyed – white ash and pin oak were the most common species in this size class. Small seedlings are still vulnerable to changes in growing condition and herbivory; however, this size class does have a higher rate of survival as compared to germinants.

Size Class: 1-3’ (Seedling)

Woody stems from 1-3’ are considered “seedlings” and are typically 1-2 years old depending upon species and growing condition. This size class accounted for 10% of all native woody stems surveyed – white ash and shagbark hickory were the most common species in this size class. This size class is less susceptible to environmental conditions such as changes in weather; however, we found this size class to be the most impacted by herbivory. Species (native and invasive) in this size class such as white ash, American beech, hawthorn, spicebush, multiflora rose, common privet, and glossy buckthorn all show signs heavy browse pressure from white-tailed deer.

Size Class: 3-5’ (Large Seedling)

Woody stems from 3-5’ are considered “large seedlings” and are typically 2-3 years old depending upon species and growing conditions. This size class accounted for only 0.5% of all native woody stems surveyed – chokecherry, American beech, and white ash were the only native species represented in this size class. Seedlings are robust by this stage and can tolerate a number of environmental pressures, however, heavy browsing can still negatively impact this size class.

The stark drop in both seedling abundance and species diversity in the 3-5’ size class can likely be attributed to heavy browse pressure at the lower size classes where preferred browse species are selected against – species such as chokecherry and American beech are low browse preference species, with chokecherry foliage being toxic to white-tailed deer.

Size Class: 5'+ <4.5" DBH (Sapling)

Woody stems taller than 5' in height but less than 4.5" DBH (diameter at breast height) are considered "saplings" and are typically a minimum of 3-5 years in age depending upon species and growing conditions. This size class represented 0.8% of all native woody stems surveyed – chokecherry and American beech were the most common species found in this size class. This size class is very robust and is generally unaffected by environmental pressures or herbivory – the greatest risk to saplings would be pests, disease, or heavy site disturbance.

Plot Scoring

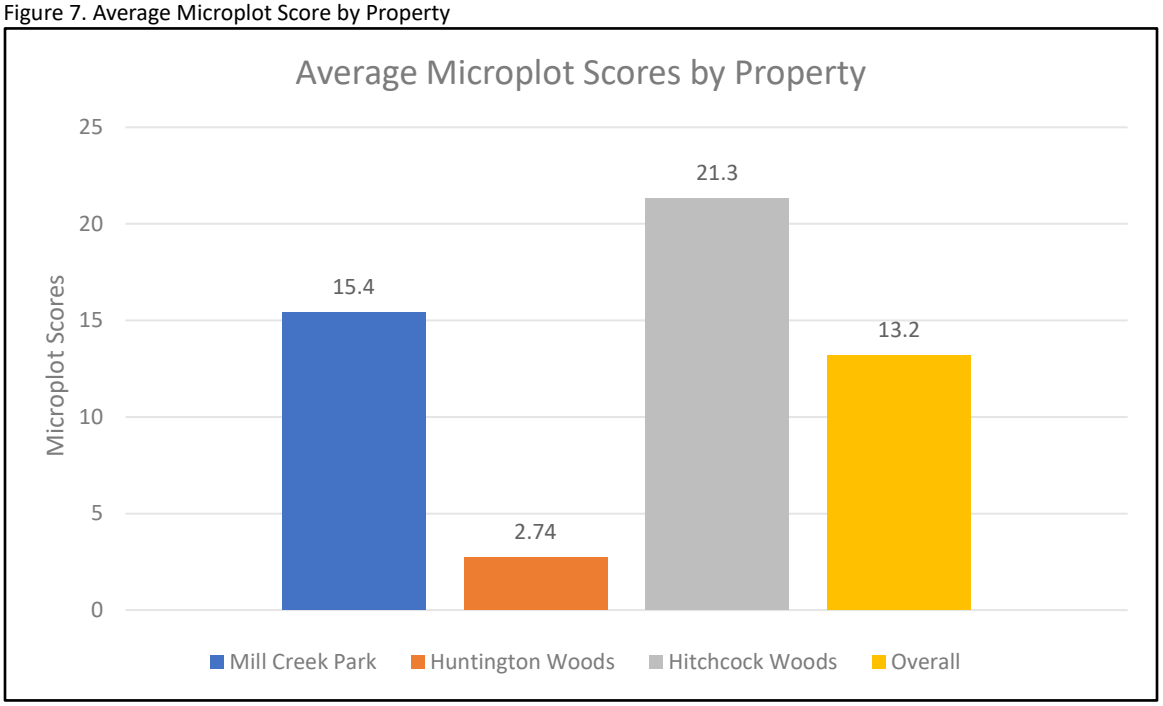
Using the scoring system described above, all microplots were assigned a score which reflects the stage of forest regeneration for each plot based upon native species abundance and height. Overall, the average microplot score for all surveyed areas was 13.2, with zero (0) of the 110 surveyed plots surpassing a forest regeneration score of 150 points.

Again, white ash was not assigned a positive score due to their lack of long-term viability. It is important to note that white ash is heavily susceptible to the emerald ash borer (EAB), a non-native boring insect that is responsible for the destruction of millions of ash trees across much of the eastern United States. It is estimated that only 1% of ash trees on the landscape have a higher-than-average resistance to this pest, with that being said ash regeneration is still taking place on the landscape, typically in the smaller size classes. Impacts from EAB will likely continue once saplings reach a suitable size rendering them largely incapable of reaching full maturity and becoming the dominant canopy species they once were.

Also, woody stems showing severe damage or outward sign of disease were scored at half-value this primarily impacted American beech which oftentimes showed both heavy browse pressure and advanced signs of beech leaf disease (BLD).

As a control, the Hitchcock Woods deer exclosure was scored using the same metrics in total the 324 sq ft area produced a forest regeneration score of 571 – scaled down to match the size of the microplots (113.1 sq ft) the deer exclosure scores 199.65 (15x better than the overall average microplot score).

Figure 7. Average Microplot Score by Property

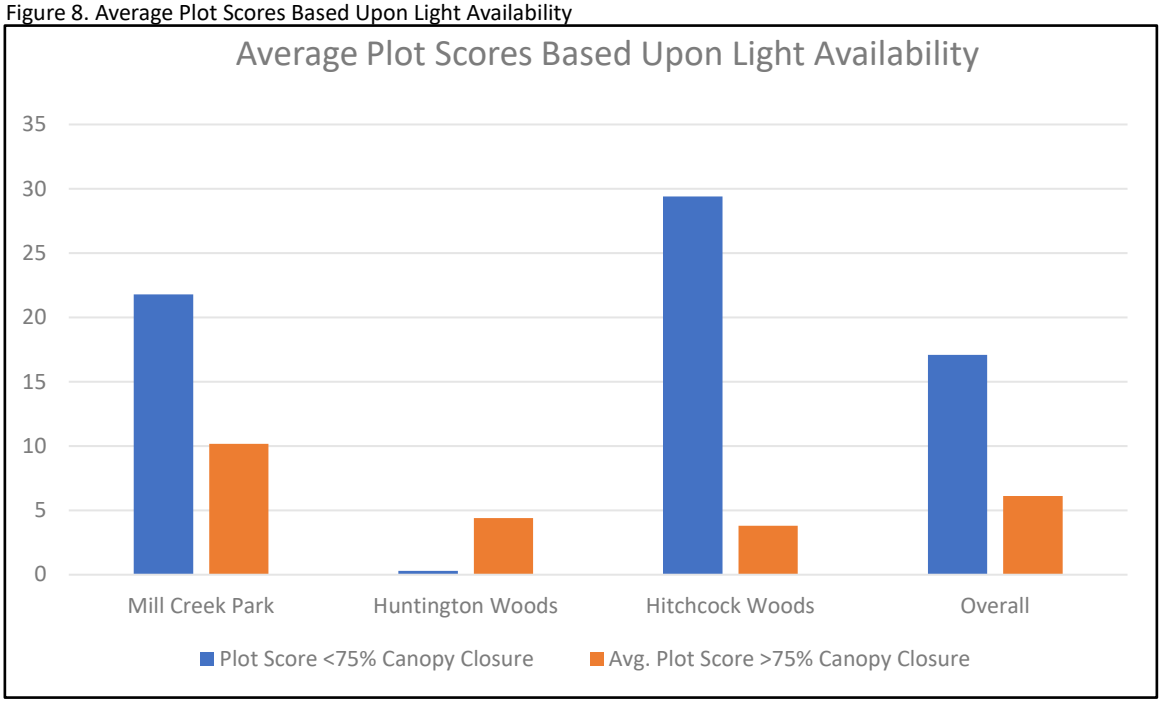


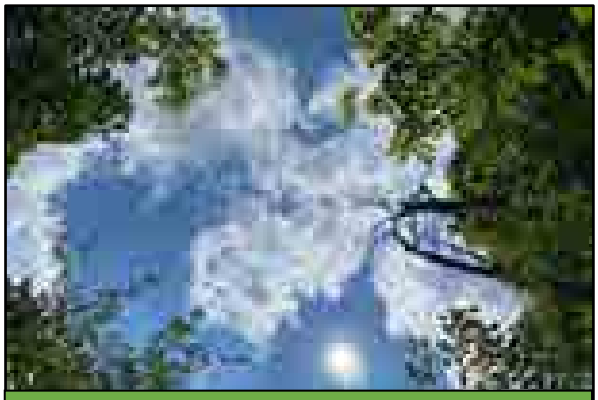
Canopy Closure

Receiving adequate amounts of sunlight is a necessary component for all plant growth. In forested settings, canopy closure affects the amount of light that reaches the forest floor, therefore, can impact a forest's ability to regenerate by affecting both growth rates and species composition. During this study, microplots displayed a wide range of % canopy closure (0-95%) with 48% of microplots with above average light availability (<75% canopy closure) due to prior disturbance from EAB and/or storm damage.

As expected, light availability had a large influence on plot scoring – microplots with less than 75% canopy closure scored 2.79x higher than microplots with greater than 75% canopy closure. Huntington Woods proved to be an exception to this rule, where available light gaps were dominated by ferns and sedges.

Figure 8. Average Plot Scores Based Upon Light Availability





Example of Microplot with <75% Canopy Closure

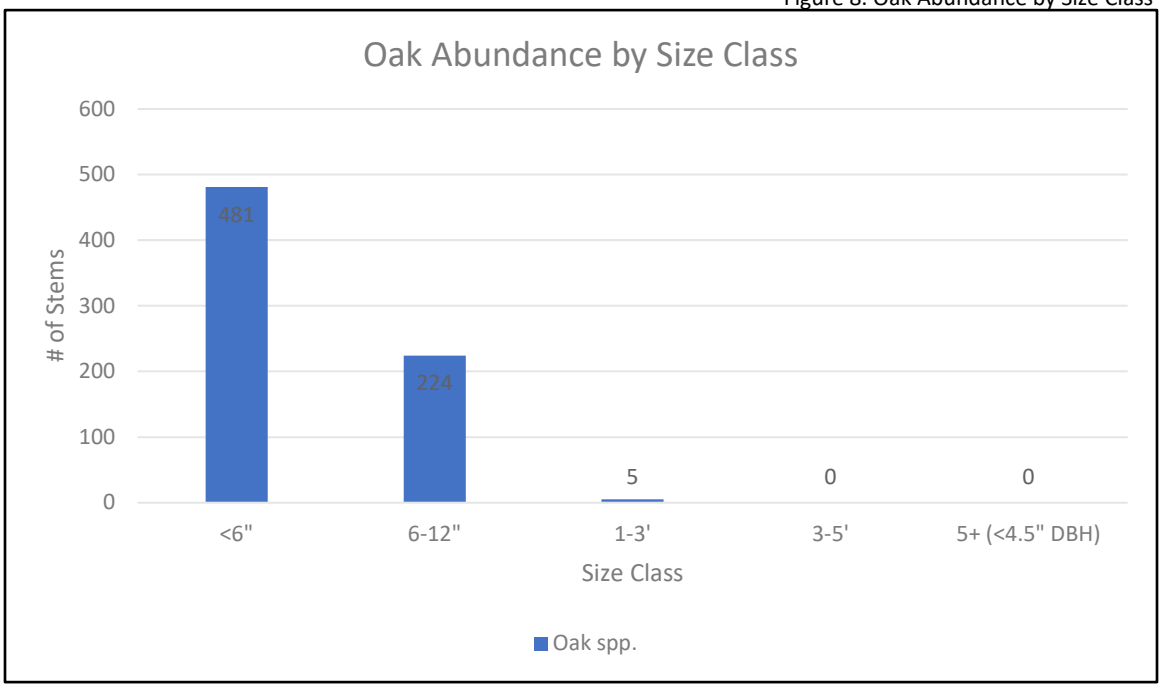
Example of Microplot with >75% Canopy Closure

Oak Regeneration:

Across their range, oaks (*Quercus spp*.) exist as common canopy trees, however, they are largely absent in the understory seedling and sapling layers. This has led to increased concern in recent decades regarding the overall lack of oak regeneration in Eastern hardwood forests – likely caused by intensive browsing by white-tailed deer (oaks are a highly preferred browse species), increased competition with other plants, land use changes, and fire suppression. Oaks provide mast crops in the form of acorns which are an essential part of the forest ecosystem providing valuable fall and winter forage for wildlife. If the current trajectory is not corrected, we may face losing this valuable forest resource in the coming decades as mature trees die with nothing in the understory to replace them.

This same principles apply here as the northern red oak (*Quercus rubra*), pin oak (*Quercus palustris*), white oak (*Quercus alba*), and swamp white oak (*Quercus bicolor*) are all species commonly found on MetroParks properties as mature canopy species and many were also found in the smaller (<6" and 6-12") size classes, however, oaks of all species were completely absent from 3-5' and 5+ size classes, with only five (5) being found in the 1-3' size class.

Figure 8. Oak Abundance by Size Class



Unprotected Red Oak Seedling

Protected Red Oak Seedling

Discussion, Management Objectives, and Recommendations:

Discussion

The results of this study reinforce the anecdotal evidence regarding a lack of forest regeneration that has been observed by MetroParks staff beginning in the 1990's by documenting the severe lack of native seedlings and/or saplings in the understory, most notably those in the larger size classes.

White-tailed deer herbivory appears to be the primary driver of forest regeneration in Mill Creek Park, Huntington Woods, and Hitchcock Woods. This is evidenced by the intensive browse pressure and overall lack of preferred browse species evidenced by this study and other anecdotal references. Other factors such as light availability, lack of disturbance, exotic pests, disease, and competition from invasive species are also contributing factors that are impacting forest health.

Management Objectives

The following set of objectives have been established regarding forest regeneration within Mill Creek MetroParks:

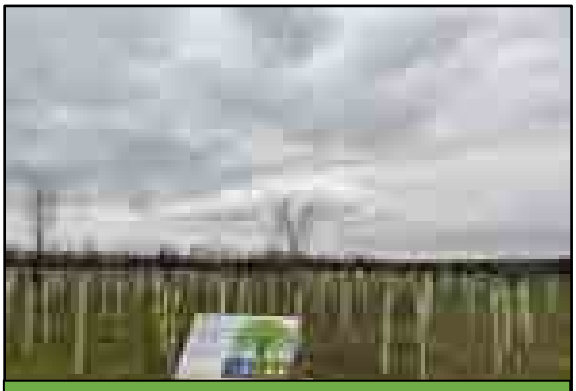
- 75% of Microplots Scoring 150 Points or More.
- 25% of All Surveyed Oak Stems Measuring Greater than 12" in Height with at Least 10% Reaching the 5'+ Size Class.
- Increase in Native Species Diversity with 75% of Surveyed Species Present as Germinants (<6") Also Being Present in the Large Seedling (3-5') or Sapling (5'+) Size Class.
- Maintain 80% or Greater Coverage of Native Species in Surveyed Areas.

Recommendations:

To achieve the abovementioned objectives, it is recommended that the MetroParks consider implementing the following management techniques until goals are met:

- White-tailed Deer Population Reduction and Management
- Native Species Planting
- Invasive Species Management
- Habitat Manipulation Where Appropriate
- Deer Exclusion via Fencing and/or Tree Tubes/Caging Where Appropriate

Hitchcock Woods Deer Exclosure



Collier Preserve Tree Planting

References:

Carter, David & Barrett, Scott & Barkman, Rebecca & Madigan, Olivia & Olinger, Zachary. (2022). Tree Seedling and Understory Plant Presence in Deer Exclosures on the Matthews State Forest.

Mcwilliams, W.H., Stout, S.L., Bowersox, T.W., & McCormick, L. (1995). Adequacy of Advance Tree-Seedling Regeneration in Pennsylvania's Forests. Northern Journal of Applied Forestry, 12, 187-191.

Shirer, R., & Zimmerman, C. (2010). Forest Regeneration in New York State. https://forestadaptation.org/sites/default/files/NYS_Regen_091410_0.pdf

The National Parks Service: Forest Regeneration 2022 https://www.nps.gov/articles/000/forest-regeneration-2022.htm

Assessment of Forest Regeneration in Mill Creek Park, Huntington Woods, and Hitchcock Woods

June 2024

Introduction:

By definition, forest regeneration is the process that allows a forest to replace and sustain itself in the long-term through the establishment and survival of seedlings and saplings that replace mature canopy trees as they die, either by natural causes or by large disturbance events such as windstorms, wildfire, or disease.

Healthy forest regeneration is a crucial component to forest management to ensure the long-term sustainability of our forest ecosystems for future generations.

Forest regeneration can be influenced by a number of variables such as habitat disturbance, invasive species introduction, disease, and herbivory by ungulates such as white-tailed deer.

While white-tailed deer are known as generalist herbivores, feeding on a wide range of woody and herbaceous plant growth, they are also preferential in their feeding habits which can negatively influence forest regeneration when populations exceed ecological carrying capacity.

In the case of Mill Creek MetroParks, the ecological effects of white-tailed deer overabundance such as distinct browse lines, stunted forest regeneration, and low species diversity have been anecdotally noted in some areas for over two decades, however, the effects of overbrowning had not previously been quantified prior to 2023.

Objectives:

To evaluate current conditions related to forest regeneration based upon seedling and sapling abundance/height and track changes through time in response to management changes such as deer management, invasive species treatment, and/or habitat manipulation.

Methods:

Plot Description

Survey plots (1-acre in size) are distributed throughout Mill Creek Park, Huntington Woods, and Hitchcock Woods where space allowed. Within each survey plot, five (5) microplots were established (6' radius circle). The placement of microplots was standardized, with one microplot placed at the center of each 1-acre survey plot, additional plots were established at a distance of 60' from the center point in four directions.

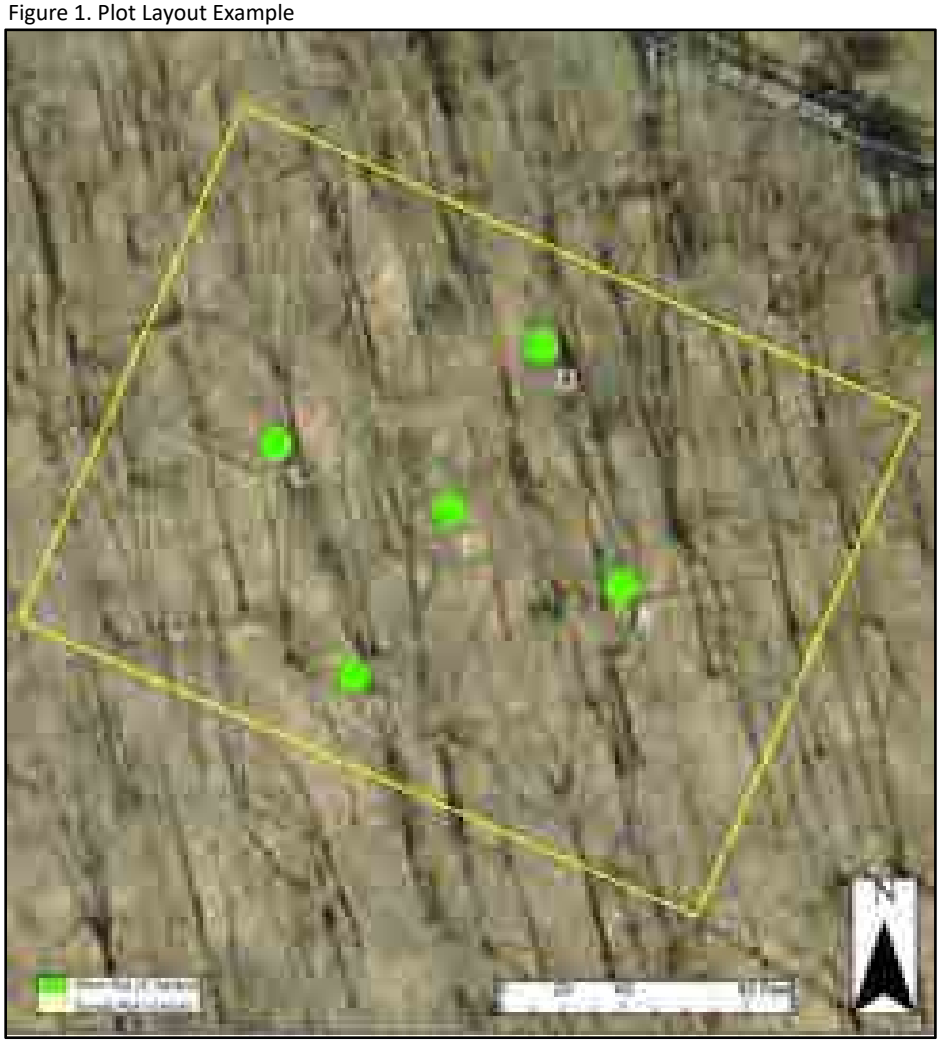
Plot Selection

Survey plots were established in upland hardwood sites with varying degrees of canopy closure (0%-95%). Sites with a lower prevalence of invasive species and desirable light availability were preferred when available to assess forest regeneration under the best possible circumstances given current site conditions. All plot locations were free of human caused disturbance such as logging, prescribed fire, or other active management.

If any of the following conditions are present at the predetermined 60' spacing, the microplot center point will be adjusted to the nearest suitable location:

- Obstructions such as rocks, downed trees, mature trees, roadways, or open water which hinder the establishment of the microplot and/or subplot.
- The proposed plot location is located on a slope greater than 70%.
- The proposed plot location is dominated by large invasive shrubs (<75% coverage).

Figure 1. Plot Layout Example



Once microplots are established they are affixed with a permanent stake. These plots will be used to gauge changes in forest regeneration on an annual basis, but may also be used to examine other metrics such as winter browse damage and/or spring ephemeral wildflower abundance.

*In 2024, some microplots had to be reestablished due to suspected vandalism. This potentially caused some minor changes in microplot location.

Data Collection

For the purposes of assessing forest regeneration, all woody vegetation less than 4.5" DBH located within each microplot was identified and categorized based upon size class. Woody vegetation was separated into five (5) size classes: <6", 6-12", 1-3', 3-5', and 5'+ with each size class being assigned a weighted score which reflects the survivability of each size class and its value in terms of forest regeneration.

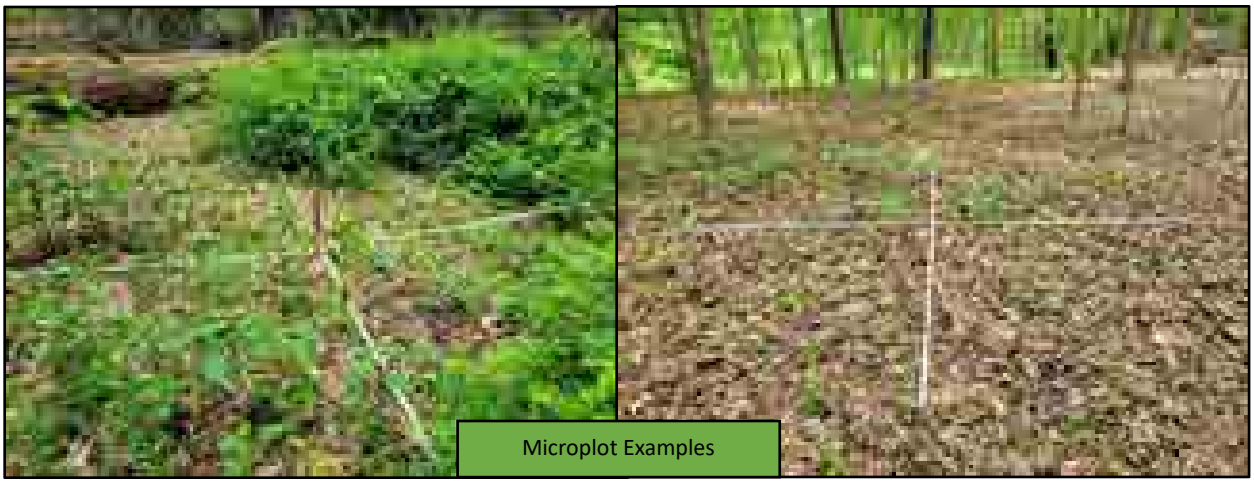
Additionally, percent canopy closure was assessed at the center point of each microplot, and photographs were gathered depicting both current plot conditions and canopy closure.

To provide a control, data was also collected from the deer exclosure located in Hitchcock Woods, which was first constructed in the year 2000 but was not refurbished and fully functional until 2018. The exclosure is 18x18' (324 sq ft) and has ~80% canopy closure directly above but is adjacent to a sizeable light gap to the south.

Figure 3. MCMP Forest Regeneration Scoring Chart

Size Class	Score
0-6"	0
6-12"	1
1-3'	2
3-5' Native Sub-Canopy or Shrub Species	7.5
3-5' Native Canopy Species	15
5'+ Native Sub-Canopy or Shrub Species (<4.5" DBH	15
5'+ Native Canopy Species (<4.5" DBH)	30

- Invasive species are noted but not assigned a positive or negative score.
- Trees showing outward signs of disease or severe damage are scored at half value.
- Ash spp. will not be assigned a positive score due to their lack of long-term viability, caused by the emerald ash borer.
- Each microplot is assessed individually, a score of 150 points or greater signifies that plot as sufficiently stocked for forest regeneration.



Microplot Examples

Results:

22 survey plots (110 microplots) were evaluated throughout Mill Creek Park, Huntington Woods, and Hitchcock Woods the results are as follows:

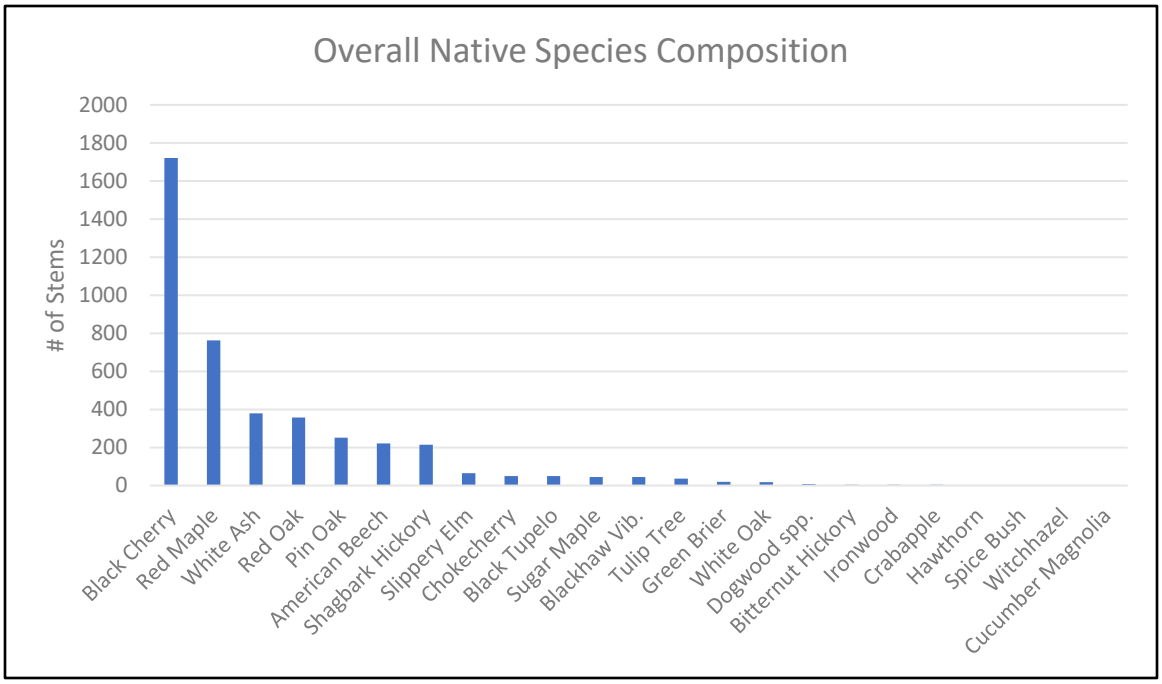
Species Composition and Diversity

In total, 4,589 woody stems were surveyed of those, a total of 24 native species and 9 invasive species were documented – native species accounted for 91.5% of the total stems surveyed (plots with <75% invasive shrub cover were excluded).

Of the 24 native species identified black cherry (*Prunus serotina*) and red maple (*Acer rubrum*) occurred with the most frequency and in combination account for 57.4% of all native woody stems. This is not surprising as these species typically have dense seeding rates, fast growth, and are tolerant to a wide range of soil conditions, often times making them the first canopy species to repopulate disturbed areas.

Other prominent species include pin oak (*Quercus palustris*), white ash (*Fraxinus americana*), red oak (*Quercus rubra*), shagbark hickory (*Carya ovata*), American beech (*Fagus grandifolia*) , sugar maple (Acer saccharum), and slippery elm (*Ulmus rubra*). Of the 24 native species documented, only 8 (33%) were present in the 3-5’ and 5’ size class.

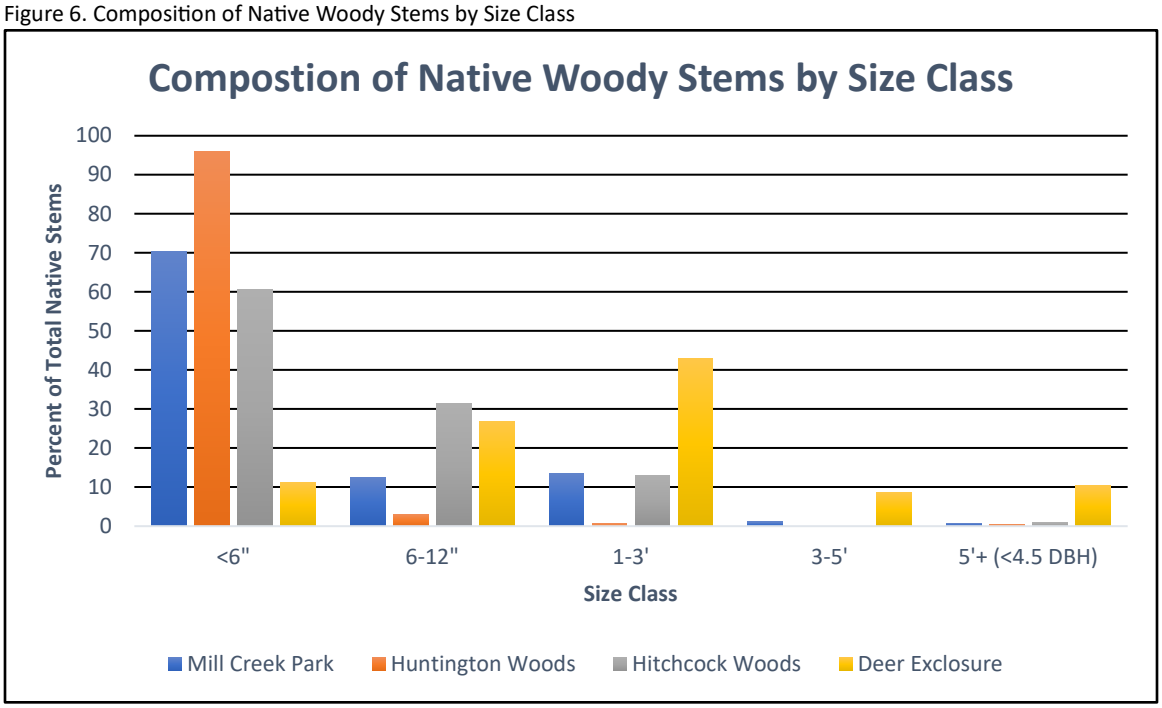
Figure 5. Overall Native Species Composition



Native Woody Stems by Size Class

As stated above, woody stems were separated into five (5) size classes the following data depicts the size class breakdown of woody stems found in all three (3) survey areas and the Huntington Woods deer exclosure.

Figure 6. Composition of Native Woody Stems by Size Class



The results show that overwhelmingly the <6” size class as the most abundant in areas unprotected from deer browsing, overall 75.5% of all native woody stems surveyed were less than 6” in height. In general, the larger size classes (3-5’ and 5’+) were largely absent from the unprotected survey areas and accounted for only 1.4% of the total stems surveyed.

On the contrary, in the Hitchcock Woods deer exclosure all size classes were well represented with the 1-3’ size class being most abundant (42.9%).

Size Class: <6” (Germinant)

Woody stems less than 6” are considered “germinants” and were by far the most common size class documented– this size class represented 75.6% of all native woody stems surveyed with black cherry and red maple occurring most frequently. This size class is comprised of newly germinated trees – this is considered a very vulnerable size class with survivability being influenced by many variables such as sunlight availability, soil condition, weather, and herbivory.

Size Class: 6-12” (Small Seedling)

Woody stems from 6-12” are considered “small seedlings” and are typically 0-1 years old, however, this can vary widely based upon species and growing conditions. This size class accounted for 13% of all native woody stems surveyed – white ash, pin oak, and red oak were the most common species in this size class. Small seedlings are still vulnerable to changes in growing condition and herbivory; however, this size class does have a higher rate of survival as compared to germinants.

Size Class: 1-3’ (Seedling)

Woody stems from 1-3’ are considered “seedlings” and are typically 1-2 years old depending upon species and growing condition. This size class accounted for 10% of all native woody stems surveyed – white ash, American beech, and shagbark hickory were the most common species in this size class. This size class is less susceptible to environmental conditions such as changes in weather; however, we found this size class to be the most impacted by herbivory. Species (native and invasive) in this size class such as white ash, American beech, hawthorn, spicebush, multiflora rose, common privet, and glossy buckthorn all show signs heavy browse pressure from white-tailed deer.

Size Class: 3-5’ (Large Seedling)

Woody stems from 3-5’ are considered “large seedlings” and are typically 2-3 years old depending upon species and growing conditions. This size class accounted for only 0.6% of all native woody stems surveyed – chokecherry, American beech, and white ash were the only native species represented in this size class. Seedlings are robust by this stage and can tolerate a number of environmental pressures, however, heavy browsing can still negatively impact this size class.

The stark drop in both seedling abundance and species diversity in the 3-5’ size class can likely be attributed to heavy browse pressure at the lower size classes where preferred browse species are selected against – species such as chokecherry and American beech are low browse preference species, with chokecherry foliage being toxic to white-tailed deer.

Size Class: 5'+ <4.5" DBH (Sapling)

Woody stems taller than 5' in height but less than 4.5" DBH (diameter at breast height) are considered "saplings" and are typically a minimum of 3-5 years in age depending upon species and growing conditions. This size class represented 0.7% of all native woody stems surveyed – sugar maple, chokecherry, slippery elm, and American beech were the most common species found in this size class. This size class is very robust and is generally unaffected by environmental pressures or herbivory – the greatest risk to saplings would be pests, disease, or heavy site disturbance.

Plot Scoring

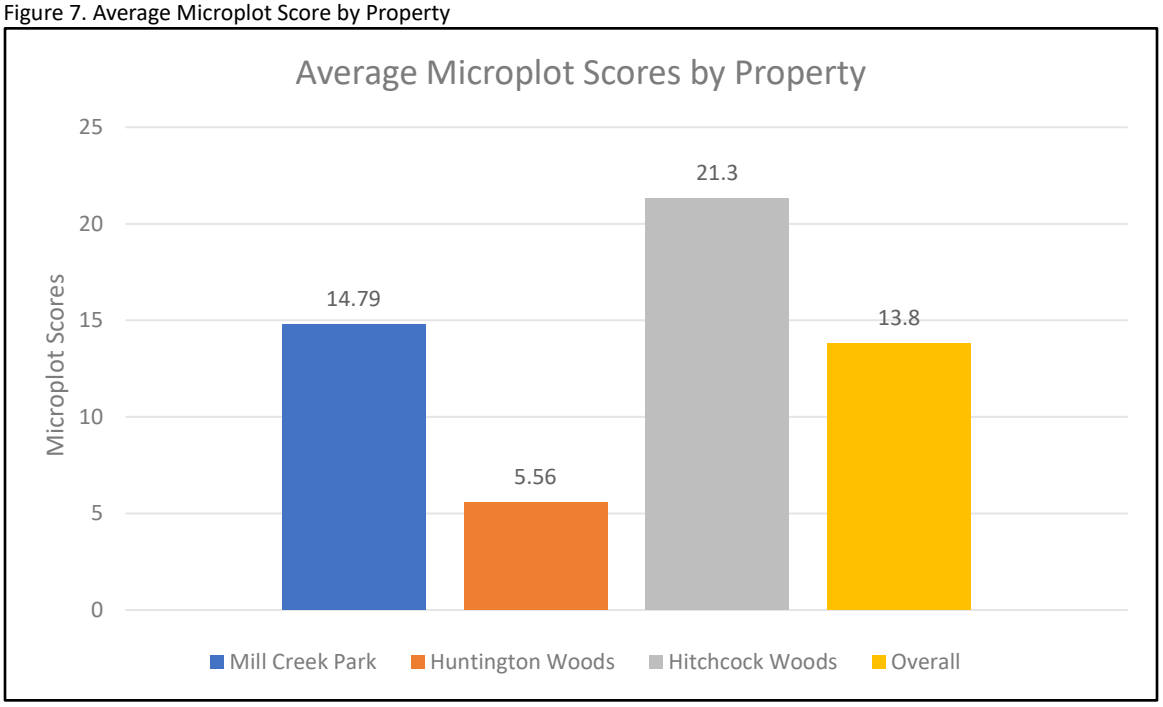
Using the scoring system described above, all microplots were assigned a score which reflects the stage of forest regeneration for each plot based upon native species abundance and height. Overall, the average microplot score for all surveyed areas was 13.8, with one (1) of the 110 surveyed plots surpassing a forest regeneration score of 150 points. In this instance, the score of 177.5 was produced due to high stem count of chokecherry in the 3-5' size class. In this case it is important to note that chokecherry is considered highly deer-resistant and even toxic to deer and other animals if eaten in large quantities, therefore, its presence could be a symptom of selective browsing pressure.

Again, white ash was not assigned a positive score due to their lack of long-term viability. It is important to note that white ash is heavily susceptible to the emerald ash borer (EAB), a non-native boring insect that is responsible for the destruction of millions of ash trees across much of the eastern United States. It is estimated that only 1% of ash trees on the landscape have a higher-than-average resistance to this pest, with that being said ash regeneration is still taking place on the landscape, typically in the smaller size classes. Impacts from EAB will likely continue once saplings reach a suitable size rendering them largely incapable of reaching full maturity and becoming the dominant canopy species they once were.

Also, woody stems showing severe damage or outward sign of disease were scored at half-value this primarily impacted American beech which oftentimes showed both heavy browse pressure and advanced signs of beech leaf disease (BLD).

As a control, the Hitchcock Woods deer exclosure was scored using the same metrics in total the 324 sq ft area produced a forest regeneration score of 571 – scaled down to match the size of the microplots (113.1 sq ft) the deer exclosure scores 195.45 (~14x better than the overall average microplot score).

Figure 7. Average Microplot Score by Property

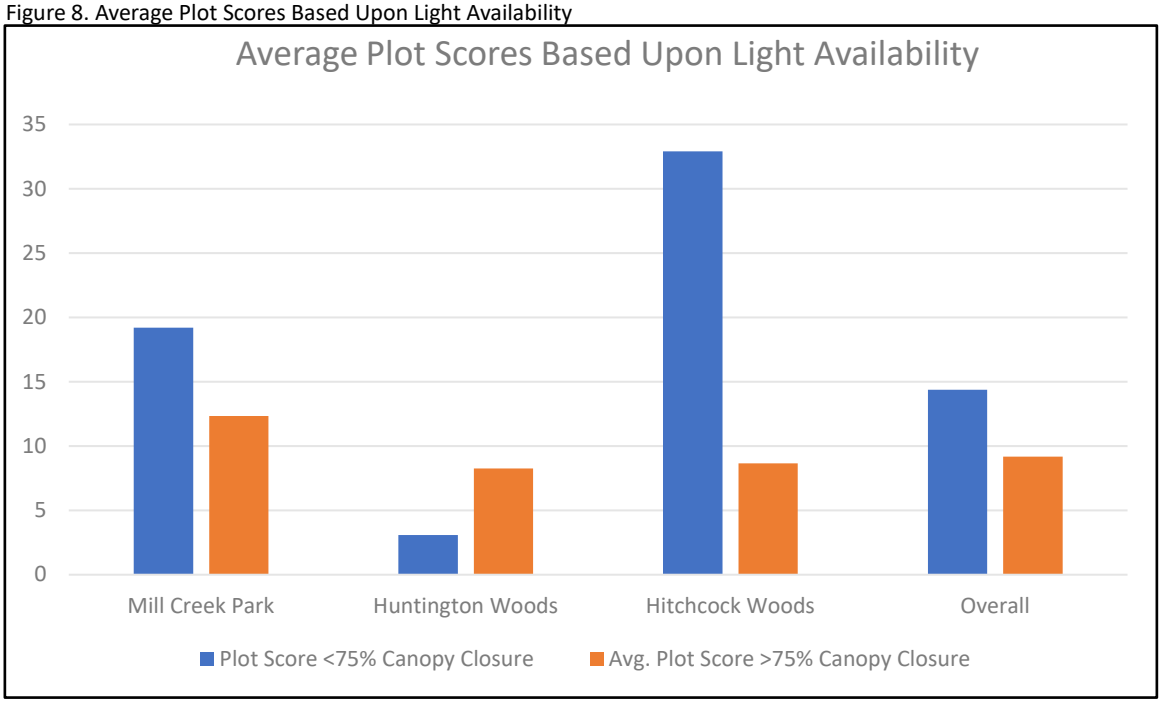


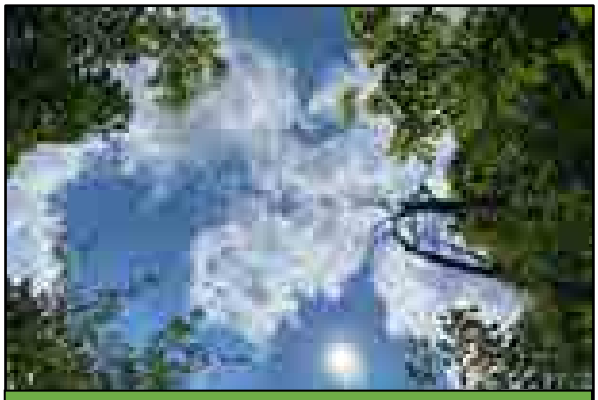
Canopy Closure

Receiving adequate amounts of sunlight is a necessary component for all plant growth. In forested settings, canopy closure affects the amount of light that reaches the forest floor, therefore, can impact a forest's ability to regenerate by affecting both growth rates and species composition. During this study, microplots displayed a wide range of % canopy closure (0-95%) with 50% of microplots with above average light availability (≤75% canopy closure) due to prior disturbance from EAB and/or storm damage.

As expected, light availability had a large influence on plot scoring – microplots with less than 75% canopy closure scored higher than microplots with greater than 75% canopy closure. Huntington Woods proved to be an exception to this rule, where available light gaps tend to be dominated by ferns, sedges, and invasive shrubs.

Figure 8. Average Plot Scores Based Upon Light Availability





Example of Microplot with <75% Canopy Closure

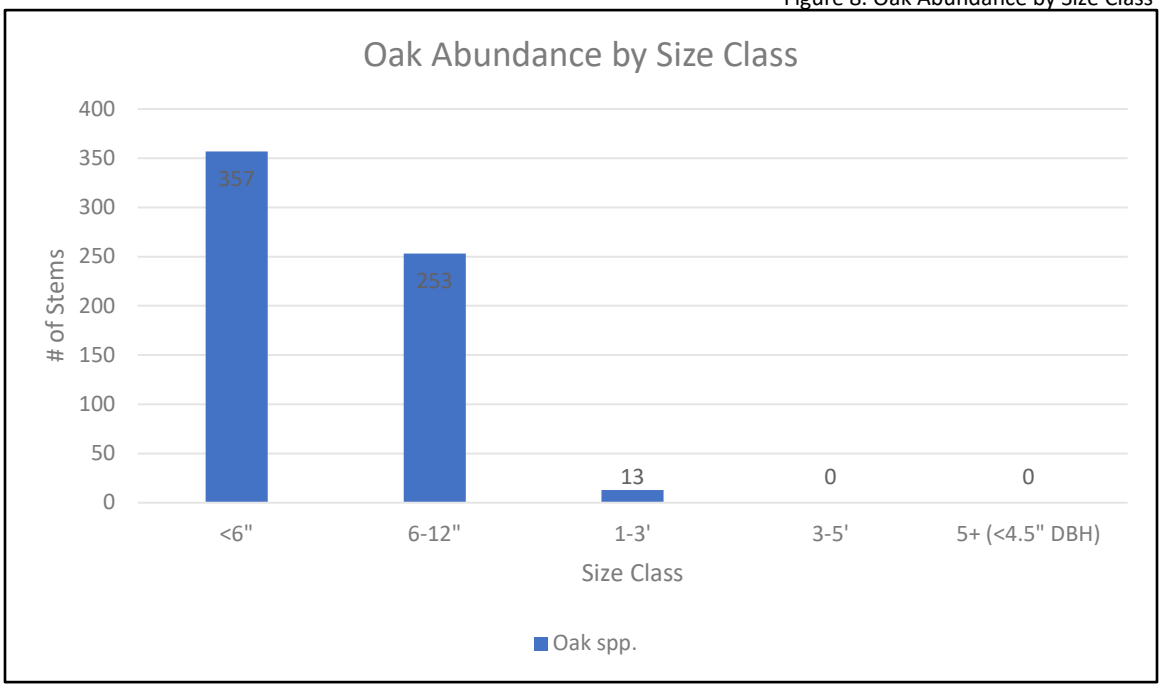
Example of Microplot with >75% Canopy Closure

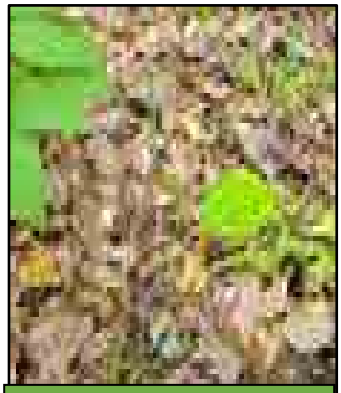
Oak Regeneration:

Across their range, oaks (*Quercus spp*.) exist as common canopy trees, however, they are largely absent in the understory seedling and sapling layers. This has led to increased concern in recent decades regarding the overall lack of oak regeneration in Eastern hardwood forests – likely caused by intensive browsing by white-tailed deer (oaks are a highly preferred browse species), increased competition with other plants, land use changes, disease, and fire suppression. Oaks provide mast crops in the form of acorns which are an essential part of the forest ecosystem providing valuable fall and winter forage for wildlife. If the current trajectory is not corrected, we may face losing this valuable forest resource in the coming decades as mature trees die with nothing in the understory to replace them.

This same principles apply here as the northern red oak (*Quercus rubra*), pin oak (*Quercus palustris*), white oak (*Quercus alba*), and swamp white oak (*Quercus bicolor*) are all species commonly found on MetroParks properties as mature canopy species and many were also found in the smaller (<6" and 6-12") size classes, however, oaks of all species were completely absent from 3-5' and 5+ size classes, with only thirteen (13) being found in the 1-3' size class.

Figure 8. Oak Abundance by Size Class



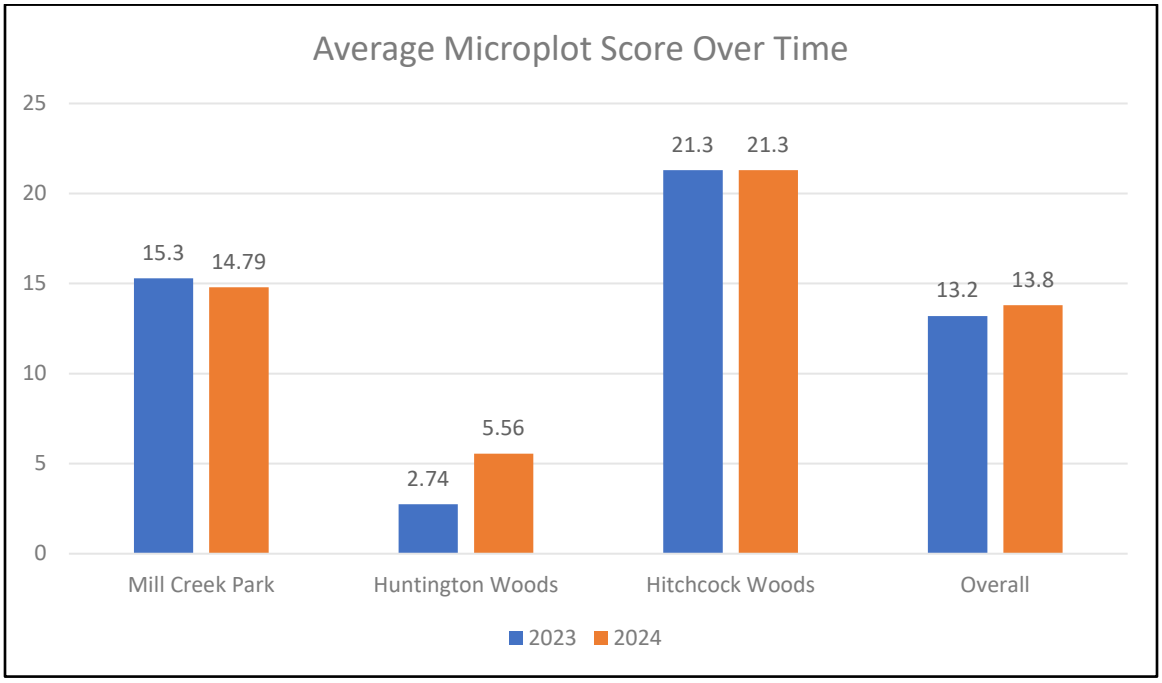


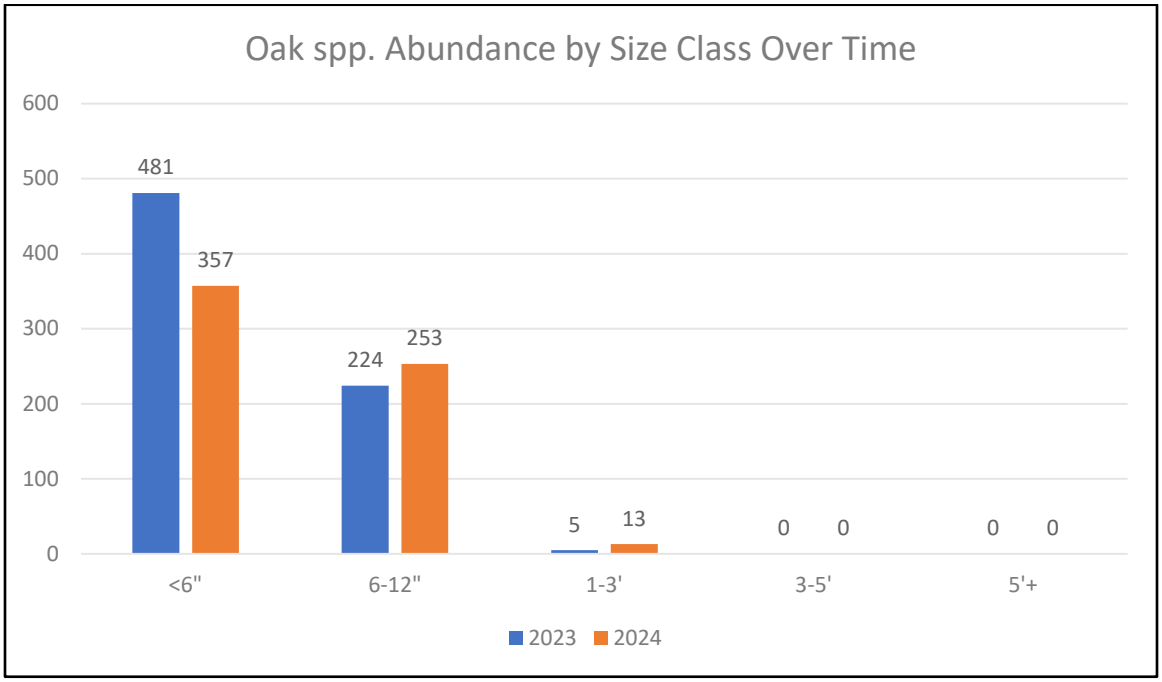
Unprotected Red Oak Seedling

Protected Red Oak Seedling

Ongoing Changes:

While it will take years to fully evaluate changes on a landscape level, this scoring assessment will continue to be conducted on an annual basis to identify noticeable trends over time.





Discussion, Management Objectives, and Recommendations:

Discussion

White-tailed deer herbivory continues to be the primary driver of forest regeneration in Mill Creek Park, Huntington Woods, and Hitchcock Woods. This is evidenced by the intensive browse pressure and overall lack of preferred browse species evidenced by this study and other anecdotal references. Other factors such as light availability, lack of disturbance, exotic pests, disease, and competition from invasive species are also contributing factors that are impacting forest health.

Management Objectives

The following set of objectives have been established regarding forest regeneration within Mill Creek MetroParks:

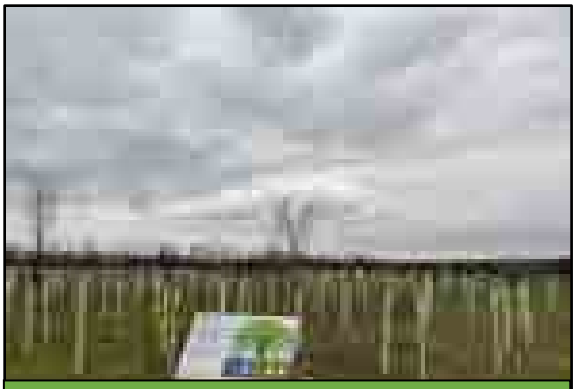
- 75% of Microplots Scoring 150 Points or More.
- 25% of All Surveyed Oak Stems Measuring Greater than 12" in Height with at Least 10% Reaching the 5'+ Size Class.
- Increase in Native Species Diversity with 75% of Surveyed Species Present as Germinants (<6") Also Being Present in the Large Seedling (3-5') or Sapling (5'+) Size Class.
- Maintain 80% or Greater Coverage of Native Species in Surveyed Areas.

Recommendations:

To achieve the abovementioned objectives, it is recommended that the MetroParks consider implementing the following management techniques until goals are met:

- White-tailed Deer Population Reduction and Management
- Native Species Planting
- Invasive Species Management
- Habitat Manipulation Where Appropriate
- Deer Exclusion via Fencing and/or Tree Tubes/Caging Where Appropriate

Hitchcock Woods Deer Exclosure



Collier Preserve Tree Planting

References:

Carter, David & Barrett, Scott & Barkman, Rebecca & Madigan, Olivia & Olinger, Zachary. (2022). Tree Seedling and Understory Plant Presence in Deer Exclosures on the Matthews State Forest.

Mcwilliams, W.H., Stout, S.L., Bowersox, T.W., & McCormick, L. (1995). Adequacy of Advance Tree-Seedling Regeneration in Pennsylvania's Forests. Northern Journal of Applied Forestry, 12, 187-191.

Shirer, R., & Zimmerman, C. (2010). Forest Regeneration in New York State. https://forestadaptation.org/sites/default/files/NYS_Regen_091410_0.pdf

The National Parks Service: Forest Regeneration 2022 https://www.nps.gov/articles/000/forest-regeneration-2022.htm

Appendix C: Deer Damage Photographic Log

MILL CREEK
METROPARKS

White-tailed Deer in Mill Creek MetroParks

Photographic Log – 2022

Board of Park Commissioners

7574 Columbiana-Canfield Rd.

Canfield, Ohio 44406

Mahoning County, Ohio

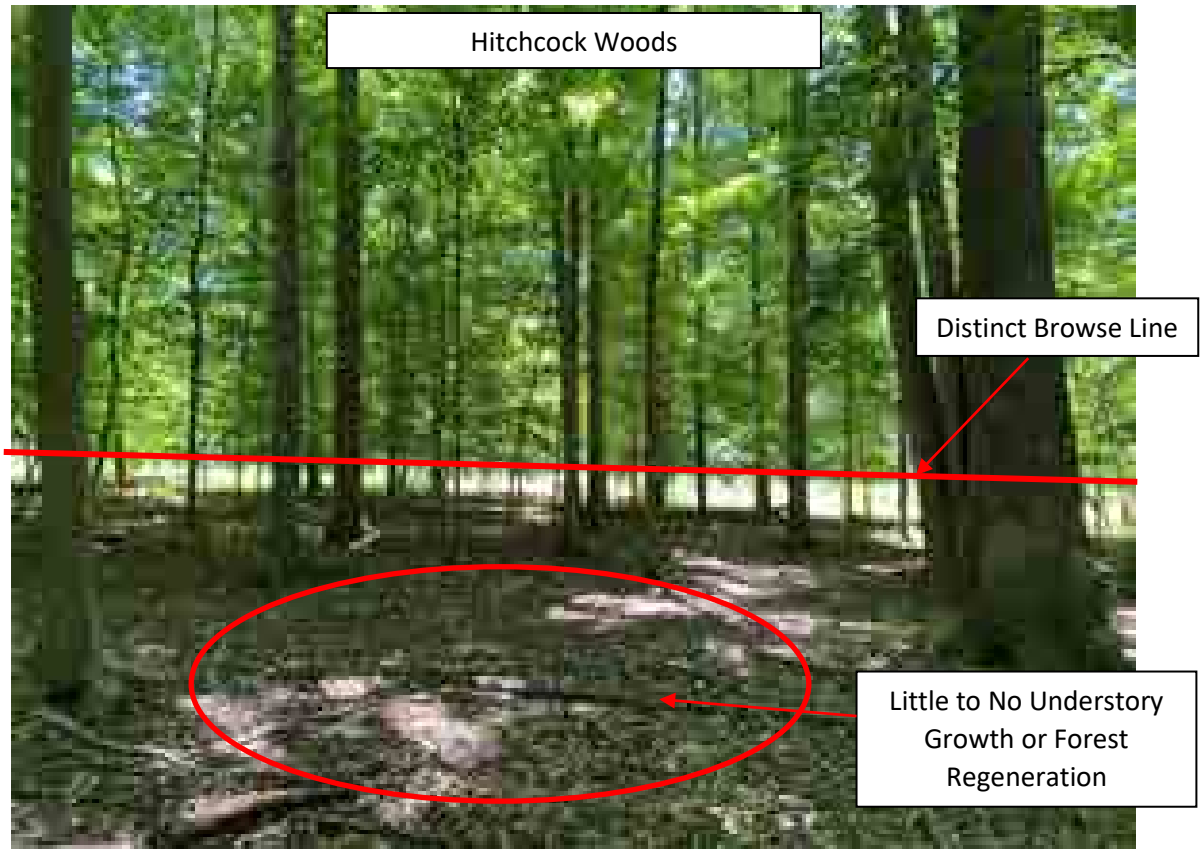
Introduction

These photograph locations highlight examples of deer browse damage in forested and/or landscaped areas throughout the MetroParks, with the most notable impacts being visible at Hitchcock Woods, Huntington Woods, and Mill Creek Park. Negative ecological impacts commonly associated with an overabundance of white-tailed deer such as visible browse lines, limited forest understory growth, and a prevalence of invasive species are commonplace throughout MetroParks facilities, consistent with the data collected from the January 2022 population survey.

January 2022 Aerial Infrared Survey Results:

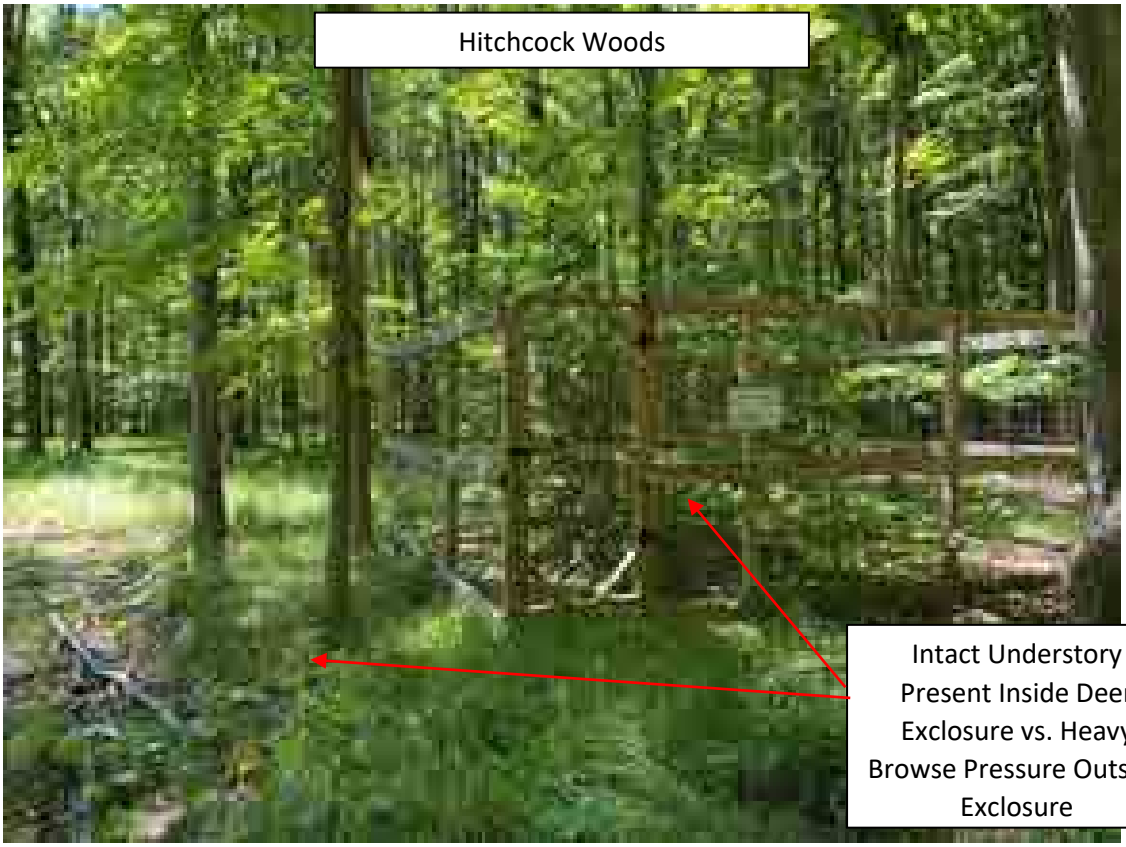
Recommended Population Densities Are 10-20 Deer/M² to Remain Below Ecological Carrying Capacity.

Our Results Average 387 Deer/Mi²


Hitchcock Woods
Distinct Browse Line
Little to No Understory Growth or Forest Regeneration

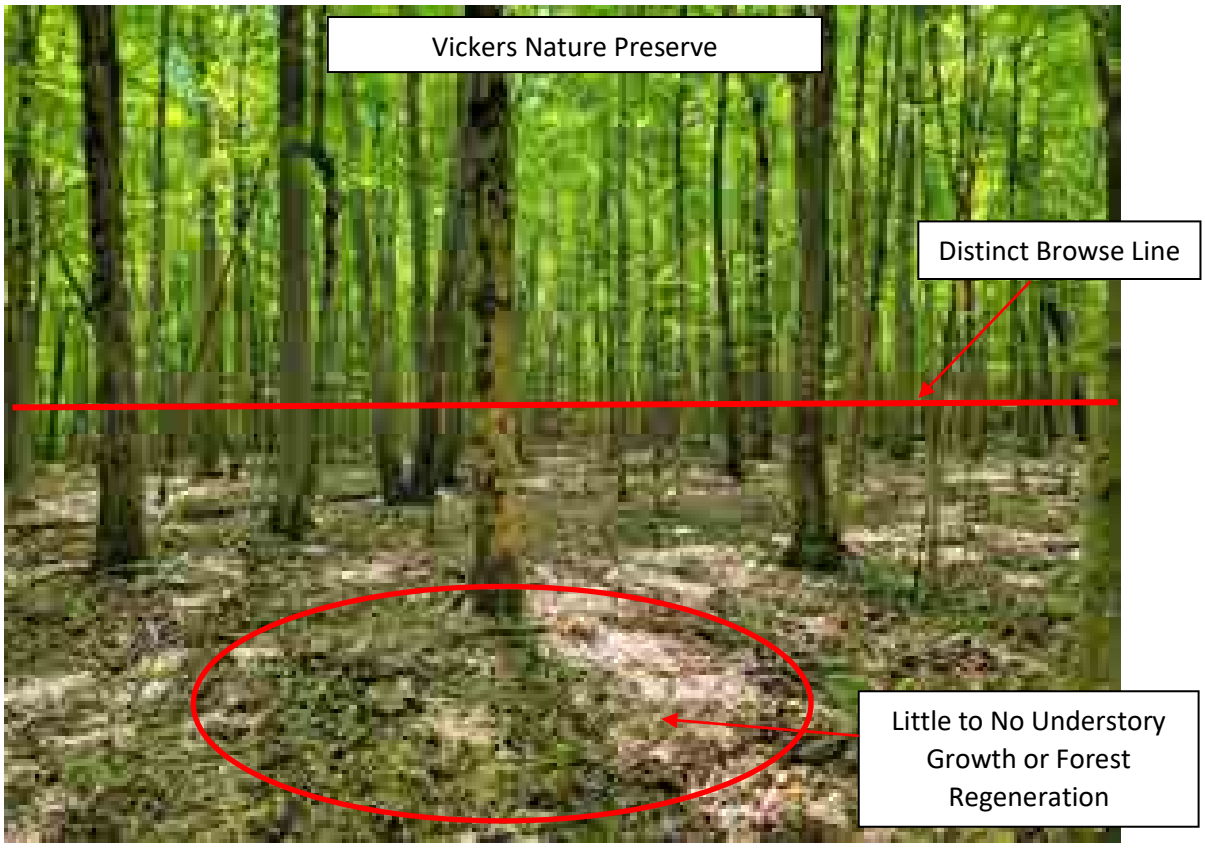

Hitchcock Woods
Distinct Browse Line


Hitchcock Woods
Little to No Understory Growth or Forest Regeneration

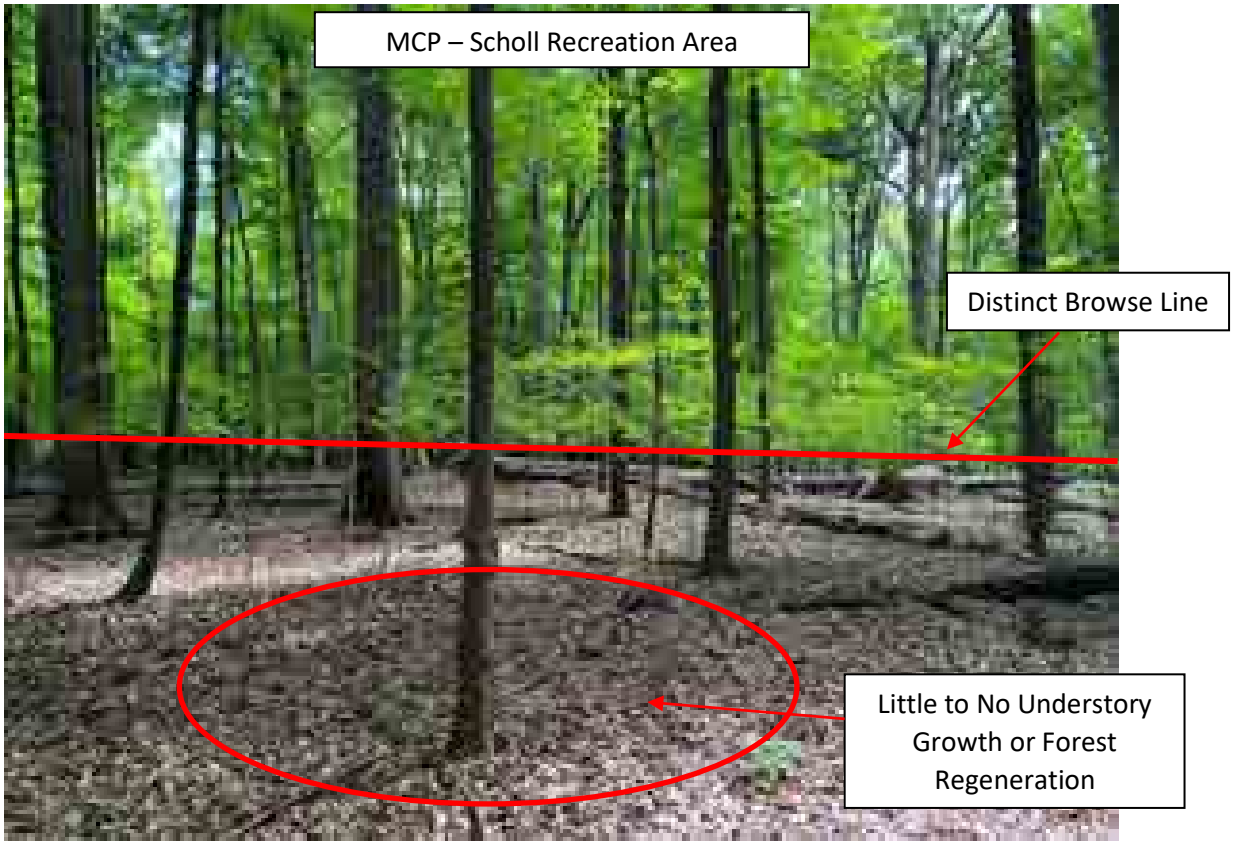

Hitchcock Woods
Intact Understory Present Inside Deer Exclosure vs. Heavy Browse Pressure Outside Exclosure


Hitchcock Woods
Intact Understory Present Inside Deer Exclosure vs. Heavy Browse Pressure Outside Exclosure

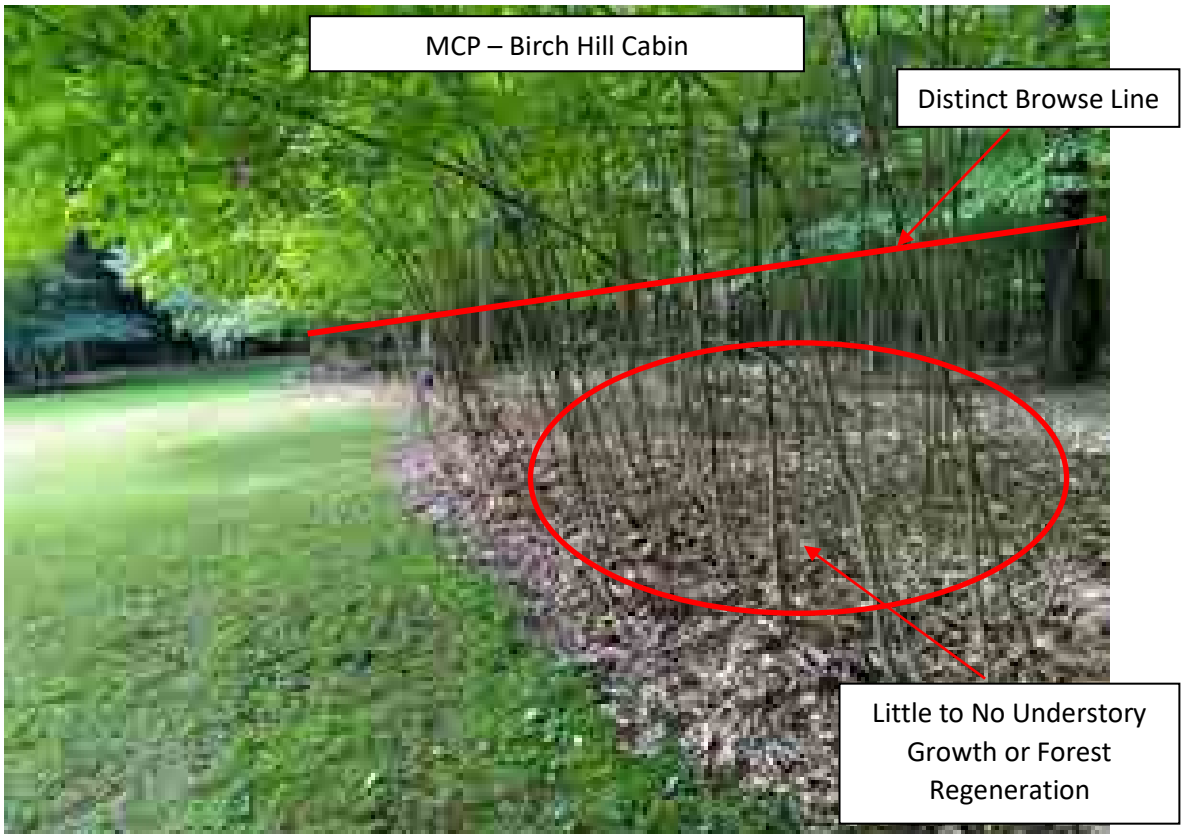

Vickers Nature Preserve
Little to No Understory Growth or Forest Regeneration


Vickers Nature Preserve
Distinct Browse Line
Little to No Understory Growth or Forest Regeneration


MCP – West Golf Drive
Distinct Browse Line
Little to No Understory Growth or Forest Regeneration


MCP – Scholl Recreation Area
Distinct Browse Line
Little to No Understory Growth or Forest Regeneration

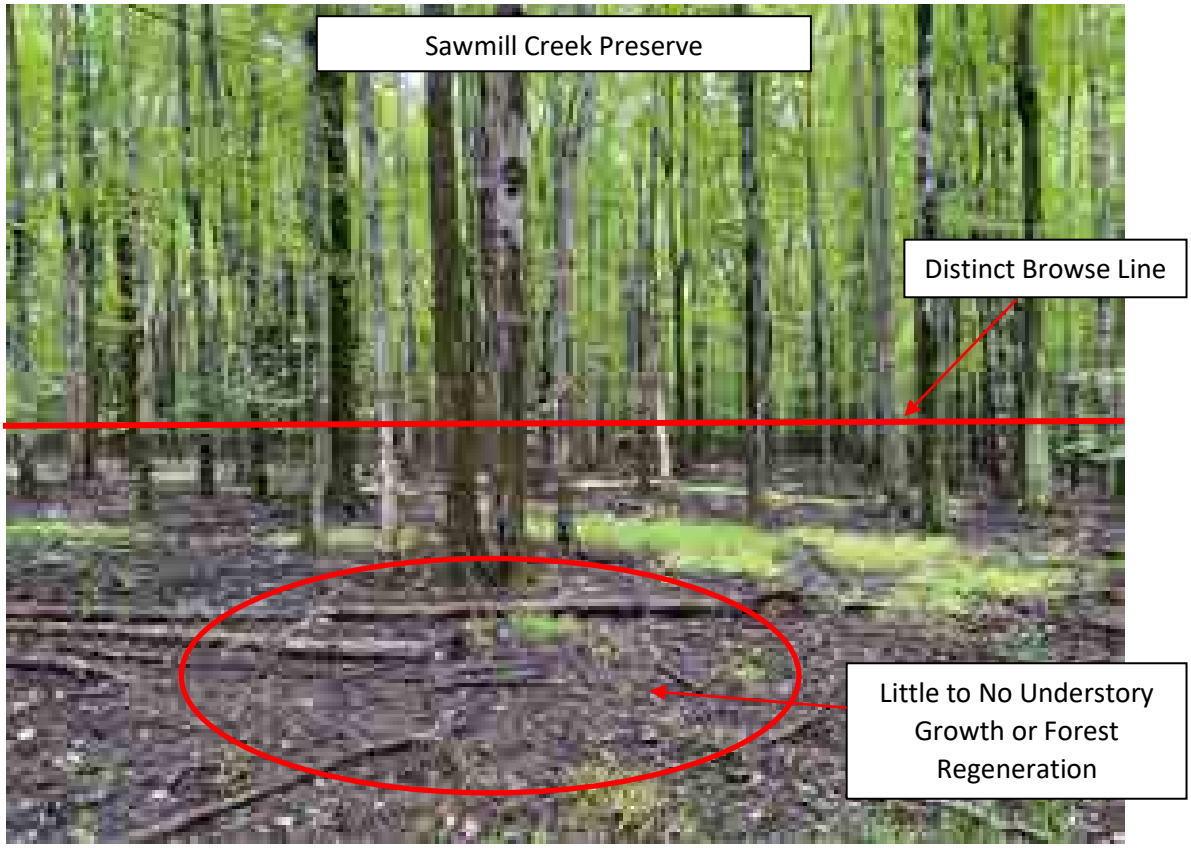

MCP – Scholl Recreation Area
Distinct Browse Line


MCP – Birch Hill Cabin
Distinct Browse Line
Little to No Understory Growth or Forest Regeneration


MCP – Birch Hill Cabin
Little to No Understory Growth or Forest Regeneration


MCP – Wick Recreation Area
Little to No Understory Growth or Forest Regeneration


MCP – Wick Recreation Area
Distinct Browse Line
Little to No Understory Growth or Forest Regeneration


Sawmill Creek Preserve
Distinct Browse Line
Little to No Understory Growth or Forest Regeneration

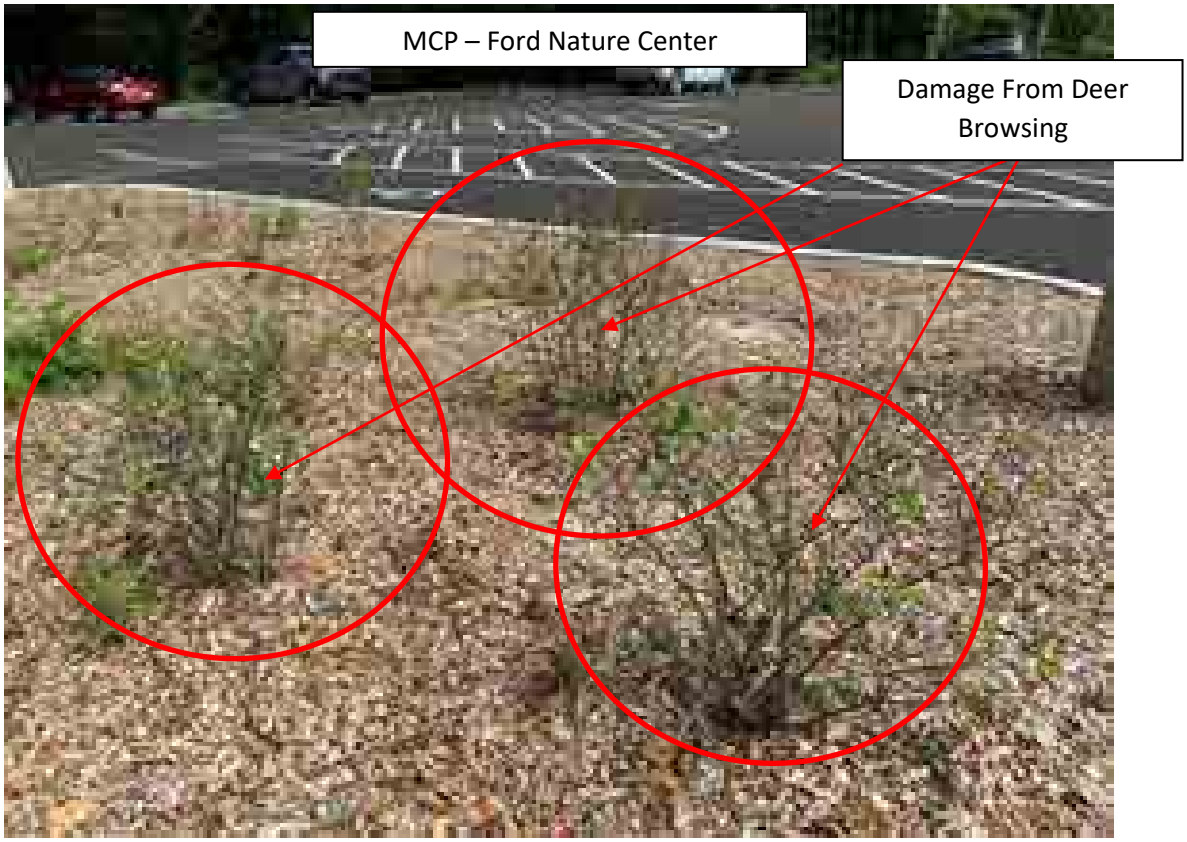

McGuffey Wildlife Preserve
Little to No Understory Growth or Forest Regeneration


Sebring Woods
Little to No Understory Growth or Forest Regeneration

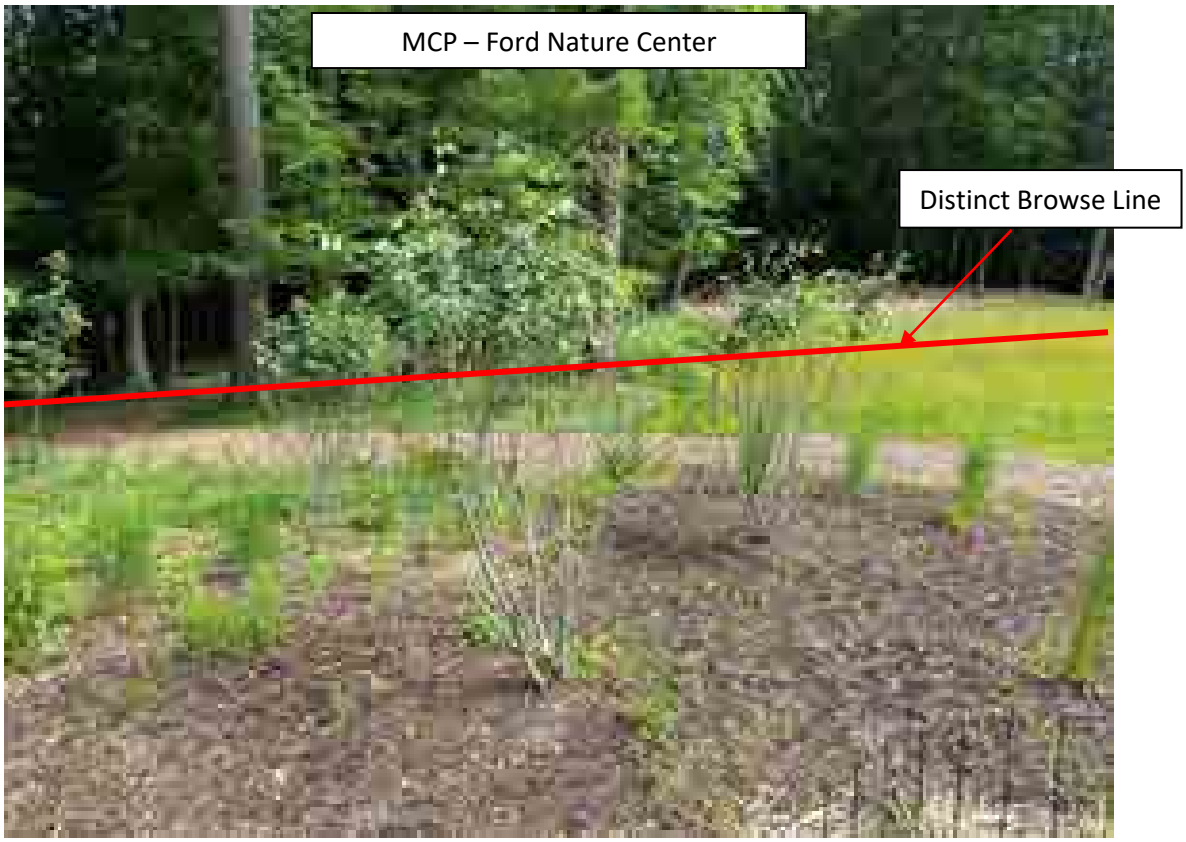

Huntington Woods
Little to No Understory Growth or Forest Regeneration

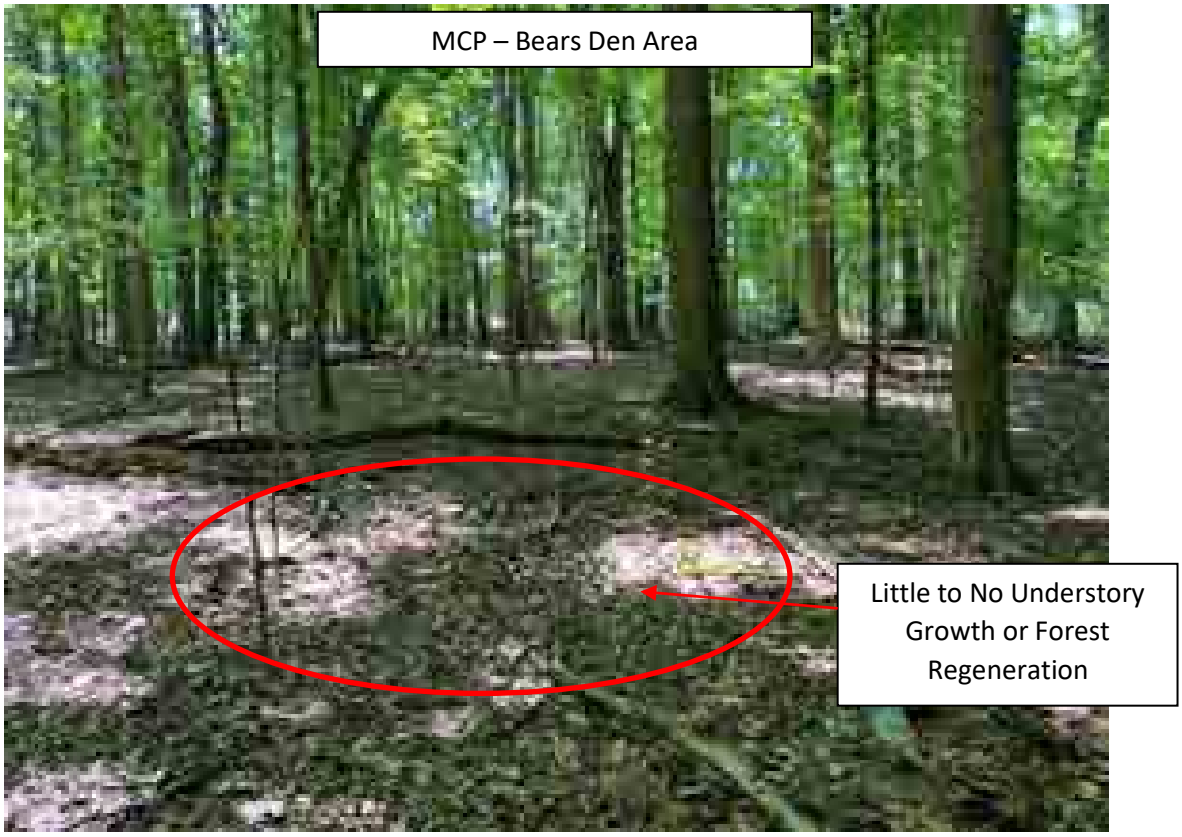

Huntington Woods
Little to No Understory Growth or Forest Regeneration

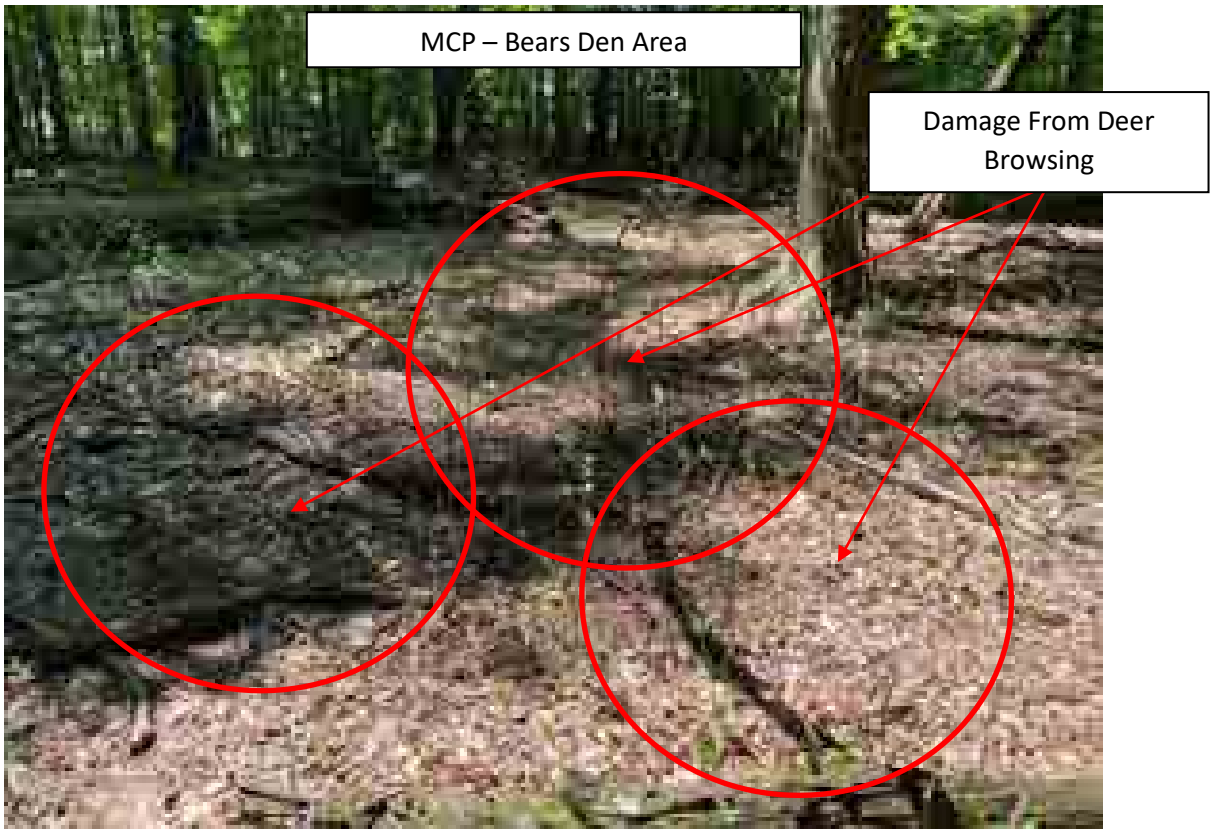

MCP – Ford Nature Center
Damage From Deer Browsing

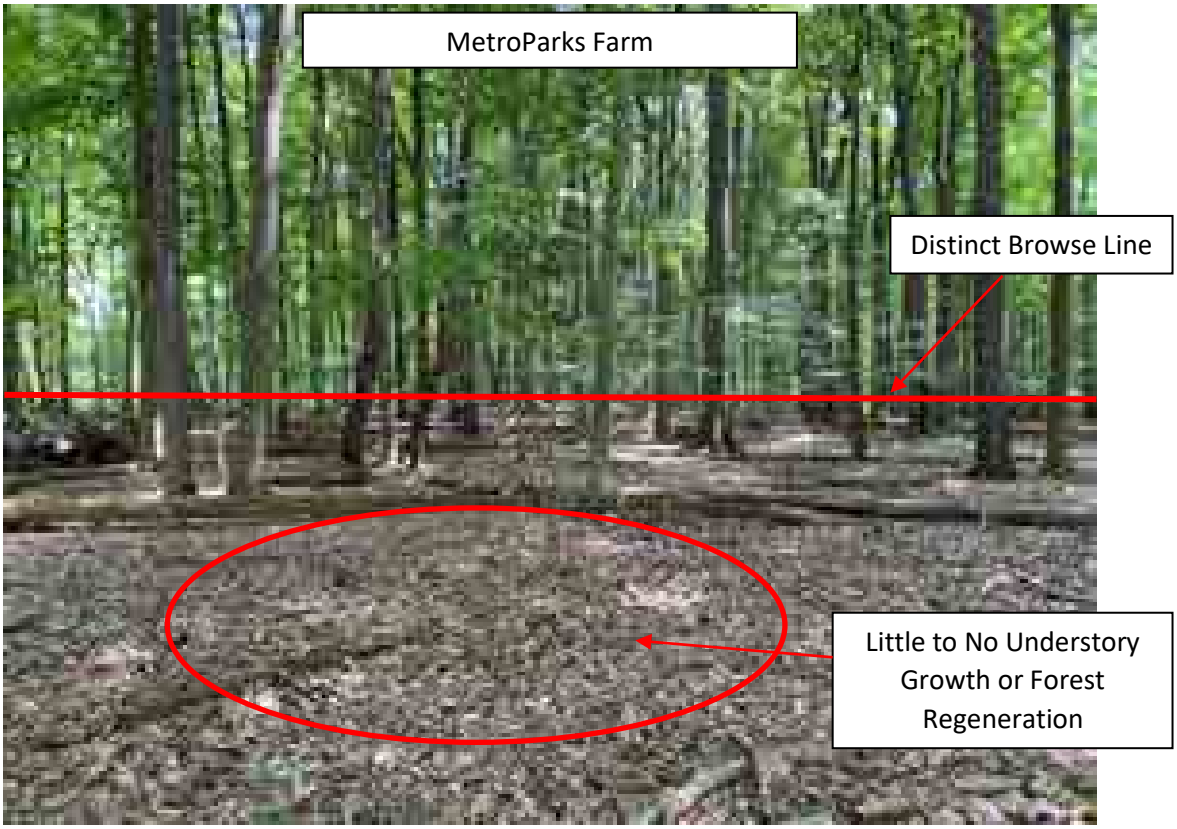

MCP – Ford Nature Center
Damage From Deer Browsing


MCP – Ford Nature Center
Distinct Browse Line


MCP – Ford Nature Center
Distinct Browse Line


MCP – Bears Den Area
Little to No Understory Growth or Forest Regeneration


MCP – Bears Den Area
Damage From Deer Browsing


MetroParks Farm
Distinct Browse Line
Little to No Understory Growth or Forest Regeneration


Hawkins Marsh
Little to No Understory Growth or Forest Regeneration


Springfield Forest
Little to No Understory Growth or Forest Regeneration


Mill Creek Wildlife Sanctuary
Little to No Understory Growth or Forest Regeneration


Egypt Swamp Preserve
Distinct Browse Line
Little to No Understory Growth or Forest Regeneration

Appendix D: Description of Properties

MILL CREEK
METROPARKS

Description of Properties to be Managed

Collier Preserve

Acquired in 2006 and 2007, the Collier Preserve (formerly known as the "Mill Creek Preserve"), consists of 303-acres located along Western Reserve Road in Boardman Township (Mahoning County, Ohio). The Collier Preserve hosts a wide array of habitat types including tall-grass prairie, wooded ravines, reverting fields, and perhaps most notably the eastern portions of the property are dominated by emergent and forested wetlands, some identified as category 3 (highest quality). Public access at this facility is restricted to a primitive, but extensive trail system which allows for various form of passive recreation such as hiking, birding, photography, etc.

Sawmill Creek Preserve

Acquired in 2002, the Sawmill Creek Preserve consists of 155-acres along South Turner Road in Canfield Township (Mahoning County, Ohio). The Sawmill Creek Preserve is primarily dominated by hardwood forest; however, several areas can be characterized as emergent wetland, or intermediate shrub/scrub brush. Public access at this facility is restricted to a primitive, but extensive trail system which allows for various form of passive recreation such as hiking, birding, photography, etc.

Mill Creek Wildlife Sanctuary

Acquired partially in 2004 and in 2022, the Mill Creek Wildlife Sanctuary consists of 482-acres along Calla Road in Beaver Township (Mahoning County, Ohio). The Mill Creek Wildlife Sanctuary is primarily dominated by emergent wetlands and open water ponds, however, several areas include hardwood forest and early successional grasslands. Public access at this facility is restricted on the western side of Mill Creek, allowing access by permit only for approved activities such as birding or photography. The eastern portion of the facility is open to the public but currently lacks any formal amenities for public access such as a parking area or trails.

Springfield Forest

Acquired in 2021, the Springfield Forest consists of 89-acres along Springfield Road in Springfield Township (Mahoning County, Ohio). As a result of previous mining activities on the property, the Springfield Forest is dominated by intermediate successional shrubs and small trees, with some limited areas of mature hardwoods and early successional hardwoods. This facility is open to the public, with a parking lot, fishing pier, and a partially improved trail system to allow for various form of passive recreation such as hiking, fishing, birding, photography, etc.

Hawkins Marsh

Acquired in 2022, the Hawkins Marsh consists of 161-acres along W. Western Reserve Road in Smith Township (Mahoning County, Ohio). The Hawkins Marsh is primarily dominated by mature hardwood forest with large areas classified as forest wetland (category 3). This facility is open to the public but currently lacks any formal amenities for access such as a parking area or trails (scheduled for installation in 2023).

Vickers Nature Preserve

Acquired in 1993, the Vickers Nature Preserve consists of 264-acres located on Akron-Canfield Road (U.S. Route 224) in Ellsworth Township (Mahoning County, Ohio). Vickers Nature Preserve is primarily dominated by hardwood forest, but some areas of early successional grassland, emergent wetland, and an open water pond are present. Public access at this facility is restricted to a partially improved and extensive trail system which allows for various form of passive recreation such as hiking, fishing, birding, photography, and unique to Vickers Nature Preserve, equestrian trail riding.

Huntington Woods

Huntington Woods consists of 383 acres located directly south of U.S. Route 224 in Boardman Township. Huntington Woods is dominated almost exclusively by dense hardwood forest, with some areas of forested wetland present within the extensive floodplain of Mill Creek. This facility is not open to the public as currently there are no parking lots or trail systems to facilitate access.

Hitchcock Woods

Hitchcock Woods consists of 665-acres located along Hitchcock Road in Boardman Township (Mahoning County, Ohio). Hitchcock Woods is comprised almost entirely of dense hardwood forest, with some areas of forested or emergent wetland present within the extensive floodplain of Mill Creek. Public access at this facility is restricted to a primitive trail loop which allows for various form of passive recreation such as hiking, birding, photography, etc.

Mill Creek Park

Established in 1891, Mill Creek Park is considered Ohio's First Park District and consists of approximately 1600 acres located north of U.S. Route 224 in Boardman Township and the City of Youngstown (Mahoning County, Ohio). Mill Creek Park is highly developed, with interspersed natural areas consisting of hardwood forest, emergent wetlands, and several open water lakes and ponds. Mill Creek Park is highly accessible to the public including both active and passive recreation such as golf, fishing, jogging, biking, hiking, organized sports, etc.

Appendix E: Controlled Hunt Program Structure

Date of Last Revision: 6.7.24

Hunt Unit Descriptions

Hitchcock Woods (Archery Only)

- Hunt Unit: 489 Acres
- 5 – Permits per Period

Huntington Woods (Archery Only)

- Hunt Unit: 223 Acres
- 2 – Permits per Period

Mill Creek Wildlife Sanctuary (East)

- Hunt Unit: 209 Acres
- 2 – Permits per Period

Mill Creek Wildlife Sanctuary (West)

- Hunt Unit: 220 Acres
- 2 - Permits per Period

Collier Preserve

- Hunt Unit: 162 Acres
- 2 – Permits per Period

Springfield Forest

- Hunt Unit: 82 Acres
- 2 – Archery Permits per Period
- 1 – Firearm Permit per Period

Hawkins Marsh

- Hunt Unit: 128 Acres
- 2 – Permits per Period

Vickers Nature Preserve

- Hunt Unit: 225 Acres
- 3 – Permits per Period

Sawmill Creek Preserve

- Hunt Unit: 128 Acres
- 3 – Archery Permits per Period
- 2 – Firearm Permits per Period

MetroParks Farm (Archey Only)

- Hunt Unit: 50 Acres
- 1 – Archery Permit per Period

Total Hunt Unit Acreage = 1,942

Total Archery Permit Periods = 8 (16 at Hitchcock & Huntington Woods)

Total Archery Permit Holders per Period = 24

Total Archery Permit Holders per Season = 192

Total Number of Firearm Permit Periods = 5

Total Firearm Permit Holders per Period = 14

Total Number of Firearm Permit Holders per Season = 70

Total Number of Permit Holders per Season = 318

Controlled Hunting Program: Rules and Regulations (Archery)

- If the permittee cannot participate, the permit may be transferred to another hunter before the start of their permit window.
- Each permittee may select one (1) partner per day.
- The permittee is required to be present in order for the selected partner to hunt.
- This permit authorizes a maximum of 2 hunters (permittee + partner) per day. Additional non-hunting persons are not permitted to participate in the hunt or venture off-trail.
- Permit valid for the dates listed on the permit only.
- Permittee and partner are responsible for obtaining necessary permits, license, endorsements, and stamps. Refer to the Ohio Hunting and Trapping Regulations.
- Permittees may not actively pursue game outside of their assigned hunt unit.
- Permit must be carried by the permittee and partner (if applicable) while in use. Digital copies are sufficient.
- Permits must also be visibly displayed on the vehicle dashboard while participating in the hunt.
- All applicable hunting regulations set forth by the Division of Wildlife must be adhered to at all times.
- All applicable MetroParks Rules and Regulations must be adhered to at all times.
- Only white-tailed deer may be harvested.
- Off-trail scouting is not permitted outside of your allotted permit window.
- Permittees and their guest may each harvest up to nine (9) deer as part of this controlled hunt by utilizing their three (3) deer bag limit allotted for Mahoning County and an additional six (6) deer management permits. The use of deer management permits as part of a controlled hunt to harvest antlerless deer does not count towards the bag limit for the county in which this hunt occurs, nor the statewide bag limit of six deer.
- Each permittee and their guest may harvest (1) antlered deer, utilizing an either-sex permit assuming they have not previously harvested an antlered deer in the same hunting season (only 1 antlered deer permitted per person statewide regardless of harvest method/location per ODOW regulations).
- Permittees and their partners may only use archery equipment legal to harvest deer in Ohio. Refer to the Ohio Hunting and Trapping Regulations.
- No hunting shall be permitted within areas defined as “No Hunting Zones” – referenced on map.
- No hunting shall be permitted within 100’ of any established pedestrian trail.

- Hunting structures such as portable treestands and ground blinds are permitted. All structures must be removed at the end of each permit window, any structure left on MCMP property must be tagged with the owner's name and phone number.
- No treestand, climbing method, and/or accessory equipment shall cause injury or damage any tree on MetroParks property – screw in steps/gear holders, climbing spikes, etc. are strictly prohibited.
- Baiting is not permitted.
- Field dressing of harvested deer onsite is permitted; however, entrails must be left out of visual distance from park infrastructure (trails, parking lots, roads, etc.).
- Any harvested deer left unattended must be temporarily tagged in accordance with ODNR regulations and shall not be left within visual sight of park infrastructure (trails, parking lots, roads, etc.). Successful hunters who wish to continue hunting the same day may do so once these conditions are met.
- Permittees and their guest may only park in the designated parking area(s) assigned to their permit. Those needing special assistance must contact the MetroParks prior to their hunt date.
- Permittees and their guest may not park in such a way to obstruct normal ingress/egress to the facility.
- Permittees and their guest are permitted to access their hunt units between the hours of 5am – 10pm. For circumstances that require access outside of these hours please contact the MetroParks Police Department (contact information below).
- Any deer exhibiting a unique color phase (albino, piebald, melanistic, etc.). are not permitted to be harvested.
- **In addition to ODOW game check requirements, all harvested deer must be reported to the MetroParks Natural Resources Manager at the end of each permit window via email at nderico@millcreekmetroparks.org or by phone at 330.702.3000 x136.**
- Failure to abide by any of the rules and regulations listed above will result in the immediate revocation of your controlled hunting permit and you will not be permitted to participate in future controlled hunting opportunities at the MetroParks.

Mill Creek MetroParks Contact Information

MetroParks Police Department
810 Glenwood Avenue
Youngstown, OH 44502
330-744-3848

Nick Derico, Natural Resources Manager
7574 Columbiana Canfield Road
Canfield, OH 44406

Date of Last Revision: 5.13.24

330-702-3000x136
nderico@millcreekmetroparks.org

Controlled Hunting Program: Rules and Regulations (Firearm)

- If the permittee cannot participate, the permit may be transferred to another hunter before the start of their permit window.
- Each permittee may select one (1) partner per day.
- The permittee is required to be present in order for the selected partner to hunt.
- This permit authorizes a maximum of 2 hunters (permittee + partner) per day. Additional non-hunting persons are not permitted to participate in the hunt or venture off-trail.
- Permit valid for the dates listed on the permit only.
- Permittee and partner are responsible for obtaining necessary permits, license, endorsements, and stamps. Refer to the Ohio Hunting and Trapping Regulations.
- Permittees may not actively pursue game outside of their assigned hunt unit.
- Permit must be carried by the permittee and partner (if applicable) while in use. Digital copies are sufficient.
- Permits must also be visibly displayed on the vehicle dashboard while participating in the hunt.
- All applicable hunting regulations set forth by the Division of Wildlife must be adhered to at all times.
- All applicable MetroParks Rules and Regulations must be adhered to at all times.
- Only white-tailed deer may be harvested.
- Off-trail scouting is not permitted outside of your allotted permit window.
- Permittees and their guest may each harvest up to nine (9) deer as part of this controlled hunt by utilizing their three (3) deer bag limit allotted for Mahoning County and an additional six (6) deer management permits. The use of deer management permits as part of a controlled hunt to harvest antlerless deer does not count towards the bag limit for the county in which this hunt occurs, nor the statewide bag limit of six deer.
- Each permittee and their guest may harvest (1) antlered deer, utilizing an either-sex permit assuming they have not previously harvested an antlered deer in the same hunting season (only 1 antlered deer permitted per person statewide regardless of harvest method/location per ODOW regulations).
- Permittees and their partners may only use firearm equipment legal to harvest deer in Ohio. Refer to the Ohio Hunting and Trapping Regulations.
- Hunter orange must be worn during all firearm controlled hunts and shall include wearing a vest, coat, jacket, or coveralls that are either solid hunter orange or camouflage hunter orange.

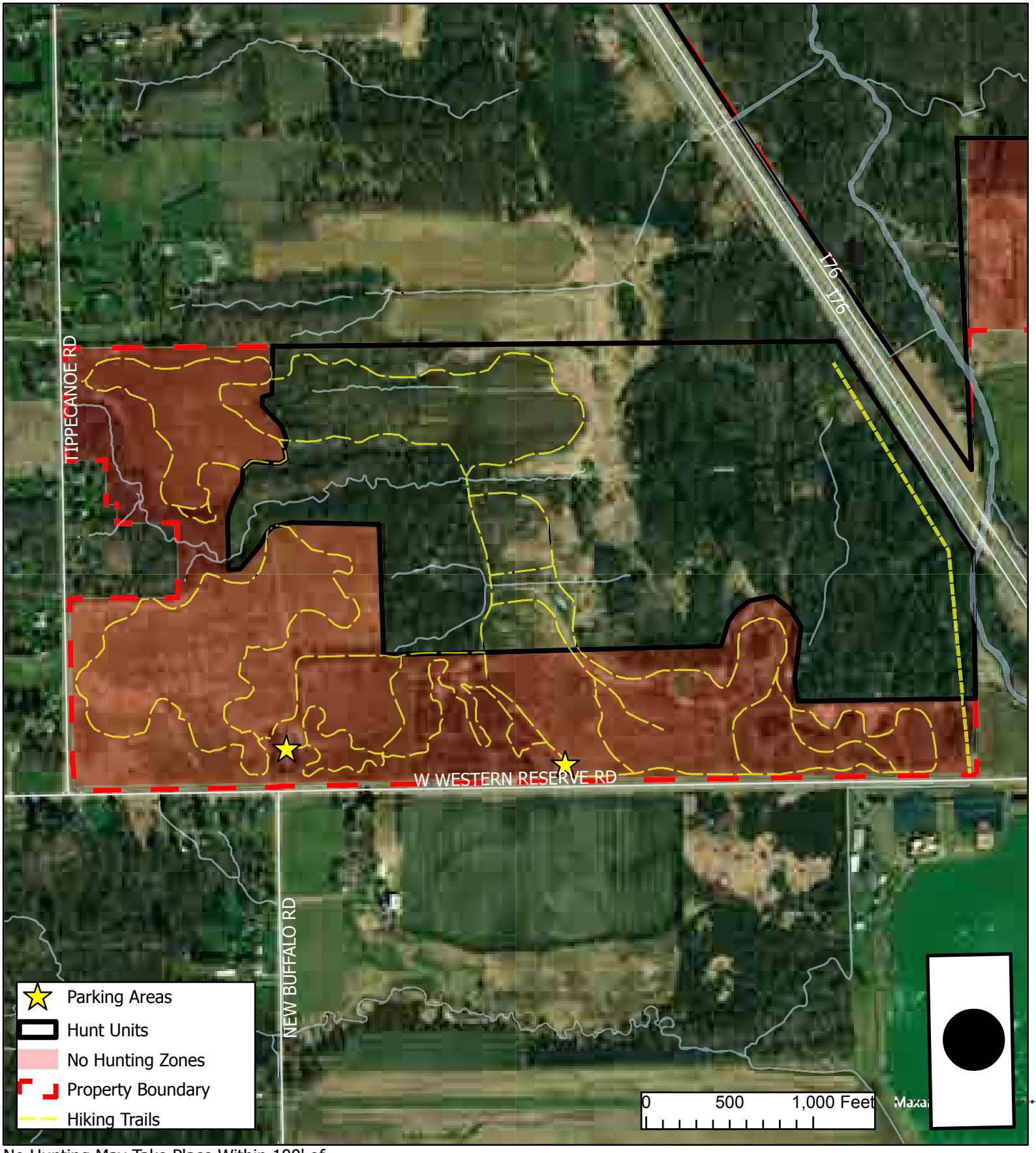
- No hunting shall be permitted within areas defined as “No Hunting Zones” – referenced on map.
- No hunting shall be permitted within 100’ of any established pedestrian trail.
- Hunting structures such as portable treestands and ground blinds are permitted. All structures must be removed at the end of each permit window, any structure left on MCMP property must be tagged with the owner’s name and phone number.
- No treestand, climbing method, and/or accessory equipment shall cause injury or damage any tree on MetroParks property – screw in steps/gear holders, climbing spikes, etc. are strictly prohibited.
- Baiting is not permitted.
- Field dressing of harvested deer onsite is permitted; however, entrails must be left out of visual distance from park infrastructure (trails, parking lots, roads, etc.).
- Any harvested deer left unattended must be temporarily tagged in accordance with ODNR regulations and shall not be left within visual sight of park infrastructure (trails, parking lots, roads, etc.). Successful hunters who wish to continue hunting the same day may do so once these conditions are met.
- Permittees and their guest may only park in the designated parking area(s) assigned to their permit. Those needing special assistance must contact the MetroParks prior to their hunt date.
- Permittees and their guest may not park in such a way to obstruct normal ingress/egress to the facility.
- Permittees and their guest are permitted to access their hunt units between the hours of 5am – 10pm. For circumstances that require access outside of these hours please contact the MetroParks Police Department (contact information below).
- Any deer exhibiting a unique color phase (albino, piebald, melanistic, etc.). are not permitted to be harvested.
- **In addition to ODOW game check requirements, all harvested deer must be reported to the MetroParks Natural Resources Manager at the end of each permit window via email at nderico@millcreekmetroparks.org or by phone at 330.702.3000 x136.**
- Failure to abide by any of the rules and regulations listed above will result in the immediate revocation of your controlled hunting permit and you will not be permitted to participate in future controlled hunting opportunities at the MetroParks.

Mill Creek MetroParks Contact Information

MetroParks Police Department
810 Glenwood Avenue
Youngstown, OH 44502
330-744-3848

Date of Last Revision: 5.13.24

Nick Derico, Natural Resources Manager
7574 Columbiana Canfield Road
Canfield, OH 44406
330-702-3000x136
nderico@millcreekmetroparks.org

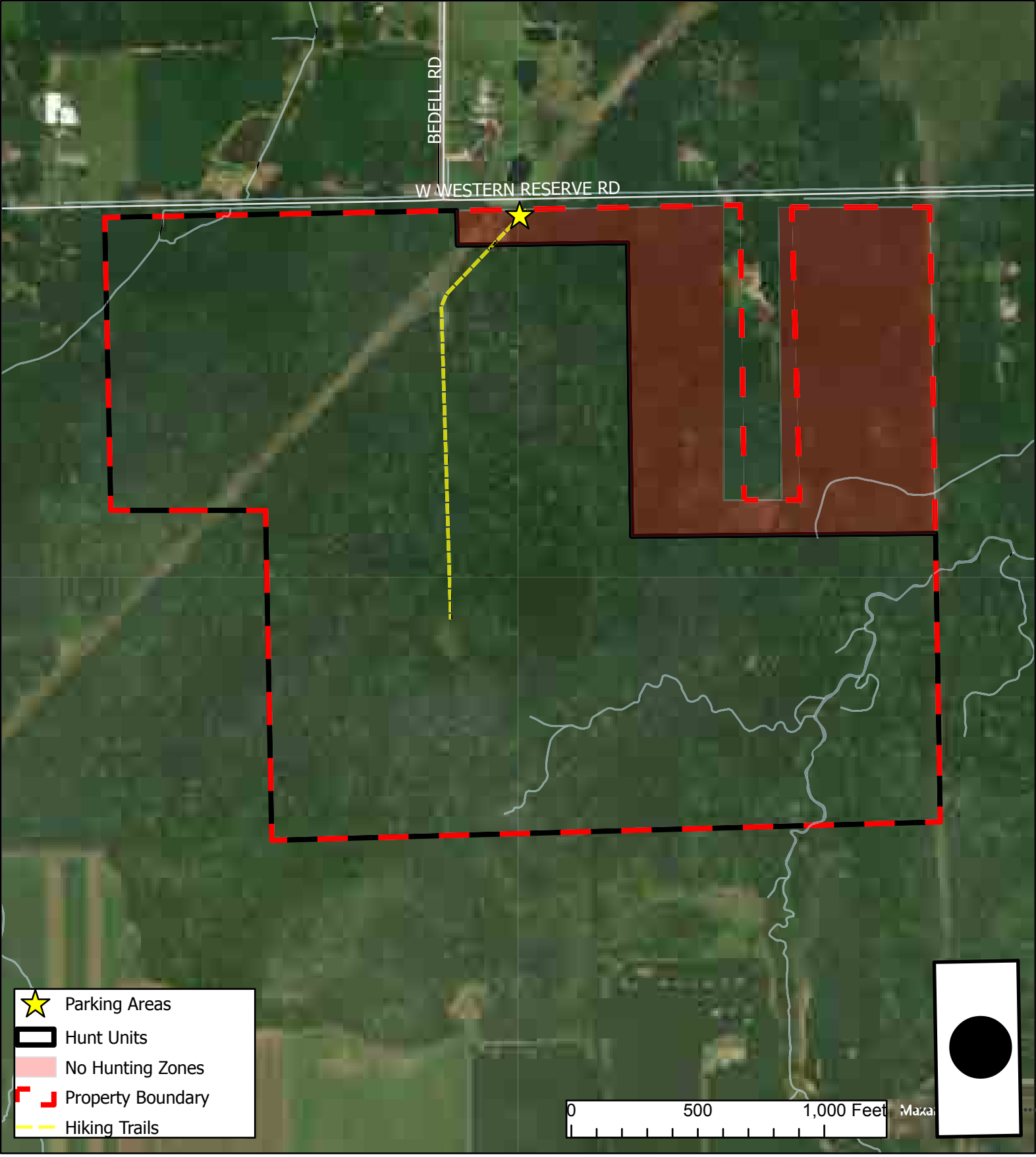


No Hunting May Take Place Within 100' of Any Established Pedestrian Trail

No Hunting Within 300' of Any Property Boundary Adjacent to Residential Areas

Collier Preserve
Hunt Units
Boardman Township
Mahoning County, Ohio

MILL CREEK METROPARKS

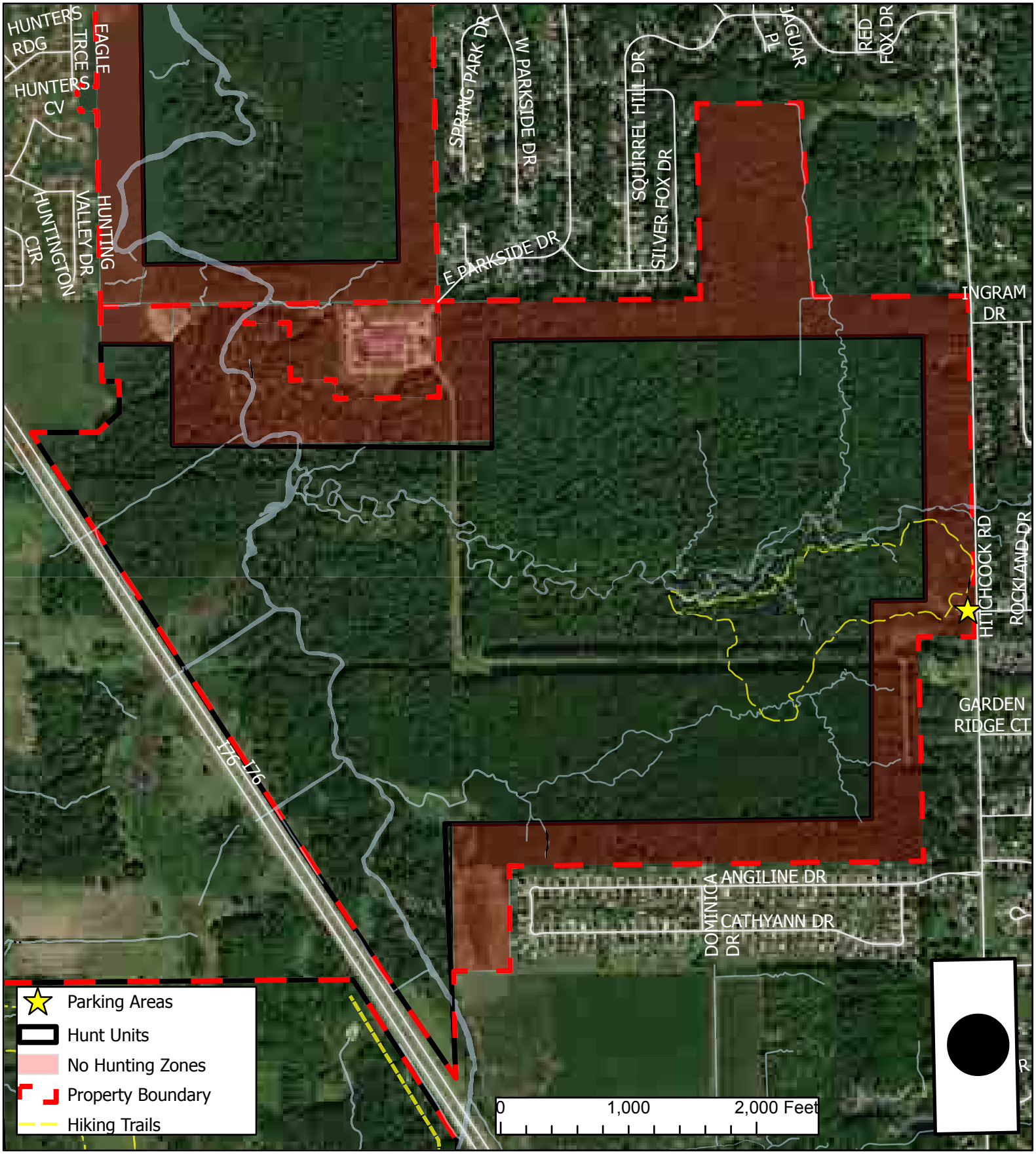


No Hunting Within 100' of Any Established Pedestrian Trail

No Hunting Within 300' of Any Property Boundary Adjacent to Residential Areas

Hawkins Marsh
Hunt Units
Smith Township
Mahoning County, Ohio

MILL CREEK METROPARKS

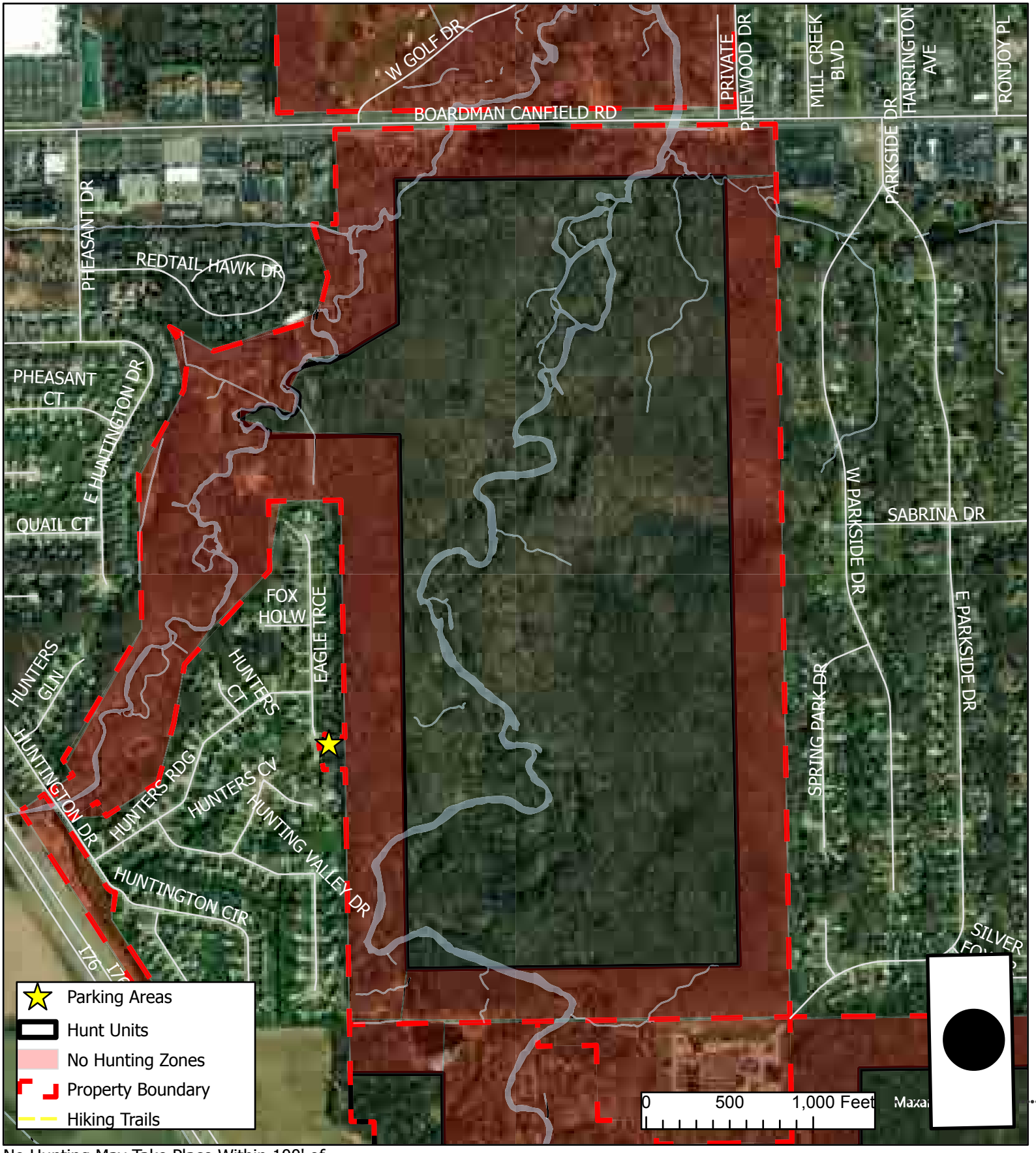


No Hunting Within 100' of Any Established Pedestrian Trail

No Hunting Within 300' of Any Property Boundary Adjacent to Residential Areas

Hitchcock Woods
Hunt Units
Boardman Township
Mahoning County, Ohio

MILL CREEK METROPARKS

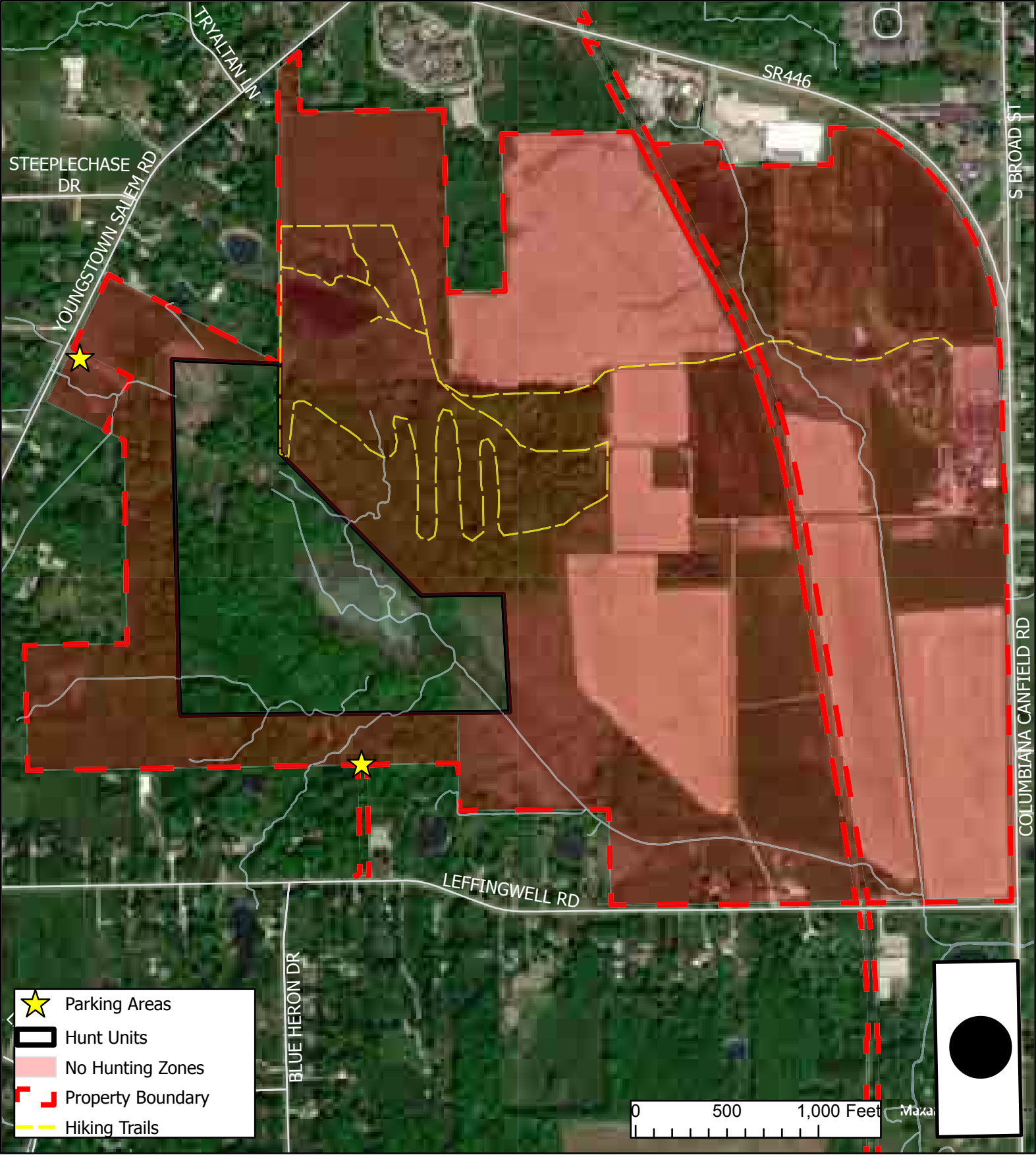


No Hunting May Take Place Within 100' of Any Established Pedestrian Trail

No Hunting Within 300' of Any Property Boundary Adjacent to Residential Areas

Huntington Woods
Hunt Units
Boardman Township
Mahoning County, Ohio

MILL CREEK METROPARKS

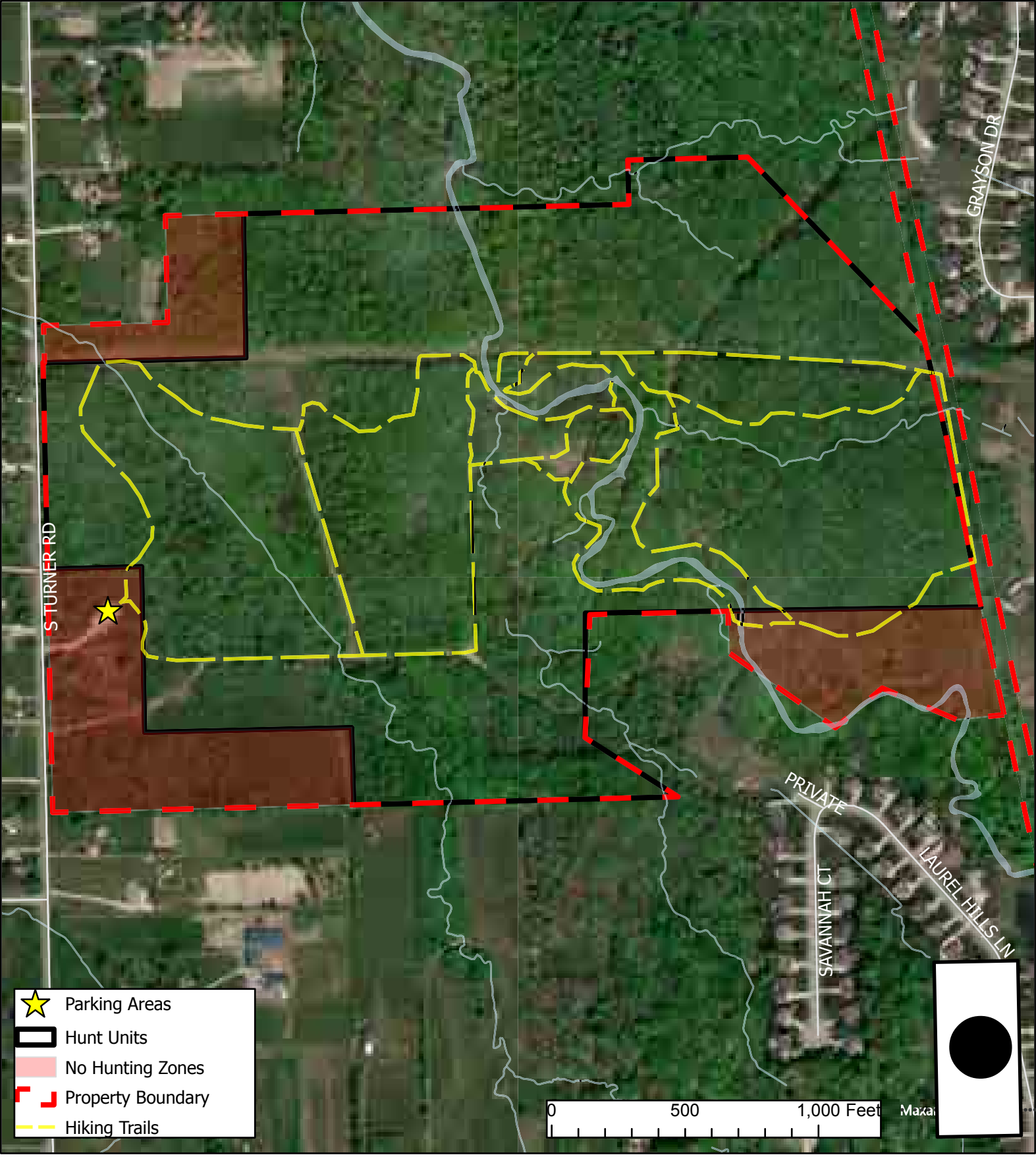


No Hunting May Take Place Within 100' of Any Established Pedestrian Trail

No Hunting Within 300' of Any Property Boundary Adjacent to Residential Areas

MetroParks Farm
Hunt Units
Canfield Township
Mahoning County, Ohio

MILL CREEK METROPARKS



No Hunting May Take Place Within 100' of Any Established Pedestrian Trail

No Hunting Within 300' of Any Property Boundary Adjacent to Residential Areas

Sawmill Creek Preserve
Hunt Units
Canfield Township
Mahoning County, Ohio

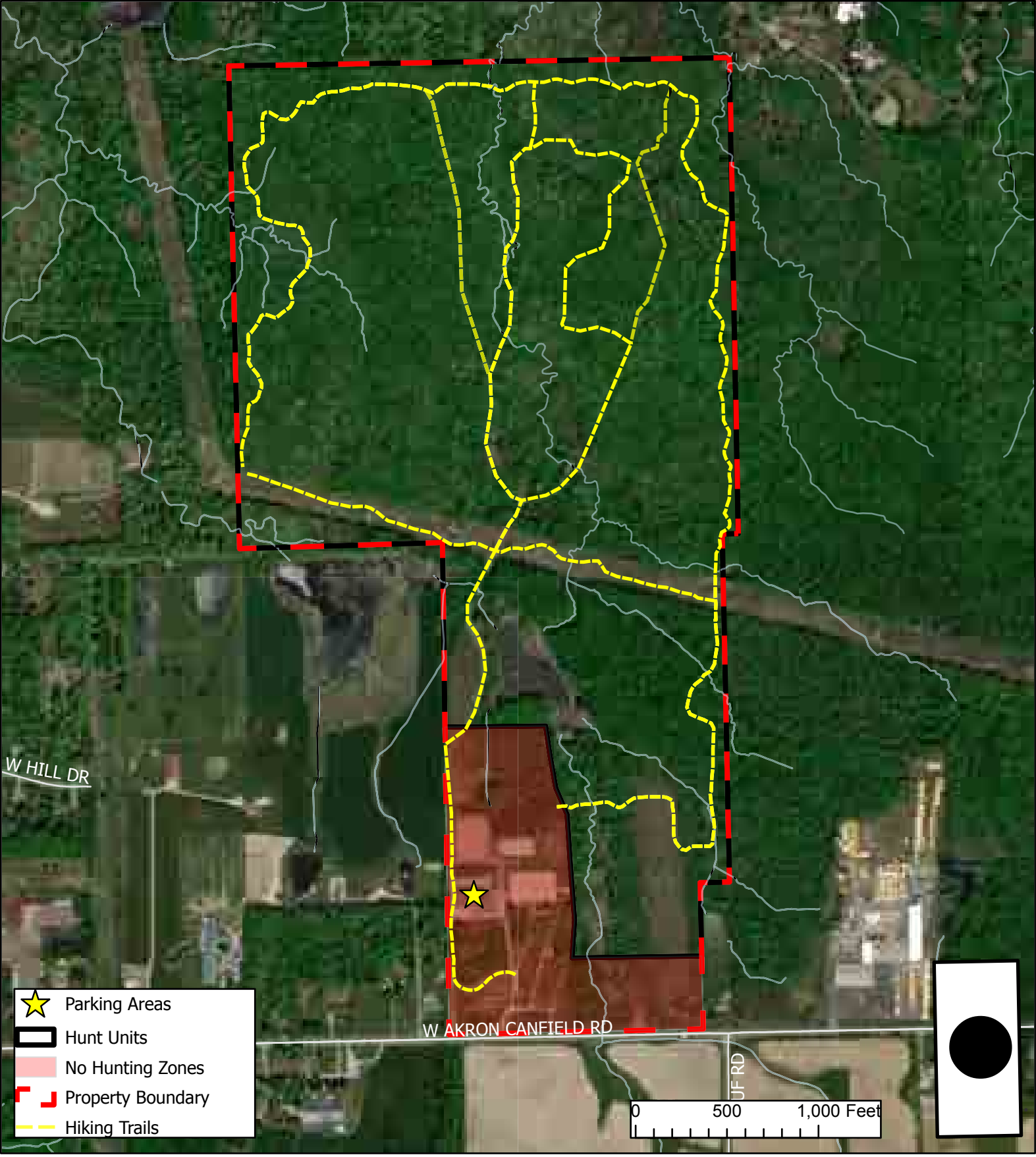
MILL CREEK METROPARKS

No Hunting May Take Place Within 100' of Any Established Pedestrian Trail

No Hunting Within 300' of Any Property Boundary Adjacent to Residential Areas

Springfield Forest
Hunt Units
Springfield Township
Mahoning County, Ohio

MILL CREEK METROPARKS



No Hunting May Take Place Within 100' of Any Established Pedestrian Trail

No Hunting Within 300' of Any Property Boundary Adjacent to Residential Areas

Vickers Nature Preserve
Hunt Units
Ellsworth Township
Mahoning County, Ohio

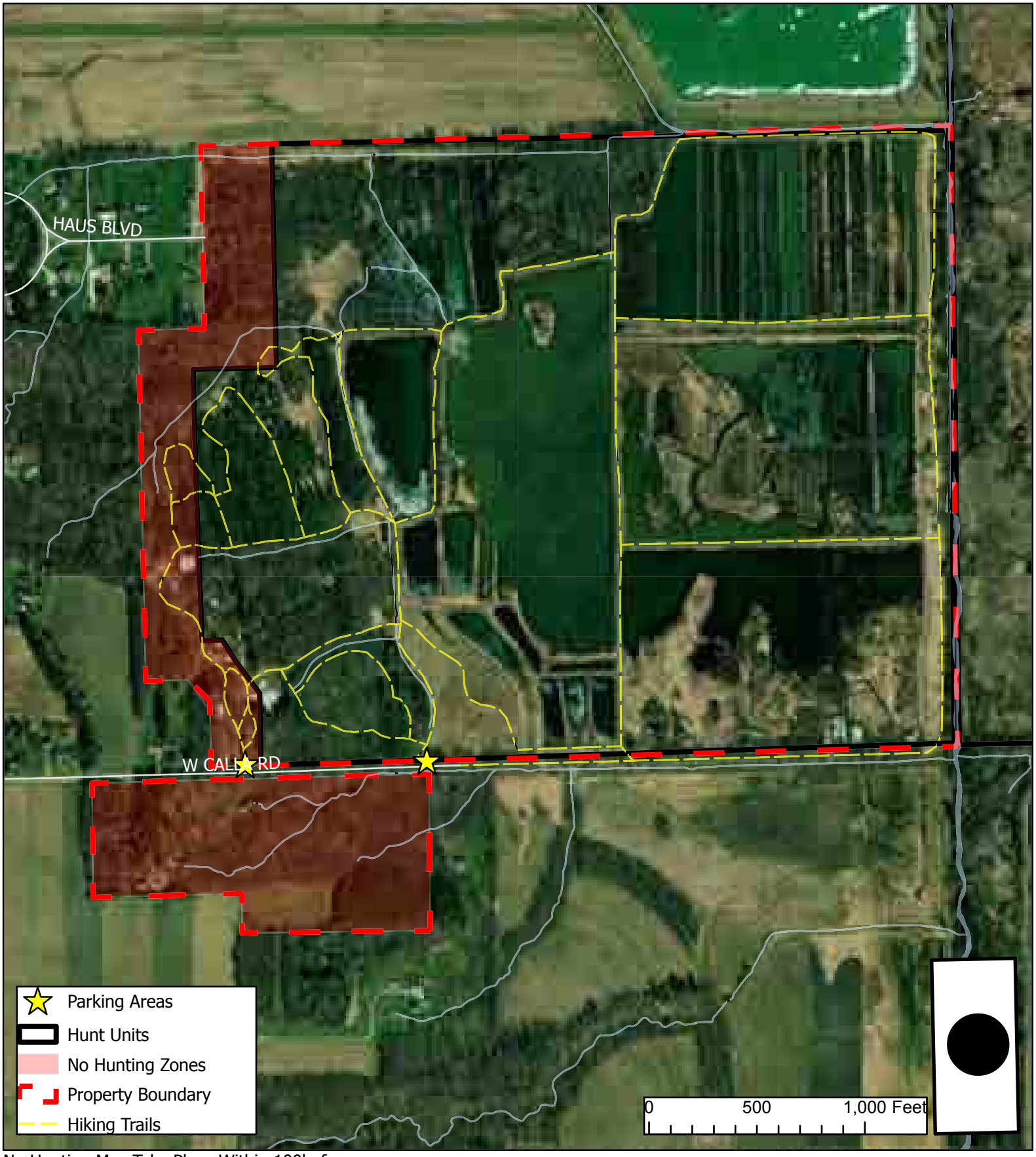
MILL CREEK METROPARKS

No Hunting May Take Place Within 100' of Any Established Pedestrian Trail

No Hunting Within 300' of Any Property Boundary Adjacent to Residential Areas

Mill Creek Wildlife Sanctuary (East)
Hunt Units
Beaver Township
Mahoning County, Ohio

MILL CREEK METROPARKS



No Hunting May Take Place Within 100' of Any Established Pedestrian Trail

No Hunting Within 300' of Any Property Boundary Adjacent to Residential Areas

Mill Creek Wildlife Sanctuary (West)
Hunt Units
Beaver Township
Mahoning County, Ohio

MILL CREEK METROPARKS

Appendix F: Targeted Removal Annual Summary

EXECUTIVE SUMMARY

Mill Creek MetroParks entered into a Cooperative Service Agreement with the United States Department of Agriculture, Wildlife Services to implement portions of the park's Deer Management Program during the 2023-2024 management season. Under this agreement, WS performed all targeted removal activities, site preparation, field dressing, data collection, and transportation of harvested deer to a butchering facility to be processed for donation and human consumption.

The targeted removals were conducted in accordance with the Ohio Division of Wildlife Deer Damage Control Permit #18048. Deer management occurred on two separate nights. The targeted removal program focused on the southern portion of Mill Creek Park (Boardman Township), with all activity taking place between Shields Road and U.S. Route 224. Thirty-eight deer were removed by Wildlife Services. Seventy-nine percent (79%) of the total harvest was comprised of female deer.

Deer were processed for human consumption by a Litchfield, Ohio based processor. A total of 1,071.5 pounds of processed meat from deer harvested on this project was donated by the park to the Second Harvest Food Bank of the Mahoning Valley. Due to staff limitations, the Second Harvest Food Bank of the Mahoning Valley declined the venison donation that resulted from the 11/30/24 targeted removal. Instead, that 284.3 pounds of venison was donated to the Greater Cleveland Food Bank.

United States Department of Agriculture
Animal and Plant Health Inspection Service
Wildlife Services

2023-2024 Summary Report of Activities
Mill Creek MetroParks Targeted Removal Program

Mill Creek MetroParks Logo

Submitted by:
USDA APHIS Wildlife Services
6100 Columbus Ave.
Sandusky, OH 44870

This document should be cited as:

*U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services. 2023-2024 Summary Report of Activities for the Mill Creek MetroParks Targeted Removal Program. Cooperative Service Agreement No.*2472395691RA. 7*pp.*

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

OVERVIEW

Need for Action

In support of white-tailed deer management to reduce damage to natural resources, the Ohio Division of Wildlife (DOW) issued Deer Damage Control Permit # 18048, authorizing Mill Creek MetroParks (MCMP) to remove up to 30 deer using targeted removal. That permit was amended on 11/29/2023 to include the authorized take of an additional 14 deer. The permit stipulated that only seven of those deer could be antlerless. The remaining seven were to be antlered deer. The DOW is the regulatory authority of wildlife in Ohio. The DOW urban/suburban deer management goal is to provide a deer population that will allow maximum recreational, aesthetic, and economic benefits while minimizing conflicts with property damage, loss of ecological biodiversity, and ensuring the overall health of the deer herd. It was under this permit that MCMP requested the assistance of Wildlife Services (WS) in meeting some of the objectives outlined in their Deer Management Plan. Specifically, MCMP would rely on professionally trained marksman from WS to perform targeted removals in areas where controlled hunting is not feasible or where controlled hunting alone fails to meet MCMP management objectives (MCMP 2023).

METHODS

Targeted Removal

For 2023/2024 the targeted removal program was focused on the southern portion of Mill Creek Park (Boardman Township), with all activity taking place between Shields Road and U.S. Route 224. The area was inspected by representatives from WS and MCMP to establish safe shooting zones before the targeted removals took place. MCMP rangers were on location, providing site security during each targeted removal effort.

Wildlife Services used rifles equipped with noise suppression devices, also known as suppressors. Suppressors quiet the muzzle blast of a rifle shot by slowing and redirecting the gases produced when the ammunition is discharged. A suppressor does not silence the sonic signature (sonic crack) of the projectile (bullet) in flight. In accordance with the American Veterinary Medical Association (AVMA) guidelines for euthanasia, shots were placed with the goal of penetration and destruction of brain tissue, causing an instant loss of consciousness.

Wildlife Services used forward looking infrared (FLIR) technology aided by night vision devices and/or firearm mounted spotlights when conducting sharpshooting activities. Wildlife Services utilized a handheld FLIR unit to locate and observe deer in complete darkness. These capabilities also further enhanced WS ability to ensure the safety of humans and pets during operations.

Data Collection and Processing

All harvested deer were tagged using temporary tags created by WS per DOW permit instructions. Each tag contained a unique identification number. Harvested deer were transported to a central processing station within the park. Biological data (gender, age, live weight) was collected for every deer. Deer were aged by assessing the tooth replacement and wear of the lower jaw (Severinghaus 1949). Deer were classified into the following age (years old) categories; 0.5, 1.5, 2.5, 3.5, 4.5 and 4.5+. The DOW places all deer older than 4.5 years of age into the 4.5+ category.

Deer were processed for human consumption by a Litchfield, Ohio based processor. A total of 1,071.5 pounds of processed meat from deer harvested on this project was donated by the park to the Second Harvest Food Bank of the Mahoning Valley. Due to staff limitations, the Second Harvest Food Bank of the Mahoning Valley declined the venison donation that resulted from the 11/30/24 targeted removal. Instead, that 284.3 pounds of venison was donated to the Greater Cleveland Food Bank.

RESULTS

Effort

Wildlife Services conducted targeted removals on two different nights (Table 1). A total of 18-person hours were utilized to remove 38 deer from the established management area within Mill Creek Park. This yielded a ratio of 0.47-person hours per deer harvested (total number of person hours spent shooting/total number of deer removed) (Table 2).

Table 1. WS targeted removals in Mill Creek Park, Ohio, 11 October and 30 November 2023.

Date	Deer Removed
10/12/2023	30
11/30/2023	8

Table 2. Effort required by WS to harvest 38 deer in Mill Creek Park, 11 October and 30 November 2023.

Number of Days	Number of Person Hours	Number of Deer Removed	Average Number of Deer Removed per Day	Number of Man Hours per Deer Removed
2	18	38	19	0.47

Age and Sex Distribution

Seventy-nine percent (79%) of the total harvest was comprised of female deer.

Table 3. Age and sex distribution of deer harvested by WS in Mill Creek Park, 11 October and 30 November 2023.

Age Class	Male	Percent of Total Harvest	Female	Percent of Total Harvest	Total for Age Class	Percent of Total Harvest
0.5	7	18%	10	26%	17	45%
1.5	1	3%	4	11%	5	13%
2.5	0	0%	8	21%	8	21%
3.5	0	0%	5	13%	5	13%
4.5	0	0%	2	5%	2	5%
4.5+	0	0%	1	3%	1	3%
Total	**8**	**21%**	**30**	**79%**	**38**	**100%**

Harvest Locations

Figure 1. A map depicting the harvest locations of deer removed by WS during the targeted removals in Mill Creek Park, 11 October and 30 November 2023.

Live Weight

Figure 2 depicts the mean live weights (lbs.) for deer harvested during management activities in Mill Creek Park. Mean weights (lbs.) have been calculated by age class for both males and females.

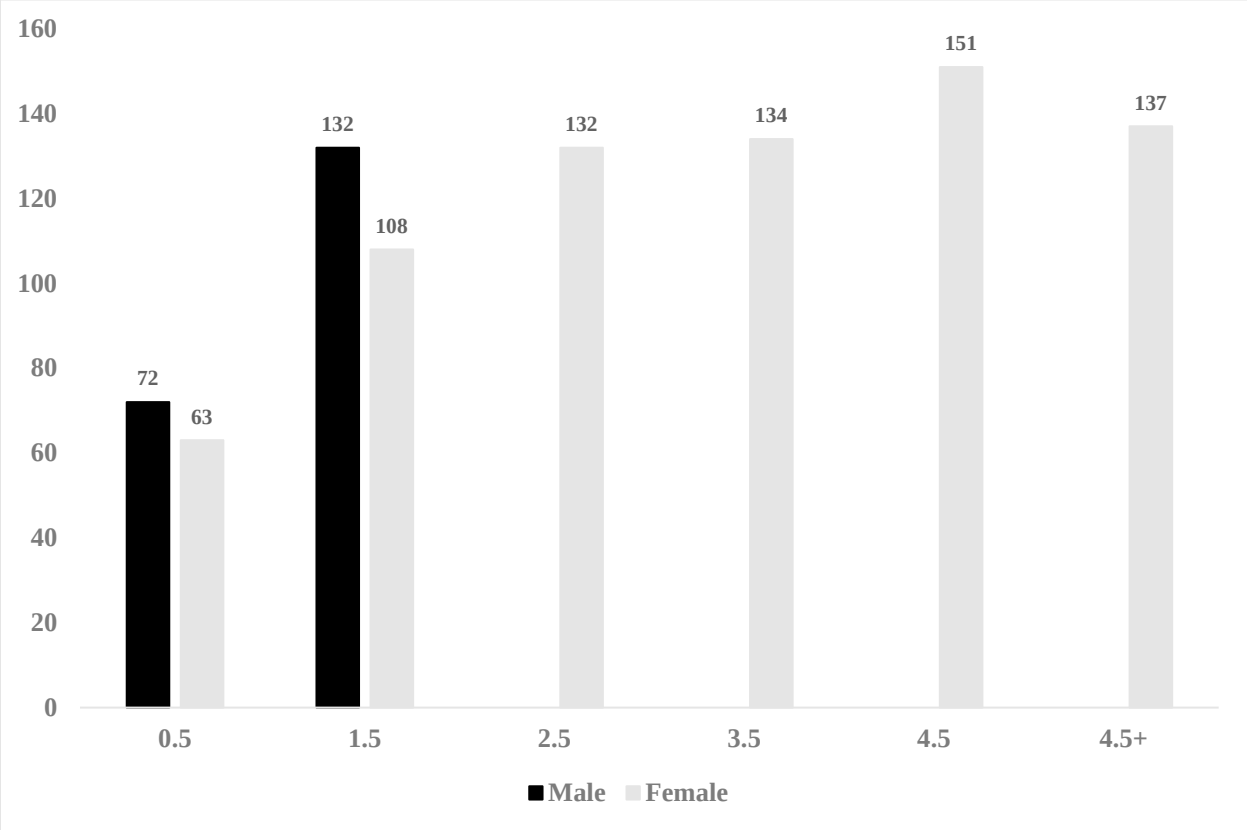


Figure 2. Mean live weights calculated by age class for male and female deer harvested by WS in Mill Creek Park, 11 October and 30 November 2023.

FUTURE MANAGEMENT

In 2023, MCMP finalized the development of a goal-oriented Deer Management Plan (MCMP 2023). The Deer Management Plan should be reviewed on an annual basis and updated periodically to reflect changing trends in science and culture. Wildlife Services will continue to support MCMP in evaluating and refining their Deer Management Plan and monitoring techniques to ensure that the most appropriate, effective, and current management practices are being utilized.

Management techniques considered in the Deer Management Plan included the use of hunting through controlled public hunts and targeted removals (MCMP 2023). Some combination of the two techniques will likely be the most efficient and cost-effective means for MCMP to reduce deer conflicts on properties where they have management authority. When possible, lethal management should be supported with non-lethal measures for an Integrated Wildlife Damage Management (IWDM) approach. The most effective approach to resolving wildlife damage is to integrate the use of several methods simultaneously. Management alternatives should be reviewed and updated annually. Goals should be evaluated and updated to reflect changes in deer populations, damage to natural resources, and overall public perception to deer within the MCMP. As the deer management program continues there may be a need to refine or change techniques to have continued success (MCMP 2023).

LITERATURE CITED

Mill Creek MetroParks (MCMP). 2023. White-tailed Deer Management Plan. 7 September 2023. 208 pp.

APPENDIX 1. 2023-2024 Biological Data for Deer Removed by WS

Date	ID Number	Sex	Age	Live Weight
10/12/2023	FY24MC001	Female	1.5	113.6
10/12/2023	FY24MC002	Male	0.5	76
10/12/2023	FY24MC003	Female	0.5	60.2
10/12/2023	FY24MC004	Female	0.5	77.3
10/12/2023	FY24MC005	Female	2.5	148.8
10/12/2023	FY24MC006	Female	2.5	129.2
10/12/2023	FY24MC007	Female	3.5	142.6
10/12/2023	FY24MC008	Male	0.5	78.4
10/12/2023	FY24MC009	Female	0.5	68.9
10/12/2023	FY24MC010	Female	0.5	47.8
10/12/2023	FY24MC011	Female	2.5	116.4
10/12/2023	FY24MC012	Female	1.5	97.4
10/12/2023	FY24MC013	Female	4.5+	136.8
10/12/2023	FY24MC014	Male	0.5	61.2
10/12/2023	FY24MC015	Female	2.5	166
10/12/2023	FY24MC016	Female	0.5	59.4
10/12/2023	FY24MC017	Female	1.5	110
10/12/2023	FY24MC018	Female	0.5	64.3
10/12/2023	FY24MC019	Male	0.5	68.2
10/12/2023	FY24MC020	Female	3.5	144.1
10/12/2023	FY24MC021	Female	0.5	62
10/12/2023	FY24MC022	Female	4.5	132.8
10/12/2023	FY24MC023	Female	3.5	123.3
10/12/2023	FY24MC024	Female	3.5	135
10/12/2023	FY24MC025	Female	0.5	52
10/12/2023	FY24MC026	Female	2.5	115
10/12/2023	FY24MC027	Male	0.5	59
10/12/2023	FY24MC028	Female	4.5	170
10/12/2023	FY24MC029	Female	2.5	131
10/12/2023	FY24MC030	Female	1.5	110.4
11/30/2023	FY24MC031	Female	3.5	127
11/30/2023	FY24MC032	Male	0.5	88
11/30/2023	FY24MC033	Male	0.5	74
11/30/2023	FY24MC034	Female	2.5	112
11/30/2023	FY24MC035	Female	0.5	67
11/30/2023	FY24MC036	Female	2.5	136
11/30/2023	FY24MC037	Female	0.5	72
11/30/2023	FY24MC038	Male	1.5	132

APPENDIX 2. 2023-2024 Mill Creek MetroParks Ohio Division of Wildlife Deer Damage Control Permit

Control Permit Number: 19048
Key: 2479993678

Division of Wildlife
Ohio Department of Natural Resources
DEER DAMAGE CONTROL PERMIT

This following permit is issued to:

Nick Derico — (330) 702-3000
(Name of Landowner, Lessee, or Agent) — (Phone No. w/Area Code)

7574 Columbiana Canfield Rd — Canfield — 44406
(Mailing Address) — (City) — (Zip Code)

This permit may be utilized on the following properties in Mahoning County:

Address (closest road intersection if no address)
1. ☐ Mailing Address (if checked)
2. Mill Creek MetroParks Properties
3.
4.
5.
6.
7.
8.

Only the below listed shooters may be present while pursuing deer utilizing this Deer Damage Control Permit:
- All shooters (except for Ohio resident landowners, their spouses, and children) must have a current Ohio hunting license to take deer under this permit.
- All shooters are subject to a background check and may be denied as a shooter if they have been convicted of a prior wildlife or weapons offense.

Shooter's Legal Name	Date of Birth
1. USDA Wildlife Services	1/1/2000
2.	
3.	
4.	
5.	

This permit shall be in effect from September 20, 2023 to March 31, 2024

This permit authorizes the killing of a total of 44 deer on properties listed on this permit

The following types of deer may be killed: ☒ Antlerless deer ☒ Antlered deer

The following must be notified: (not required to notify if "N/A" is written)

before shooting each day: N/A at ( )

after shooting each day with the number of deer shot: N/A at ( )

Special conditions of this permit: Special conditions are outlined in the letter emailed to you and shall be attached to this permit. This permit notes an increase from 30 to 44 deer and shall replace the previously issued permit.

ND (Initials) I acknowledge that if I am not the landowner, I must have written permission from the landowner prior to utilizing this permit to conduct control activities on the listed property(ies).

ND (Initials) I certify that I have read and understood all of the rules and conditions for the use of this permit listed on the front and back of this permit. Further, I understand that any failure to comply with all of the provisions of this permit will result in its immediate revocation and that any misuse of this permit will result in prosecution. I also understand that this permit does not supersede, and I must adhere to, any local laws, rules, or ordinances that pertain to the properties where this permit will be utilized.

ND (Initials) I certify that all statements made by me in this application are true and correct to the best of my knowledge, information, and belief and that I understand that knowingly and willfully providing false information and applying for this permit/license is a violation of Section 2921.13 of the Ohio Revised Code for which I am subject to arrest.

(Signature of Landowner, Lessee, or Agent) — 11/29/23 (Date)

Deer Management End of Operations Report for

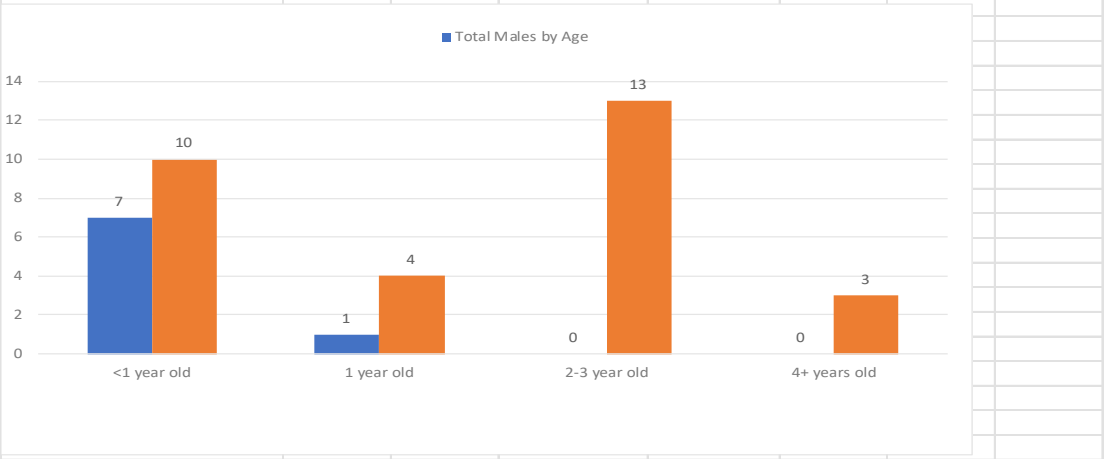
Mill Creek MetroParks

For the 2023/2024 Season

****Note-additional reports and data can be submitted with this report, but are not required****

The following is the breakdown by sex/age for the deer removed:
(double-click the chart to enter data)

Year	<1 year old	1 year old	2-3 year old	4+ years old
Total Males by Age	7	1	0	0
Total Females by Age	10	4	13	3



A total of 38 deer were removed. 38 of the deer removed resulting in 1,355.8 pounds of meat were delivered to Second Harvest Mahoning Valley 1,071.5 & Greater CLE Foodbank 284.3

remaining [ ] deer were receipted to the following:

Div. of Wildlife Deer Tag #	Name of person/organization who was receipted the deer

If any deer removed as part of this permit were tested for diseases (ex. CWD), attach the location where each sample was taken and the results to this report.

Appendix G: Browse Preference of Regional Plant Species

Deer Browse Preference of Plant Species Found Within MCMP

This document does not represent the entire catalog of flora found within Mill Creek MetroParks but is meant to highlight native species and their invasive counterparts that are found within MetroParks properties and the relative deer browse preference for that species.

In general, MetroParks properties are experiencing very little regeneration of native deciduous or coniferous tree species. Additionally, where present, the suite of understory shrubs are dominated primarily by unpalatable invasive species or deer-resistant natives such as common privet, glossy buckthorn, Japanese barberry, ironwood, or hawthorn. The same could be said for wildflowers and forbs, with unpalatable invasive species or deer-resistant natives such common teasel, Canada thistle, daffodils, wingstem, Virginia bluebell, Christmas fern, or jack-in-the-pulpit being among the species most observed.

Distinct browse lines, a lack of forest regeneration (even in non-preferred species), and the dominance of unpalatable or deer-resistant shrubs and forbs all suggest that the forest ecosystems of Mill Creek MetroParks are being shaped by the heavy browse pressure of white-tailed deer, resulting in decreased biodiversity and habitat degradation.

Deciduous Tree Species	Category	Browse Preference
Northern Red Oak	Native	High
White Oak	Native	High
Swamp White Oak	Native	High
Sugar Maple	Native	High
White Ash	Native	High
Red Maple	Native	Moderate
Pin Oak	Native	Moderate
Black Walnut	Native	Moderate
Tulip Poplar	Native	Moderate
Black Cherry	Native	Moderate
Bitternut Hickory	Native	Moderate
Hawthorn	Native	Moderate
Norway Maple	Invasive	Moderate
Shagbark Hickory	Native	Low
Ironwood	Native	Low
American Sycamore	Native	Low

American Beech	Native	Low
Slippery Elm	Native	Low
Tree of Heaven	Invasive	Low

Evergreen Tree Species	Category	Browse Preference
White Pine	Native	High
Eastern Hemlock	Native	High

Shrub Species	Category	Browse Preference
Canada Yew* (Potentially Threatened)	Native	High
Black Chokeberry	Native	High
Dogwood spp.	Native	High
Greenbrier	Native	High
Multiflora Rose	Invasive	High
American Elderberry	Native	Moderate
Honeysuckle spp.	Invasive	Moderate
Autumn Olive	Invasive	Moderate
Buttonbush	Native	Low
Spicebush	Native	Low
Common Chokecherry	Native	Low
Ninebark	Native	Low
American Holly	Native	Low
Common Privet	Invasive	Low
Glossy Buckthorn	Invasive	Low
Japanese Barberry	Invasive	Low

Wildflower/Forb Species	Category	Browse Preference
Large White Trillium	Native	High
Red Trillium	Native	High
American Cancer Root	Native	High
Jacob's Ladder	Native	High
False Solomon's Seal	Native	High
Canada Mayflower	Native	High
Goldenseal	Native	High
Cut Leaved Toothwort	Native	High
Virginia Bluebell	Native	Low
Daffodils	Introduced	Low
Dutchman's Breeches	Native	Low
Jack-in-the-Pulpit	Native	Low
Mayapple	Native	Low
Christmas Fern	Native	Low
Blue Phlox	Native	Low
Wingstem	Native	Low
Common Milkweed	Native	Low
Purple Coneflower	Native	Low
Tall Ironweed	Native	Low
Wild Leek	Native	Low
Garlic Mustard	Invasive	Low
Skunk Cabbage	Native	Low
Black-eyed Susan	Native	Low
Woodland Sunflower	Native	Low
Common Teasel	Invasive	Low
Canada Thistle	Invasive	Low
Cardinal Flower	Native	Low