

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

NDA's Trail-Camera Survey Computation Form

Year: 2022

Survey Dates: From: 7/18 To: 8/1

Property: MCWS

Acres: 300

Bucks¹ (unique) 9

Bucks² (total) 142

Does³ (total) 584

Fawns⁴ (total) 94

Pop. Factor $\frac{9}{142} = 0.063$

Does⁵ $584 \times 0.063 = 36.80$

Fawns⁶ $94 \times 0.063 = 5.92$

Correction Factor

Bucks⁷ 9 $\times 1.11 = 9.99$

Does⁸ 36.80 $\times 1.11 = 40.85$

Fawns⁹ 5.92 $\times 1.11 = 6.57$

Adjusted Population Estimates

Does per Buck $\frac{40.85}{9.99} = 4.08$

Fawns per Doe $\frac{6.57}{40.85} = 0.16$

Acres Surveyed 300

Total Pop. 57.41

Acres Surveyed 300

Deer/Square Mile $\frac{57.41 \times 640}{300} = 122$

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Hitchcock Woods

NDA's Trail-Camera Survey Computation Form

Year: 2022

Survey Dates: From: 7/18 To: 8/1

Property: Hitchcock Woods

Acres: 300

Bucks¹ (unique) 14

Bucks² (total) 262

Does³ (total) 1447

Fawns⁴ (total) 130

Pop. Factor $\frac{14}{262} = 0.053$

Does⁵ $1447 \times 0.053 = 76.69$

Fawns⁶ $130 \times 0.053 = 6.89$

Correction Factor

Bucks⁷ 14 $\times 1.11 = 15.54$

Does⁸ 76.69 $\times 1.11 = 85.13$

Fawns⁹ 6.89 $\times 1.11 = 7.65$

Adjusted Population Estimates

Does per Buck $\frac{85.13}{15.54} = 5.48$

Fawns per Doe $\frac{7.65}{85.13} = 0.09$

Acres Surveyed 300

Total Pop. 108.32

Acres Surveyed 300

Deer/Square Mile $\frac{108.32 \times 640}{300} = 231$

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Discussion

The recommended 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 camera surveys using this methodology to better understand populations densities of white-tailed deer throughout the park system and how deer are impacting the ecosystem.

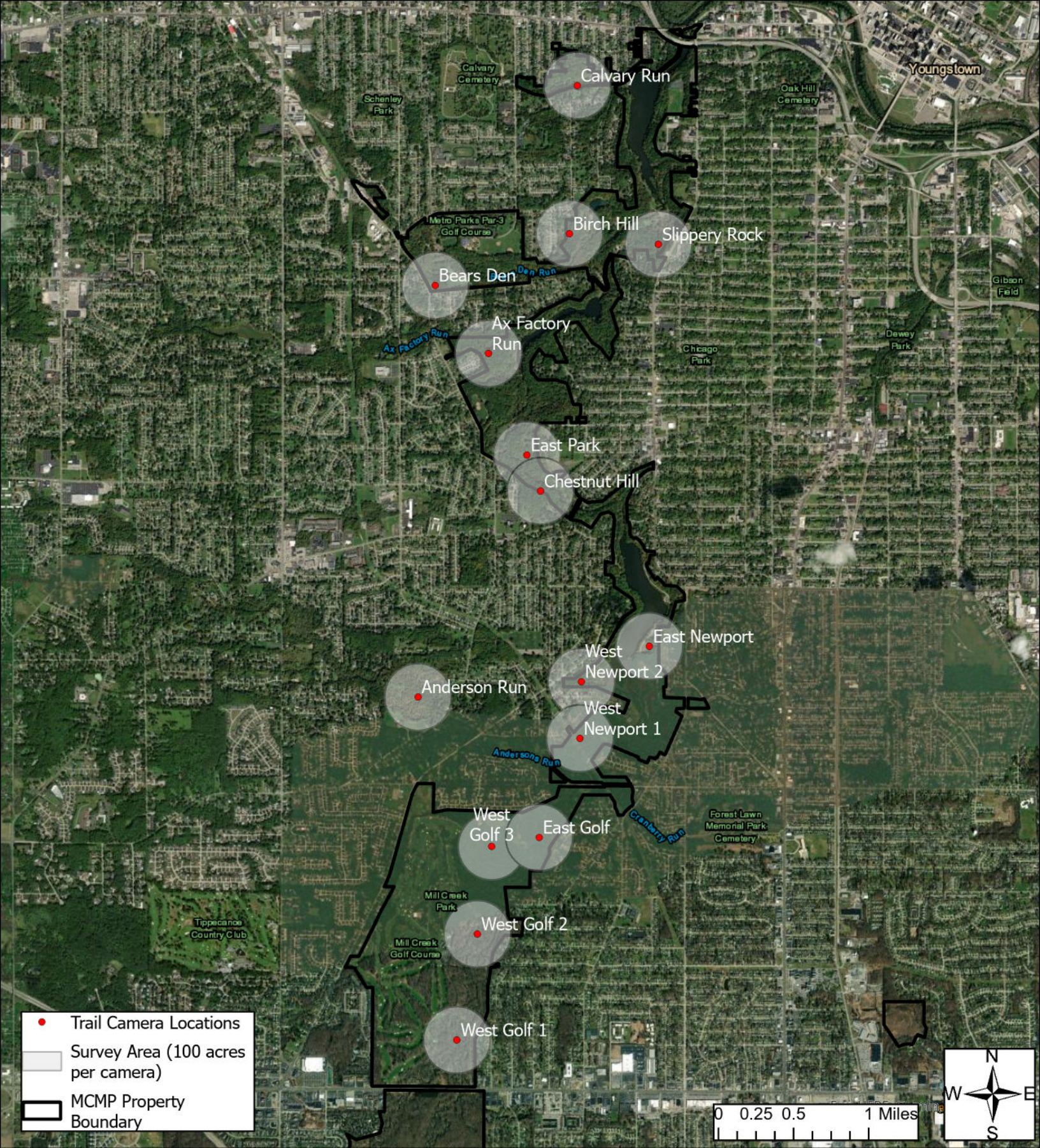
Notes

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>



Mill Creek Park

Trail Camera Survey Locations

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 disproportionately 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. This effort was extended to include Mill Creek Park in July of 2023.

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) were 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 be 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 6,718 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 mi²)
- Unique Bucks – 46
- Total Buck Pictures – 1223
- Total Doe Pictures – 3941
- 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 – 283 (51 Bucks, 167 Does, 64 Fawns)

- Doe to Buck Ratio – 3.27
- Fawn to Doe Ratio – 0.39
- Acres per Deer – 5.07
- Deer Density per Square Mile - 126

Survey Accuracy

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 126 deer/mi² an adjusted estimate for the entirety of Mill Creek Park (1,626 acres or 2.54 mi²) would be 320 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 mi²) the estimated total population would rise to 687 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

NDA's Trail-Camera Survey Computation Form



Bucks^U (unique)
 Bucks^U ÷ Bucks^T = Pop. Factor

Bucks^T (total)

Does^T (total) → × = Does^U

Fawns^T (total) → × = Fawns^U

Year: 2023

Survey Dates:

From: 7/14 To: 7/31

Property: Mill Creek Park

Acres: 1436

Bucks^U × Correction Factor = Bucks

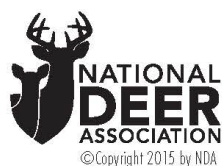
Does^U × = Does

Fawns^U × = Fawns

Adjusted Population Estimates

Carry Down to Additional Formulas

For a 14-day survey, enter a correction factor of 1.11
For a 10-day survey, enter a correction factor of 1.18
*Assuming camera density of 1 per 100 acres.



Does ÷ Bucks = Does per Buck

Fawns ÷ Does = Fawns per Doe

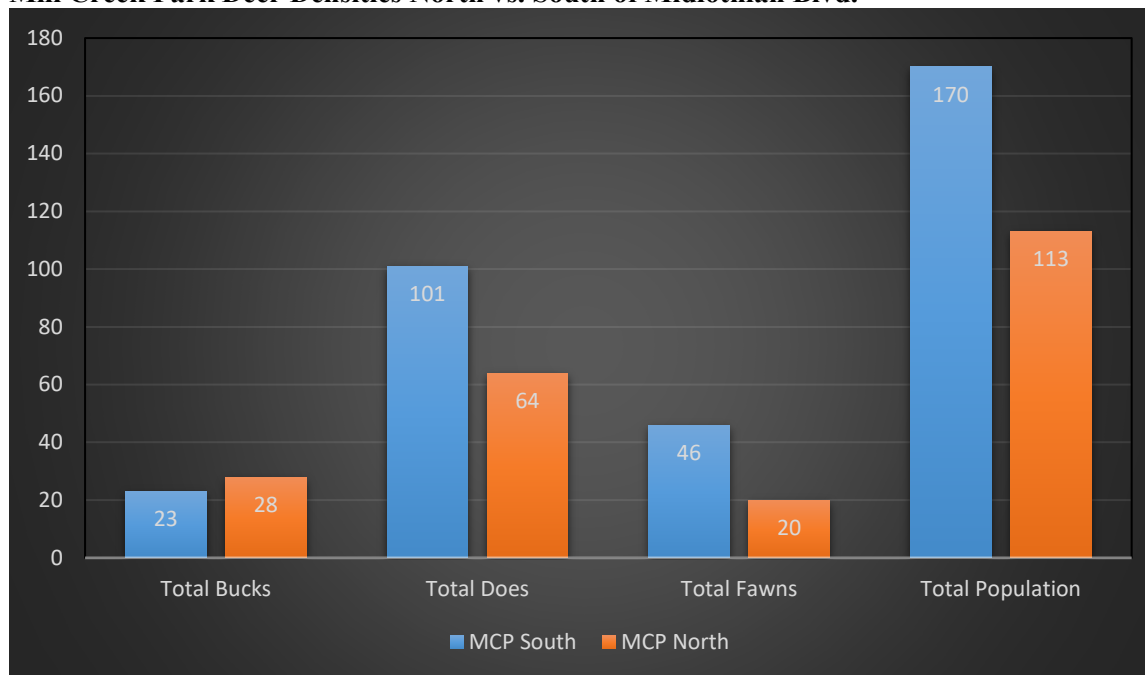
Acreage Surveyed ÷ Total Pop. = Acres/Deer

Total Pop. × 640 = ÷ Acreage Surveyed = Deer/Square Mile



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



To aid 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 documented within the survey area alone exceeds the generally accepted ecological carrying capacity of 10-20 deer/mi² ($51 \text{ bucks} / 2.24 \text{ mi}^2 = 23 \text{ bucks per mi}^2$) – when the entire population is considered (126 deer/mi²) 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 future surveys, cameras be programmed to take 2 or 3 picture 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>

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 disproportionately 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 be 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 mi²)
- 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.

Survey Accuracy

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/mi² an adjusted estimate for the entirety of Mill Creek Park (1626 acres or 2.54 mi²) 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 mi²) 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

NDA's Trail-Camera Survey Computation Form



Year: 2024

Survey Dates:

From: 8/5 To: 8/19

Property: Mill Creek Park

Acres: 1436

Bucks^U (unique) 46

Bucks^T (total) 753

Does^T (total) 2197

Fawns^T (total) 1001

Bucks^U 42 ÷ Bucks^T 753 = Pop. Factor 0.056

Does^T 2197 × Pop. Factor 0.056 = Does^U 123

Fawns^T 1001 × Pop. Factor 0.056 = Fawns^U 56

Correction Factor

Bucks^U 42 × Correction Factor 1.11 = Bucks 47

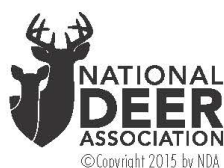
Does^U 123 × Correction Factor 1.11 = Does 137

Fawns^U 56 × Correction Factor 1.11 = Fawns 62

Adjusted Population Estimates

Carry Down to Additional Formulas

For a 14-day survey, enter a correction factor of 1.11
For a 10-day survey, enter a correction factor of 1.18
*Assuming camera density of 1 per 100 acres.



Does 137 ÷ Bucks 47 = Does per Buck 2.91

Fawns 62 ÷ Does 137 = Fawns per Doe 0.45

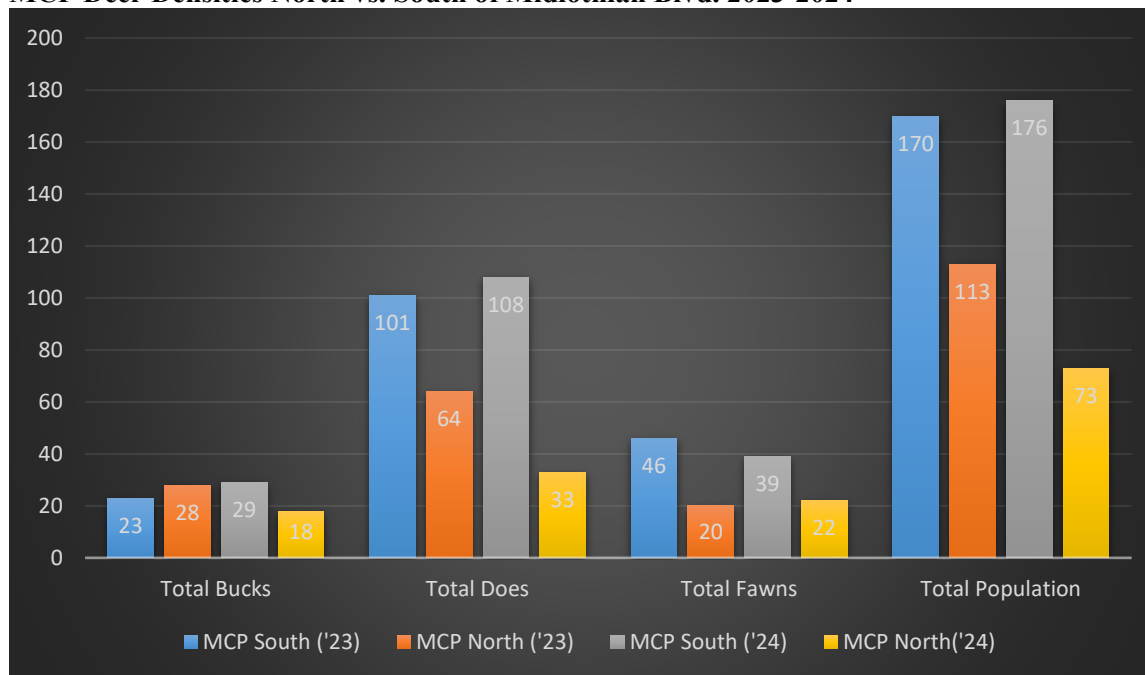
Acres Surveyed 1436 ÷ Total Pop. 246 = Acres/Deer 5.84

Total Pop. 246 × 640 = 157440 ÷ Acres Surveyed 1436 = Deer/Square Mile 110



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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 ($47 \text{ bucks} / 2.24 \text{ mi}^2 = 21 \text{ bucks per mi}^2$) – when the entire population is considered ($110 \text{ deer} / \text{mi}^2$) 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 future surveys, cameras be programmed to take 2 or 3 picture 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>

White-tailed Deer Population Densities - 2025 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 (~25lbs per camera) for a period of fourteen (14) days beginning on 7/21 and concluding on 8/4. 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 a two (2) photo burst with a three (3) second delay between the first and second photo. Each photo was stamped with time and date.

The SD cards were collected from each camera on the last day of the survey. 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 be 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 8,259 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 mi²)
- Unique Bucks – 48
- Total Buck Pictures – 1760
- Total Doe Pictures – 4463
- Total Fawn Pictures – 2036

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 – 250 (53 Bucks, 135 Does, 62 Fawns)

- Doe to Buck Ratio – 3
- Fawn to Doe Ratio – 0.46
- Acres per Deer – 5.7
- Deer Density per Square Mile – 111

*Equipment malfunctions occurred during the survey at camera locations Bears Den, Birch Hill, Calvary Run, East Golf, East Park, East Newport, Slippery Rock, West Newport 1, and West Newport 2. The malfunctions resulted in a loss of photos throughout the survey. This negatively impacted the total number of pictures collected, therefore, would have effects on the end result of the survey.

Survey Accuracy

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 111 deer/mi² an adjusted estimate for the entirety of Mill Creek Park (1626 acres or 2.54 mi²) would be 282 deer within park boundaries. Furthermore, by 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 mi²) the estimated total population would rise to 605 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 the time of writing.

MCP Trail Camera Data Sheet 2025

NDA's Trail-Camera Survey Computation Form

Bucks^u (unique) 48

Bucks^t (total) 1760

Does^t (total) 4463

Fawns^t (total) 2036

Bucks^u 48 ÷ Bucks^t 1760 = Pop. Factor 0.0273

Does^t 4463 × Pop. Factor 0.0273 = Does^u 122

Fawns^t 2036 × Pop. Factor 0.0273 = Fawns^u 56

Correction Factor

Bucks ^u	x	1.11	=	53	Adjusted Population Estimates
Does ^u	x	1.11	=	135	
Fawns ^u	x	1.11	=	62	

For a 14-day survey, enter a correction factor of 1.11
For a 10-day survey, enter a correction factor of 1.18
*Assuming camera density of 1 per 100 acres.

Year: 2025

Survey Dates: From: 7/21 To: 8/4

Property: Mill Creek Park

Acres: 1436

Does 135 ÷ Bucks 53 = Does per Buck 3

Fawns 62 ÷ Does 135 = Fawns per Doe 0.46

Acres Surveyed 1436 ÷ Total Pop. 250 = Acres/Deer 5.7

Total Pop. 250 × 640 = 160,000 ÷ Acres Surveyed 1436 = Deer/Square Mile 111

Carry Down to Additional Formulas



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Notes on Using this Computation Form:

Total Deer: In sorting photos from a 14-day survey, count the total number of antlered bucks, total number of does, and total number of fawns (deer under 1 year of age). "Total" includes known repeats, so an individual deer photographed 10 times in one visit would count 10 times toward the "total" number.

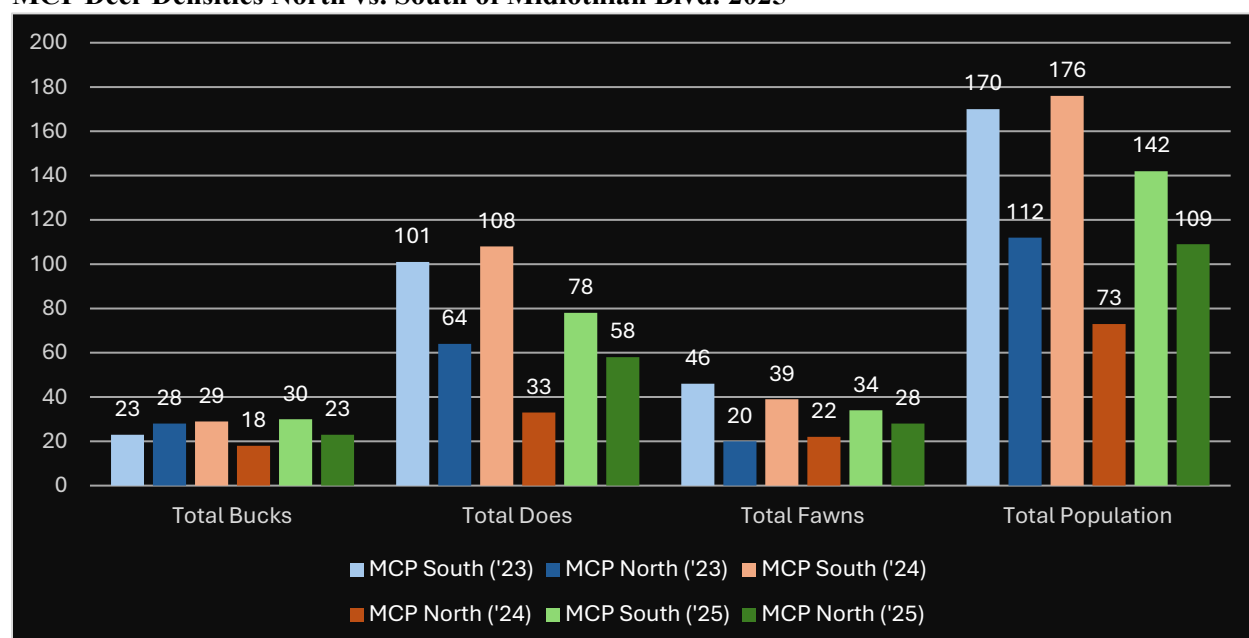
Unique Bucks: This is the number of unique, individual bucks that appear in your total set of photos from the 14-day survey period. For example, you may have a total of 1,000 photos of bucks, and this number includes 30 unique bucks photographed multiple times each.

Unidentified: Remember to be conservative in your sorting. If you cannot confidently identify a deer as a buck, doe or fawn, do not include it in the "total" numbers for your survey.



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MCP Deer Densities North vs. South of Midlothian Blvd. 2025



To aid 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 graphs above, antlered bucks have been distributed fairly evenly, but does and fawns are higher in the southern section. Additionally, the graph shows that the overall population for the southern section of the park is largely unchanged from 2023-2025. Despite the removal of 113 deer (38 in 2023 and 75 in 2024). The overall population estimates have remained largely unchanged. Indicating the need for continued and increased management efforts in this area.

In terms of total estimated population, the southern section of Mill Creek Park was 21.9% 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

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 over browsing. As documented by this study, the corrected number of unique antlered bucks alone exceeds ecological carrying capacity ($53 \text{ bucks} / 2.24 \text{ mi}^2 = 24 \text{ bucks per mi}^2$). When the entire population is considered ($111 \text{ deer} / \text{mi}^2$), 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 over-browsing is readily apparent throughout the park, where distinct browse lines and little-to-no native understory regeneration are commonplace. This can be seen visually but is also supported through ecological survey work conducted in 2023-2025 that can 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.

Furthermore, it is recommended that SD cards are switched every Friday during the survey period to identify and resolve any equipment and/or other issues as quickly as possible during the survey period.

Additional Resources

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

White-tailed Deer Population Densities - 2026 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 for a period of fourteen (14) days beginning on 7/21 and concluding on 8/4. Camera locations were rebaited three (3) times per week on Monday, Wednesday, and Friday of each week, with ~16-17 lbs of corn each time.

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 a two (2) photo burst with a three (3) second delay between the first and second photo. Each photo was stamped with time and date.

The SD cards were collected from each camera at various points during the survey. 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 be 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 5,337 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 mi²)
- Unique Bucks – 48
- Total Buck Pictures – 1418
- Total Doe Pictures – 2687
- Total Fawn Pictures – 1232

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 – 201 (53 Bucks, 101 Does, 47 Fawns)

- Doe to Buck Ratio – 2
- Fawn to Doe Ratio – 0.47
- Acres per Deer – 7.14
- Deer Density per Square Mile – 90

*Equipment malfunctions occurred during the survey at camera locations Birch Hill, East Park, East Newport, Slippery Rock, West Newport 1, West Newport 2 West Golf 1, West Golf 2 and West Golf 3. The malfunctions resulted in a loss of photos throughout the survey. This may have resulted in a decrease in the total number of pictures collected, and therefore, a decrease in the final population density estimates.

Survey Accuracy

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 considered to be 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 90 deer/mi² an adjusted estimate for the entirety of Mill Creek Park (1626 acres or 2.54 mi²) would be 228.6 deer within park boundaries. Furthermore, by 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 mi²) the estimated total population would rise to 490 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 the time of writing.

MCP Trail Camera Data Sheet 2026

NDA's Trail-Camera Survey Computation Form

Bucks^U (unique) 48

Bucks^T (total) 1418

Does^T (total) 2686

Fawns^T (total) 1232

Bucks^U 48 ÷ Bucks^T 1418 = Pop. Factor 0.0339

Does^U 91

Fawns^U 42

Correction Factor

Bucks^U 48 × 1.11 = Bucks 53

Does^U 91 × 1.11 = Does 101

Fawns^U 42 × 1.11 = Fawns 47

For a 14-day survey, enter a correction factor of 1.11
For a 10-day survey, enter a correction factor of 1.18
*Assuming camera density of 1 per 100 acres.

Year: 2026

Survey Dates: From: 7/20 To: 8/4

Property: Mill Creek Park

Acres: 1436

Adjusted Population Estimates

Carry Down to Additional Formulas



NATIONAL DEER ASSOCIATION
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Does	101	÷	Bucks	53	=	Does per Buck	2
Fawns	47	÷	Does	101	=	Fawns per Doe	0.47
Acres Surveyed	1436	÷	Total Pop.	201	=	Acres/Deer	7.14
Total Pop.	201	× 640	=	128640	÷	Acres Surveyed	1436
					=	Deer/Square Mile	90



Deer Cameras

This computation form is taken from the pages of *Deer Cameras: The Science of Scouting*, a 242-page book available from the National Deer Association (NDA).

The book includes four chapters devoted to the trail-camera survey method, including planning, set-up, sorting photos, aging deer, interpreting results, and the answers to many frequently asked questions regarding surveys.

Notes on Using this Computation Form:

Total Deer: In sorting photos from a 14-day survey, count the total number of antlered bucks, total number of does, and total number of fawns (deer under 1 year of age). "Total" includes known repeats, so an individual deer photographed 10 times in one visit would count 10 times toward the "total" number.

Unique Bucks: This is the number of unique, individual bucks that appear in your total set of photos from the 14-day survey period. For example, you may have a total of 1,000 photos of bucks, and this number includes 30 unique bucks photographed multiple times each.

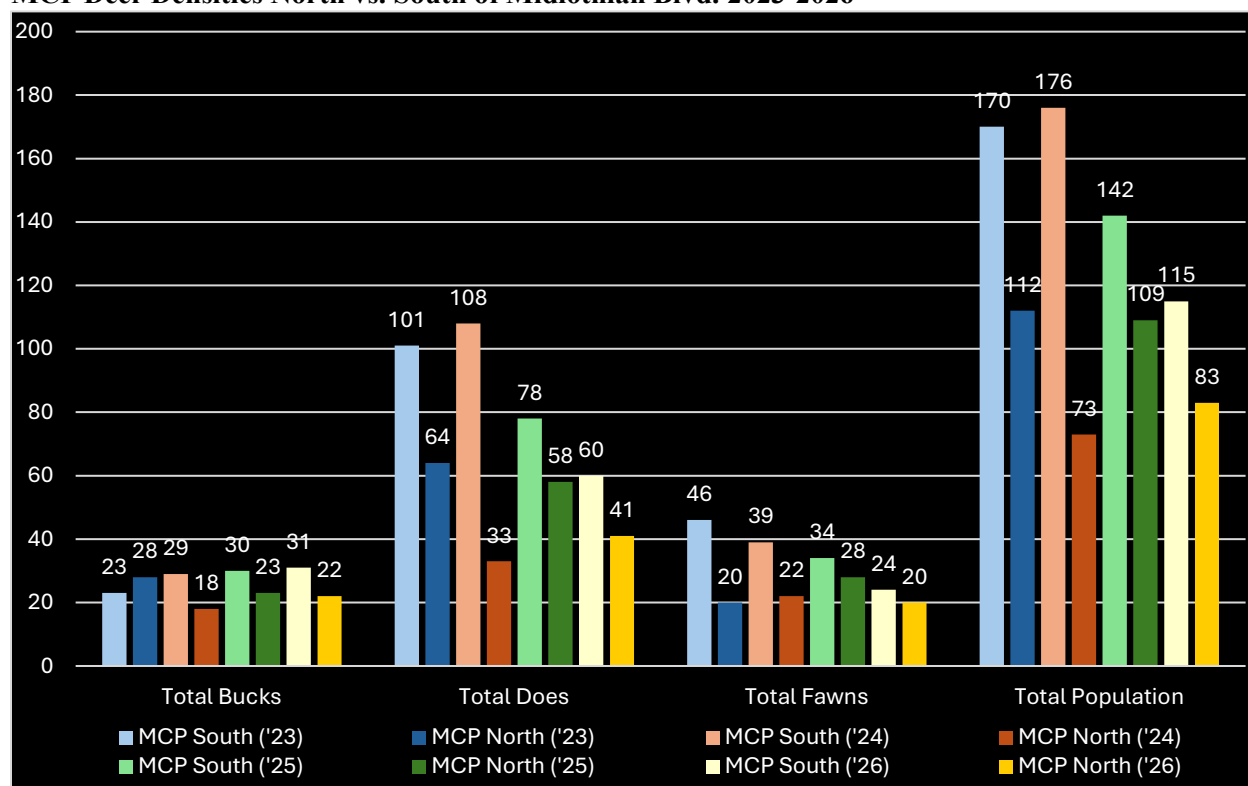
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NATIONAL DEER ASSOCIATION

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MCP Deer Densities North vs. South of Midlothian Blvd. 2023-2026



To aid in determining management decisions related to the 2026-2027 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 graphs above there has been a gradual, but steady decline in overall populations. Most significantly seen in the estimated number of does and fawns. The difference can be attributed to removal focusing mostly on antlerless deer.

Comparing the total estimated population of the northern and southern sections of Mill Creek Park, the southern section of Mill Creek Park was 38.6% higher compared to the northern section. Based on the formula used, this may be due to a higher number of unique bucks observed in the south vs. the north (28 vs 20). Though deer removal takes place in the southern portion of the park, deer densities remain higher in the south than the north. This could be an indicator of deer movement in and out and between the north and south portions of the park. However, population density estimates in both the northern and southern portions of the park have trended downward in recent years.

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 over-browsing. As documented by this study, the corrected number of unique antlered bucks alone exceeds ecological carrying capacity ($48 \text{ bucks} / 2.24 \text{ mi}^2 = 21 \text{ bucks per mi}^2$). When the entire population is considered ($90 \text{ deer} / \text{mi}^2$),

estimates greatly exceed carrying capacity, further demonstrating the continued need for active management of deer populations within Mill Creek Park.

Evidence of ecological damage caused by over-browsing is readily apparent throughout the park. Distinct browse lines and little-to-no native understory regeneration are commonplace. The lack of forest regeneration is not only supported by plain observation but also supported through ecological survey work conducted in years 2023-2026. This survey can 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.

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