2021 – 2026
Deer Management Plan

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Revised 6-11-2021

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June 11, 2021

Dear Board of Park Commissioners,

Cincinnati Parks manages over 3,500 acres of forested lands. The Cincinnati Parks Division of Natural Resources (DNR) is responsible for the conservation of park forests, trees, and greenspaces. Our team accomplishes this task through the preservation, protection, and enhancement of our natural resources for both current and future generations to enjoy. One of the greatest challenges faced by staff in managing forest areas is the loss of young tree seedlings and spring wildflowers due to the over abundant white-tailed deer population.

White-tailed deer are considered a keystone species, meaning they play an important role in shaping how an ecosystem will function. Without the presence of large, natural predators, such as mountain lions, wolves, and black bears, the deer population rapidly grows disproportionately impacting other species present in the environment. When this happens, the forest quickly becomes over-browsed, with sensitive species like our state wildflower, the Great White Trillium, disappearing from the landscape. Without deer management, our forests will continue to decline altering the overall forest composition and the long-term ability of our forests to regenerate. Because of this, our deer management plan is focused on reducing the overall deer population to a level which will not result in over-browsing of the forest and other natural areas.

Cincinnati Parks began actively managing the deer population in 2007. Similar deer management programs have been implemented in park systems throughout the country, reinforcing the need for proactive measures. Over the last 13 years, our controlled bow hunting program has become well established with an exemplary safety record. Staff are confident that this is a direct result of the mandatory annual qualification procedure that includes a skills test, certification through the Ohio Department of Natural Resources Division of Wildlife (ODNR DOW) for the completion of the state hunter educational training, and a very specific training delivered by Parks DNR staff detailing the CPB hunting regulations, safety requirements, and hunter etiquette. As a result of this due diligence, the ODNR DOW has noted that our program serves as a model for other municipalities and organizations within the state.

As noted, the goal of this program is to reach an ecological balance between the deer population and forest/wildflower regeneration. Based on the available evidence and recommendations put forth by the ODNR DOW State Wildlife Biologists, CPB has set our target deer population management goal at 20 deer per mi2. Success in

meeting this goal will be determined through a combination of population estimates derived from surveys and regular ecological assessments such as floristic and browse damage analysis. Deer population estimates and ongoing ecological assessments indicate the program is having a positive impact on our natural areas, with anecdotal evidence that wildflowers and tree seedlings are slowly returning to some areas within parks. Beyond these benefits, the program itself annually provides over 10,000 meals to those in need by hunters donating their harvests to the non-profit Farmers and Hunters Feeding the Hungry (FHFH). For every deer harvest which is donated, FHFH can provide up to 200 meals for those in need (www.fhfh.org).

Aside from the ecological aspects, it is imperative that all parks function in service to our community. Naturally, the deer management program garners significant interest from park users. As public servants, DNR staff have continuously addressed questions regarding access, safety, humaneness, and overall effectiveness. Concerns about the deer management program are addressed in a timely and respectful manner, taking into account the viewpoints of all users.

Historically, one of the most common issues brought to our attention has been the reduced park and trail access due to closures within hunting zones. After years of receiving this feedback from the public, DNR staff reviewed state and national trail closure policies in relation to hunting programs and found that open trails through hunting zones are a common practice in state and national parks. Therefore, for the 2020-21 controlled bow hunting season staff presented a plan to the Park Board Commissions recommending that we piolet opening the trails to the public in the majority of hunting zones and require hunters to maintain a 30’ buffer around trails. The piolet year was a great success, determined by the overwhelmingly positive feedback from both park patrons and hunters alike.

The core trail related complaint received this past season was regarding those few areas that remained closed (Ault, Alms, and the most active trail areas in Mt. Airy). As a result, this year we are proposing keeping all trails open throughout the system. Beyond this change, we have analyzed the entirety of CPB property for opportunities to expand the program and cover more ground where needed most, our nature preserves. Therefore, with this plan we are proposing the addition of hunting zones within Caldwell and LaBoiteaux Woods Nature Preserves.

All this being said, the purpose of this document is to present a forward-facing detailed explanation of all the nuances that are and have been taken into consideration to build out this program. Our goal, in the creation of this plan is to communicate how and why the program is structured the way it is and to guide our actions for the next five years to maintain consistent practices, research methods and community expectations. With CPB approval of this plan, we will track the successes, shortcoming, and feedback, which will inform any changes needed for the next five-year iteration of this plan.

Respectfully,



Crystal Courtney | *Division Manager of Natural Resources*

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Section 1: Area Description, Cincinnati Parks

The City of Cincinnati is located within Hamilton County in the state of Ohio. The city encompasses an area of 79.54 sq. miles and is home to 332,000 residents. Encompassing 4,394 acres, the Cincinnati Park Board (CPB) manages 8.6% of the city's land area. It is composed of five regional parks, 69 neighborhood parks, 32 nature preserves, 7 greenspaces, and 7 parkways (Figure 1). The mission of the CPB is to conserve, manage, sustain, and enhance parks' natural and cultural resources and public greenspace for the benefit of the Cincinnati community. These areas provide space for outdoor recreation and relaxation activities such as hiking, picnicking, nature immersion, and nature study to an estimated 6 million visitors per year. Of the 4,394 acres Cincinnati parks manages, 3,561 acres (81.05%) are forested, while turf grass accounts for 361 acres (8.21%), impervious surface 218 acres (4.96%), 205.6 acres of horticultural display beds (4.68%), and 48.89 acres of meadows (1.11%). Of the park system's 3,561 forested acres, 1,427 (32.48%) are utilized annually in the deer management program.

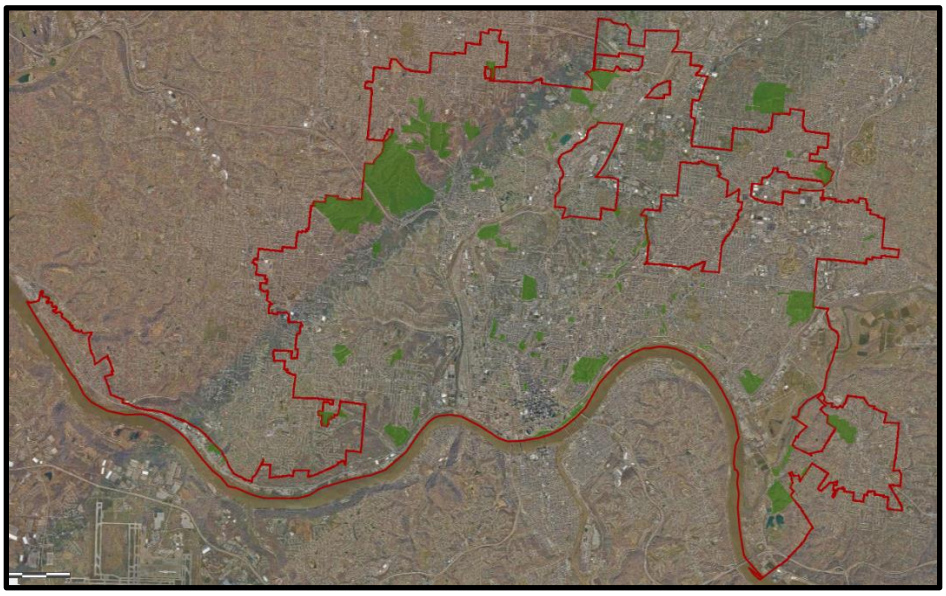


Figure 1. Satellite image of the greater Cincinnati area. The City of Cincinnati corporation line is in red while areas managed by the Cincinnati Park Board are in green and comprise 8.6% of the city's total land area.

Section 2: Obligations

Under the authority of Ohio Revised Code Chapter 755 and the Charter of the City of Cincinnati Article 7, Section 1, the Cincinnati Park Board of Commissioners are responsible for the care and management of Cincinnati parks for current and future generations of park users. As part of CPB's mission it is our responsibility to manage park natural areas in a manner which maximizes their ecological value, in terms of supporting the greatest range of biodiversity and protecting environmental services such as clean air and water. To meet this goal, it has been determined that management of the overabundant white-tailed deer (*Odocoileus virginianus*) population must be a priority.

Any deer management program has certain legal obligations that must be fulfilled. They begin at the state level and continue through local laws and ordinances. In 2009, the CPB ordained by ordinance number 0186-2009 the establishment of permitted hunting on CPB property. This ordinance authorized the legal use and discharge of weapons within Cincinnati Parks, in compliance with State of Ohio game and hunting laws. Permitted use is governed by CPB Rule 35. - Public Hunting. The program requires that the following conditions are met:

1. Safety is the top priority of this program. All approved permit holders must have demonstrated that they have:
    a. Passed the written portion of the Ohio Hunter Education Course
    b. Attended a Park Board sponsored orientation and training session
    c. Successfully completed a Park Board sponsored shooting skill qualification test
    d. Possess a current Ohio hunting license and deer permit
2. All State of Ohio Bow Hunting Regulations must be followed, including:
    a. All deer harvested must be checked in at a local State of Ohio check station
    b. Equipment must conform to the State of Ohio Archery equipment requirements
    c. Hunting hours as set forth by the State of Ohio
3. Hunters are chosen through a lottery system administered by the CPB. Park Board decision on who is permitted, and permitted location, is final. Selected hunters receive written authorization by the Park Board for marked locations only.
4. Whitetail deer are the only animal that will be permitted for hunting. Participants are allowed to take as many deer as allowed by State Law using State of Ohio Urban and Regular Deer permits. Hunting of any other animals on parks property during the deer management program will be grounds for immediate and permanent removal from the deer management program.
5. Hunting is permitted with written authorization in marked areas only.
6. Hunters must wear a safety harness at all times when in a tree stand.
7. Baiting sites do not have to be approved by CPB Division of Natural Resources (DNR) staff. Baiting is allowed during the hunter's session only. Hunters may bait during their session only, with the exception of Coordinators.

8. Mineral licks or salt blocks of any kind are prohibited.
9. Motorized vehicles are not permitted beyond designated parking areas.
10. A deer of either sex can be taken at any time, but doe harvest is encouraged.
11. Although most of the park boundaries have been marked with reflective tape to aid the hunter when approaching the park boundary line, it is the responsibility of each hunter to know where the park boundaries are and to stay within them. Note that GPS coordinates are available and shared with all hunters, and hunters are encouraged to utilize current technology to ensure safe hunting practices and distances.
12. If a deer is wounded and moves off park property the hunter must contact the adjoining property owner and DNR Park Board staff before attempting to locate the wounded deer. **DO NOT FOLLOW A WOUNDED DEER ONTO PRIVATE PROPERTY WITHOUT PERMISSION OF ADJOINING PROPERTY OWNER.**
13. When a deer is harvested, please use the recording form on the Better Impact website to enter your name, deer's sex, approximate age (adult or yearling), date, time of harvest, hunting location, and permanent tag number.
14. All deer must be checked at a local State of Ohio check station, online, or over the phone.
15. Park only in designated areas. Lock gate properly while hunting to prevent unauthorized access to the area. Be sure the gate is properly secured when leaving.
16. Parking permit and information as to hunter location must be displayed on the dashboard of the parked vehicle. The permission letter must be carried on your person while hunting, scouting, tracking deer, or cutting honeysuckle.
17. The Cincinnati Park Board is not responsible for any equipment left unattended. As such, inspect tree stands for signs of tampering before each use. Stands are to be numbered with the hunter's ID number. Stands found with no ID number will be confiscated and the hunter will be removed from the program. All stands must be removed by March 1, or they will be confiscated and the hunter will be removed from the program.
18. All other rules and regulations promulgated by the Park Board apply.

The Cincinnati Municipal Code Sec. 708-27 (included in Section 11: Supporting Documents "Cincinnati City Ordinance Sec. 708-27.- Discharging Firearms"), details that no person shall discharge any kind of firearm or dangerous weapon, unless they are authorized by this section. With regards to deer management, this includes any person lawfully engaged in the Park Board hunting program using approved weapons as authorized by CMC Sec. 708-28. This includes bows that conform to State of Ohio requirements: compound, recurve, longbow with a minimum draw weight of 40 pounds, and crossbows with a minimum draw weight of 75 pounds and a maximum draw weight of 200 pounds are allowed. Beyond traditional hunting, this section also allows for any person lawfully engaged in remote chemical immobilization of deer, to discharge a weapon using an air-powered gun as a component of a deer fertility control study authorized by the Board of Park Commissioners and authorized by a permit issued by the Ohio Department of Natural Resources (ODNR), Division of Wildlife (DOW).

With these laws in place, the CPB DNR has overseen the administration of this program since the 2009 hunting season. This includes annual:

1. Design of the hunting season sessions and impact areas.
2. Presentation of the annual plan to the CPB for approval.
3. Approval as a State Controlled Hunt from the ODNR DOW.
4. Public communication of the hunting season within Cincinnati Parks, followed by the management of community inquiries/concerns.
5. Solicitation, qualification, and organization of hunters.
6. Report outcome of hunting season to the CPB, community and operations managers.
7. Conduct ongoing ecological assessments such to estimate the deer population set future deer management goals.

Section 3: Identified Problems

White-tailed deer were abundant in North America at the time of European colonization, with population estimates of around 20 deer per square mile (Redding 1995). Deer in most areas experienced a decline with increased hunting during the 18th century but experienced a positive growth rate from around 1800 to 1865 as changing land use patterns created new habitat for deer (McCabe & McCabe, 1984). Advances in firearms technology and the proliferation of the railways led to an increase in commercial hunting which reached its peak after the civil war, leading to a near demise of the species. Around the turn of the 20th century estimates of the deer population ranged from 300,000 to 500,000 nationally (McCabe & McCabe, 1984). Since then, the adoption of state and federal hunting regulations and the general absence of natural predators have resulted in a rapid increase of deer populations, exceeding even historic numbers. In 2011 the population of deer within the state of Ohio was estimated at 725,000 (ODNR, 2015). This has increased the amount of perceived impacts caused by white-tailed deer including an increase in deer vehicle collisions (DVCs), damage of property and agriculture, and negative impacts to the ecological health of the landscape (Gkritza 2010; USDA 2009, 2015).

Deer populations which exceed 30 deer per mi^2 negatively impact tree seedling recruitment and forest regeneration rates, while deer populations exceeding 20 deer per mi^2 alter the overall composition of the forest understory and negatively impact the reproduction and survival of many native wildflowers (Waller and Alverson, 1997; Horsley et. al 2001; Wisconsin Department of Natural Resources, 2017). Heavy deer browsing has also been shown to aid in the spread of invasive species, further degrading the forest community (Côté et al., 2004). Additional findings have indicated that removing invasive plants without reducing deer populations can increase deer impacts on native species and that when resources are limited it may be most effective to first reduce deer populations before investing in efforts to reduce invasive populations (Gochov et. Al, 2021).

Cincinnati Parks began monitoring the deer population in 1995 to document possible adverse effects on natural resources within parks. This began by surveying landscape trees for damage, constructing deer exclosures, and conducting stocking surveys. These initial assessments lead to the conclusion that existing deer population levels were likely detrimental to the long-term ecological health of our natural areas (details of which are included in Section 9: Supplemental Information). Based on these early assessments and a review of relevant research literature it was determined that the size of the deer population within Cincinnati Parks was likely having a negative impact on the ecological health of our natural areas. Because of this, the over abundant deer population needed to be reduced to a level which would not result in a negative impact to forest regeneration, over-browsing of sensitive spring wildflower species, or an overall loss of native biodiversity.

Section 4: Population Estimates

Beginning in 2000 the CPB has used annual infrared flyovers to estimate the deer population. However, there are gaps in the data due to both pilot error and years where budgetary constraints resulted in missed flyovers. Future aerial IR flyovers will be conducted on a biennial cycle, while partnerships with Great Parks of Hamilton County are being considered to further reduce costs. Great Parks also utilizes deer pellet counts and infrared flyovers by drones as opposed to piloted aircraft to estimate the deer population, both methods of estimating the deer population which may be considered in the future by the CPB as their relative feasibility, costs, and benefits are better determined. The methodology of the 2020 infrared flyovers and population estimates are provided below under Section 11: Supporting Documents “2020 Aerial Infrared Deer Count Report prepared by Larry Davis”

Section 5: Desired Goals

The focus of our deer management program is ecological in nature. Its goal is to reduce the overall deer population to a level which will not result in a negative impact to forest regeneration, over-browsing of sensitive spring wildflower species, or an overall loss of native biodiversity.

Deer populations which exceed 30 deer per mi^2 have been shown to negatively impact tree seedling recruitment and forest regeneration rates, while deer populations exceeding 20 deer per mi^2 have been shown to alter the composition of the forest understory and negatively impact the reproduction and survival of many native wildflowers (Waller and Alverson, 1997; Horsley et. al 2001; Wisconsin Department of Natural Resources, 2017). Heavy deer browsing has also been shown to aid in the spread of invasive species, further degrading the forest community (Côté et al., 2004) and that removing invasive plants without reducing deer populations can increase deer impacts on native species and that when resources are limited it may be most effective to first reduce deer populations before investing in efforts to reduce invasive populations (Gochov et. Al, 2021).

As such, based on the available evidence and recommendations put forth by the ODNR DOW State Wildlife Biologists, CPB has set our target deer management goal at 20 deer per mi^2. This target population density has been shown to be the threshold at which point ecological damage occurs, as well as when the overall health of the deer population begins to be impacted by overcrowding and competition for resources. Success in meeting our deer population management goals will be based upon population estimates derived from surveys and regular ecological assessments such as floristic analysis and browse damage assessments, as well as the future recommendations of the ODNR DOW. These modifications to our program follow changing best practices related to managing deer populations in parkland-urban interfaces (Latham et. al 2009, Waller et. al 2017, Waller 2018,). Additionally, CPB is working to establish long term research partnerships with other organizations to assist us in developing scientifically sound ecological assessment methodologies.

Section 6: Description of Areas to be Managed

Of the 4,394 acres that the Cincinnati Park Board manages 1,427 acres (≈32.5%) are utilized annually in the volunteer bow hunting program. Detailed site descriptions and maps are included below. Harvest numbers and population estimates for each site are included under Section 11: Supporting Documents "Updated Harvests and Population Density Estimates by Park: The Deer Cheat Sheet"

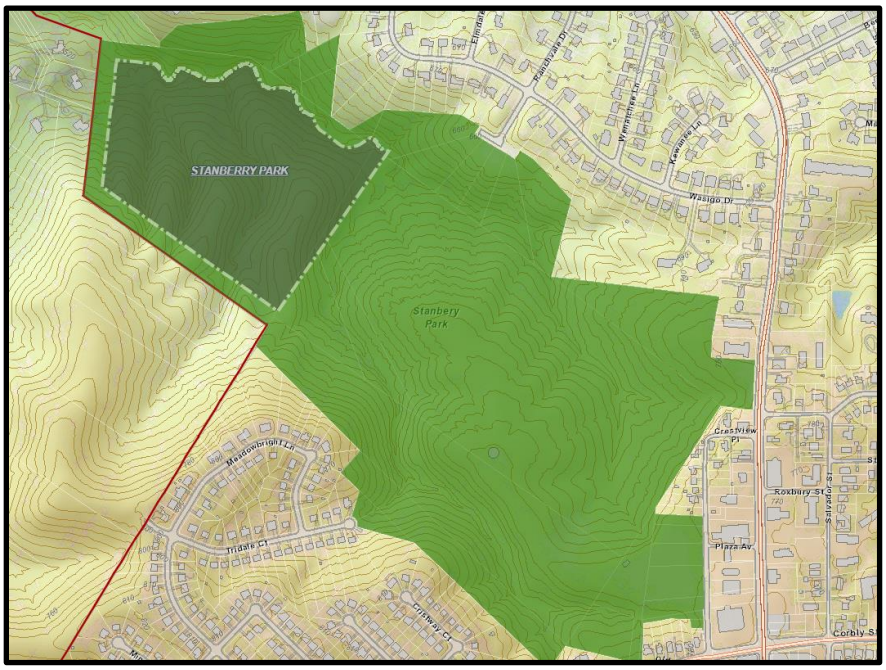


Figure 2. Stanbery Park contains 125-acres and features one of the city's most extensive hiking trail systems amid streams and acres of woodlands. It also offers a civic green and walkway, play areas, and one of Cincinnati's premier sledding hills. Stanbery is ideal for picnics, band concerts and community gatherings. The area open to hunting at Stanberry is 25 acres. The primary reason for Stanberry Park's inclusion in the deer management program is to reduce the deer population pressure on California Woods as the greenspaces along the Little Miami River corridor directly link these two parks.



Figure 3. California Woods Nature Preserve contains 113 acres of forest and year-round education programming. The park features 53 species of trees and more than 200 species of herbaceous plants and is one of the best examples of mature hardwood forest within the Cincinnati Parks. Lick Run Creek passes through this preserve and is home to kingfishers, snapping turtles, small fish, myriad invertebrates and the occasional visit from grebes, mallards, wood ducks and beavers. 89 acres of the park are open to hunting.

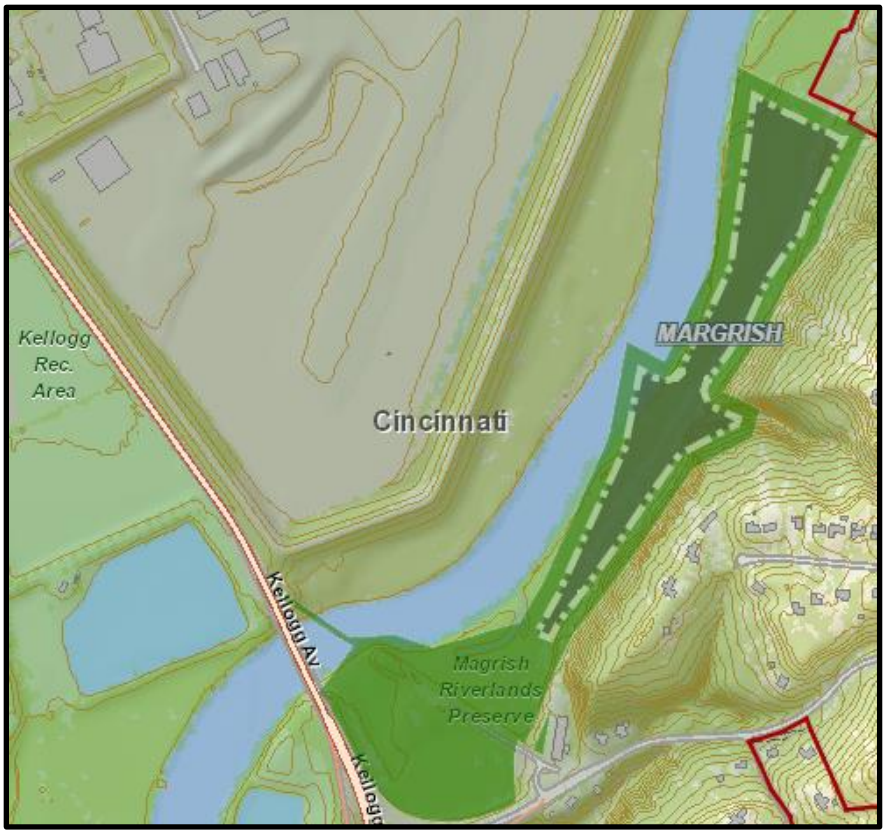


Figure 4. The James Magrish Riverlands Preserve is a rich river bottom habitat situated along the National Scenic Little Miami River. The present tract exists as a result of the efforts of the city, the Cincinnati Recreation Commission, Little Miami Incorporated, and the Cincinnati Park Board. Substantial funds were donated by Edith Krohn Magrish, in memory of her husband, James, a strong supporter of Little Miami Incorporated, to make the beauty of the area more accessible to the visiting public. The occasional flooding of the preserve provides an environment suited to the needs of an interesting variety of water-adapted wildlife. Wood Duck, Blue-Winged Teal, Willow Flycatchers and various species of frogs, as well as longed-legged wading birds, like Great Blue and Green Herons reside here. Fox, deer, muskrat, and beaver can also be found living in the preserve. The riverside location of this preserve also offers ideal vantage points for viewing river wildlife like painted and snapping turtles, Kingfisher, and Osprey. The park features hiking trails, a scenic river overlook and a canoe launch. 15 acres of the park are open to hunting.



Figure 5. Originally known as Bald Hill**,** the site was historically kept open by indigenous peoples to observe the surrounding area below. Today Frederick H. Alms Memorial Park on Mt. Tusculum still offers a magnificent view of the Ohio River valley. This 94-acre hilltop park was given to the Park Board in 1916 as a memorial to Frederick H. Alms by his wife. The land was once owned by Nicholas Longworth, who produced his Catawba wine there before the Civil War. From its heights, one can see the juncture of the Little Miami River with the gigantic bend of the Ohio, the hills of Kentucky, Lunken Airport and panoramic valleys. 32 acres of the park are open to hunting.



Figure 6. Ault Park provides picnic facilities, nature trails, and children's play areas. Ault Park adds to its attractions with a splendid pavilion, lookout point and beautiful gardens. Ault is one of Southwest Ohio's premier parks and hosts events such as the Concours d' Elegance Car Show, as well as summer dances and a community July 4th celebration. The beautiful backdrop and pavilion make it popular for weddings and private parties. At around 224 acres, Ault Park also is one of the best parks in the city in which to observe the ancient geology of Cincinnati. 43 acres of the park are open to hunting.



Figure 7. Daniel Drake Park is a 66-acre park which was named for Daniel Drake, who founded Cincinnati's first medical college and was also a nature enthusiast. Drake park has a handsome shelter, which offers a beautiful view from its overlook, as well as playgrounds and a walking path. Located in the Kennedy Heights neighborhood, 27 acres of the park are open to hunting.



Figure 8. Seymour Nature Preserve was formerly the site of a military barracks. The property was turned over to the Cincinnati Park Board during the 1970s and converted into a nature preserve. 55 acres of the park are hunted.

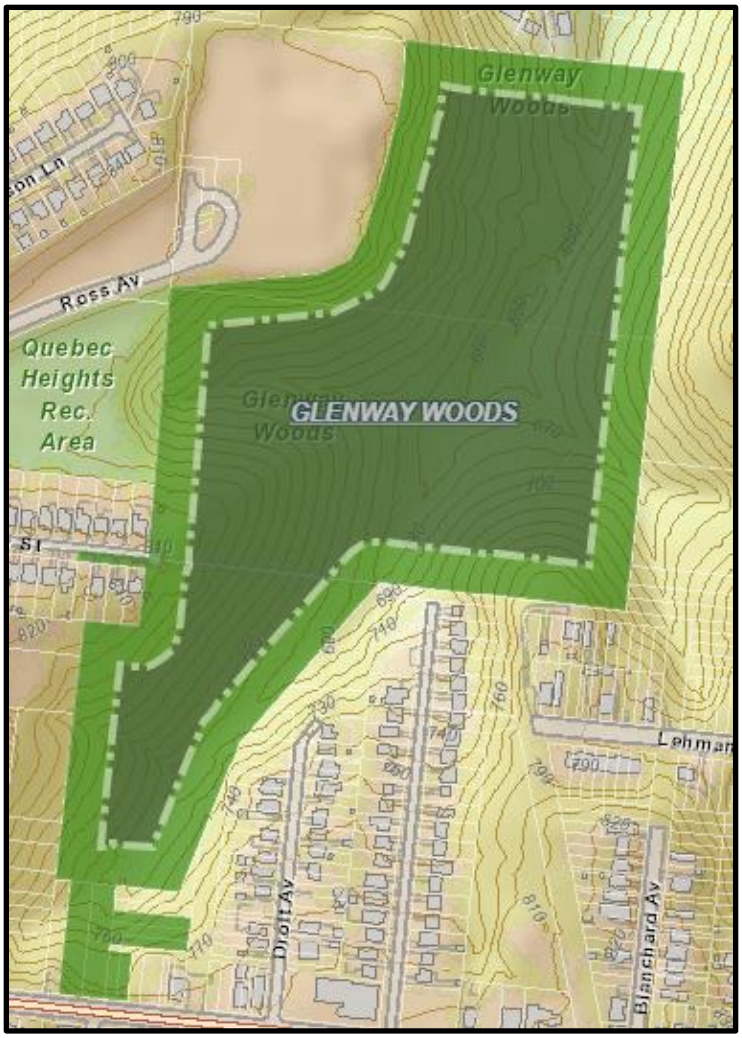


Figure 9. Glenway Woods is a nature preserve located at the end of Ross Avenue in Price Hill. It was formed as the result of citizens joining forces to save the area from development. Donald Patrick, an Elder High School teacher, chaired the Glenway Woods Project Committee, which raised necessary funds to repay a loan of $8,000 to the Nature Conservancy for the purchase of 14.3 acres of land in 1975. Additional funding was donated by more than 90 contributors including the Price Hill Kiwanis, East Price Hill Improvement Association, South Fairmount Improvement Association, Elder and Seton High School Student Councils and the Audubon Society. The area, which was then given to the Cincinnati Park Board, was later expanded through a donation of eight acres of surplus land by the Cincinnati Board of Education in 1977. Additional acreage was acquired through Federal Land and Water Conservation Funds, and currently the nature preserve encompasses 30.244 acres. 19 acres of the property are hunted. (Figure 9).

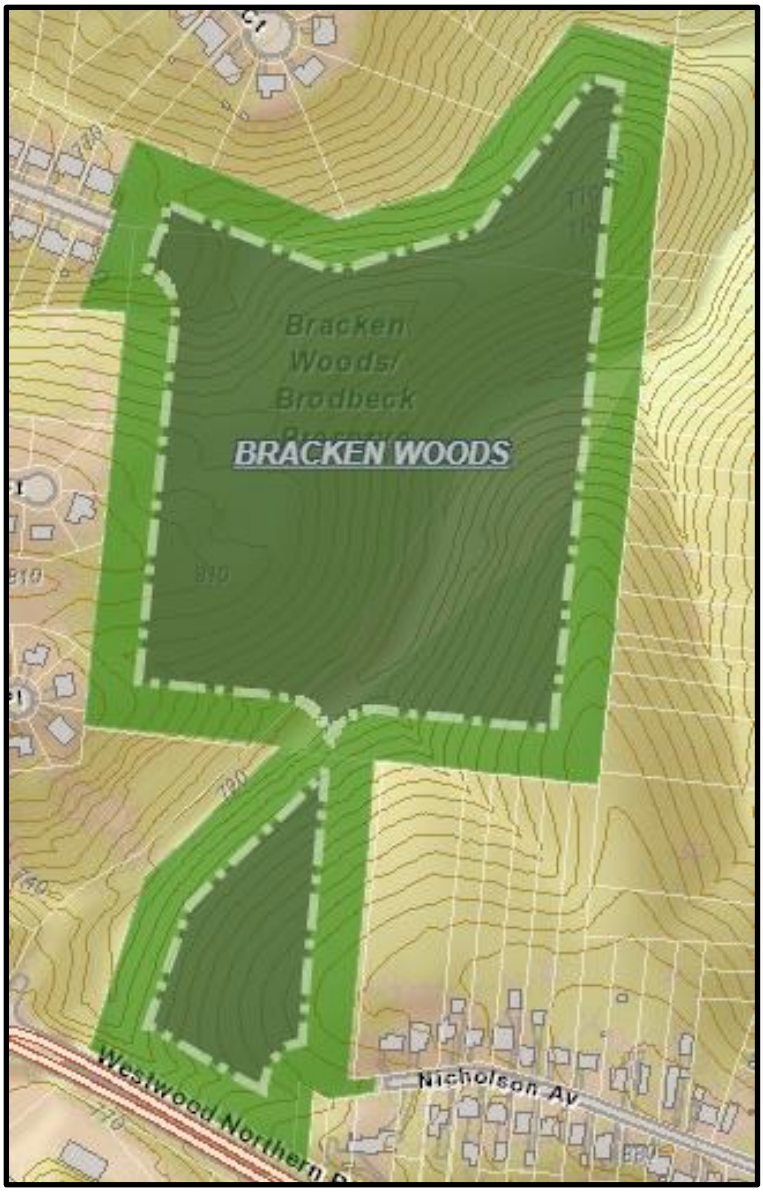


Figure 10. Bracken Woods: Bracken Woods is a city park located in the neighborhood of Westwood. It was established in 1975. It encompasses an area of 30.23 acres of land and is also home to the Robert J. Brodbeck Nature Preserve.



Figure 11. Mount Airy was established in 1911. The Mount Airy Forest covers 1,459 acres and includes natural areas, planned landscapes, buildings, structures, and landscape features. The numerous hiking trails, bridle paths, walls, gardens, pedestrian bridges, and various other improvements within Mount Airy Forest reflect the ambitious park planning and development that took place in Cincinnati in the early-to-mid-20th century. Conceived as the nation's first urban reforestation project, the park has developed over the years—especially during the Depression and post-World War II period- into a park with a variety of areas, spaces and structures designed to accommodate recreational, social, and educational activities. Today it continues to offer a large expanse of protected land within the city limits where the public can enjoy the richness and diversity of nature. Mt. Airy has seven hunting zones, totaling 975 acres.



Figure 12: Mt. Airy central contains two hunting zones, Zone G and Zone F (which is barely visible at the top of the map).



Figure 13: Mt. Airy West, also referred to as MacFarlan Woods, contains three hunting zones (A, B, and C) and as well as a system of bridle trails.

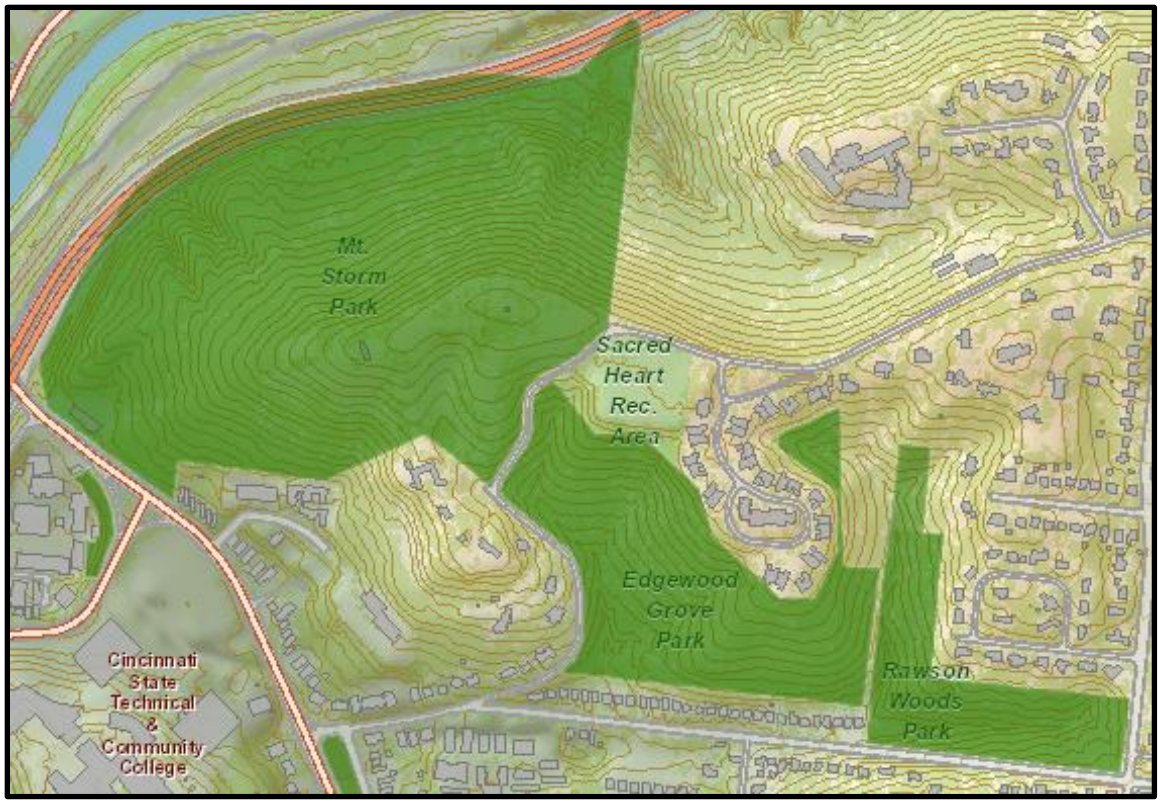


Figure 14. Mt. Storm Park, Edgewood Grove Park, and Rawson Woods Park constitute the three properties which make up the "Clifton Parks" study area referred to in the ongoing deer sterilization project which has been conducted since 2015. Mt Storm is a 75-acre neighborhood park, while Rawson Woods and Edgewood Grove are 10.6 and 32 acre preserves respectively.



Figure 15. Miles Edward Park is located in the community of Delhi. It is mostly a forested natural area, though there is a small playground and sections that are maintained as mowed turf along Fehr Rd and Mayhew Ave. Miles Edward Park has an area of 38 acres, of which 24 acres are used in our deer management program.



Figure 16. LaBoiteaux Woods will be included in our deer management program starting with the 2021-2022 season. Its enchanting mix of woodland and greenspace on the west side of Cincinnati is habitat to an interesting diversity of wildlife, which includes white-tailed deer, red and gray fox, raccoon, opossum, mink, sharp-shinned hawk, barred owl and eastern box turtle. Native wildflowers are a part of this natural community and color its landscape intensely in spring, summer and fall. There are over two miles of hiking trails, and the rustic nature center houses nature displays, animal mounts, live animals, and a small nature library and hosts enlightening nature programs. 35 acres of the property will be hunted.



Figure 17. Caldwell Nature Preserve will be added to our deer management program starting with the 2021-2022 season. It contains a mix of old growth forest and newer plantings, Caldwell Nature Preserve is home to a variety of wildlife including reptiles, amphibians, and mammals. It also features a Nature Center, an amphitheater, and 3.5 miles of nature trails including a level-paved trail that makes it possible for wheelchair users to experience nature. 70 acres of the park will be hunted.

Section 7: Management Methods

The CPB has identified the following management techniques as part of our larger deer management program. Those which are currently utilized include:

Controlled Volunteer Bow Hunting Program

According to the ODNR Division of wildlife, hunting is the most economical and efficient method of reducing deer numbers. Controlled bow hunting allows for safe and effective management of the deer population in areas where other hunting methods, such as rifles or shotguns, would not be permitted due to both local ordinances and safety concerns. Controlled bow hunting is widely supported by state wildlife management agencies and has become the best management practice across much of the country for managing deer populations in suburban settings. In addition, Ohio hunting laws allow bow hunters to use bait stations to attract deer, which greatly increases the likelihood of a successful harvest. Bait and shoot methods have been demonstrated to result in quick reductions in suburban deer populations and have been shown to be more cost effective than fertility control (Boulanger et. al 2014). An additional added benefit of the bow hunting program is that over time it modifies the behavior of the deer population by encouraging them to spend more time in areas they perceive to be safer which lessens their ecological impact on our natural areas. CPB has also encouraged hunters in the program to donate their harvests to Farmers and Hunters Feeding the Hungry (FHFH). For the 2019-2020 hunting season, hunters participating in the CPB deer management program provided 10,600 meals to those in need (see Section 11: Supporting Documents "FHFH Donation Inquiry"). CPB also has a partnership with Lakota East High school to provide undamaged deer hearts for use in their biology courses for dissection and anatomical study.

Given the above advantages, CPB instituted our bow hunting program in 2009. Controlled bow hunting takes place during the State of Ohio's bow hunting season which runs from the end of September until the first week of February. It is overseen by the CPB DNR Land Manager and an ODNR Wildlife Officer. To date, the program has resulted in the harvest of 1,668 deer from Cincinati Parks. For the year 2020, 133 hunters harvested 161 deer total (Table 1). We have also been considered by the ODNR DOW as a state approved Controlled Bow Hunt. Deer harvested during a DOW Controlled Bow Hunt do not count toward county or statewide bag limits.

The bag limit is a state law which is imposed on hunters which restricts the number of animals within a specific species that may be harvested and kept during a set time period. In Ohio, there are both statewide and county bag limits. Statewide a hunter may harvest a total of six deer with one of those being antlered, though the hunter cannot exceed county bag limits where they are hunting. In Hamilton County the bag limit permits a hunter to harvest one antlered buck and three antlerless deer for a total of four deer. Deer harvested during a DOW Controlled Bow Hunt do not count towards state or county bag limits. This means that our volunteer hunters may

harvest their allotted Hamilton County bag limit of 4 deer and an additional 6 antlerless deer as part of the DOW Controlled Bow Hunt using a deer management permit.

Year	Total Harvest	Number of bowhunters
2009-10	155	148
2010-11	122	174
2011-12	133	170
2012-13	102	141
2013-14	154	98
2014-15	147	124
2015-16	139	146
2016-17	138	158
2017-18	151	163
2018-19	145	166
2019-20	161	133
2020-2021	135	142
Totals	1803	-
Average per year	150	147

Table 1. Controlled volunteer bowhunting program harvests by year, as well as number of bowhunters. Each year begins in the Fall that the hunting season starts. On average, the program is supported by 147 bowhunters who can be expected to harvest 139 deer from park land.

Bow hunters who apply to participate in our Controlled Volunteer Bow Hunting Program are selected by lottery. The lottery is weighted toward hunters that had a successful harvest the previous season, and hunters may apply multiple times to increase their chances of being drawn. However, a hunter may only be selected once from the lottery. The minimum age for hunting in the Cincinnati Parks Bow Hunting Program is 12 years old. Hunters 12-17 years of age MUST be accompanied by a parent or guardian and must be within reach of that parent or guardian while they are with their weapon. The minimum age for hunting unaccompanied is 18 years of age.

Hunters choose hunting time and location based solely on where they were picked in the lottery. Hunters are also required to pass a State Hunter Education course, possess a current Ohio hunting license and deer permit, and be able to place at least four out of five arrows in a 10” diameter target from an elevated position at 20 yards during our qualification session held in July. Those hunters which pass the qualification are then eligible to choose their hunting time (referred to as a session) and location based solely on where they were picked in the lottery. At this time hunters will also receive topographic maps and aerial photos of the area that they select to hunt. Each hunter must also complete an online training that covers the rules and safety regulations of our program.

Approximately 250 hunters are needed to fill all the available sessions, though the number of hunting zones and available sessions per park is variable depending on the size of the park as well as other considerations such as dates where hunting is blocked out for other CPB events. Generally, hunting zones are ≈25 acres in size.

The length of an individual session is generally three-weeks, with a few exceptions. Hunters may also trade time with each other if they choose. The boundaries of each hunting zones utilize streams, roads, trails or property lines whenever possible. Within the hunting area, hunting is permitted anywhere within each area except within 30 yards of a neighboring property, road, hiking trail, or building.

An additional aspect of our bow hunting program are our volunteer hunting coordinators (VHCs). VHCs serve as mentors to new hunters, as well as those who have had difficulty getting a harvest. They assist hunters with setting up tree stands safely and in compliance with CPB guidelines, offer insights on deer movement in their assigned areas, scout out locations before the season starts, and meets with the hunters in their areas to discuss any difficulties they are having as well as ensure that both proper hunter etiquette and the rules and regulations of the CPB volunteer bow hunter program are being followed. Because of the vital work the VHCs perform, they are permitted to hunt all season long, though they must coordinate their hunting time with the current session holder.

Division of Wildlife Deer Damage Control Permits (DDCP)

DDCP from the ODNR DOW allow for use of bow hunting outside of the normal bow hunting season. The use of the DDCP in conjunction with our volunteer bow hunting program allows CPB to cull an agreed upon number of deer during the dates and under the conditions specified on the permit, which in the past has included the use of artificial lighting such as bow lights in conjunction with shooting over bait stations.

DDCPs are intended as an additional tool for landowners to both modify deer behavior and reduce deer numbers. They are intended to be used in conjunction with other deer management techniques. Just as with our volunteer bow hunting program, the permittee and their approved shooters are fully responsible for conducting management activities in a safe, legal, and responsible manner and assume all liability arising from their shooting activities (ODNR).

Bow hunters are selected to participate in the DDCP based on the total number of harvests they recorded during our controlled volunteer bowhunter program.

Fencing & Deer Exclosures

The fencing used to exclude deer from an area can range from simple netting, chain link, or even solid walls. Depending on the terrain, an adult deer can easily clear an 8-foot-high fence, with a height recommendation of 8’ commonly cited as being the standard (VerCauteren et. al, 2006). So long as the barrier is maintained, fencing will exclude deer from an area permanently, though

it will also exclude other wildlife. Compared to other methods fencing has high initial costs, requires regular maintenance, and can push deer into adjacent unfenced areas.

On a small scale CPB uses fencing as part of our larger deer management program. Deer fencing is used to protect high value landscaped areas, individual trees, and to create deer exclosures. Fencing has a limited benefit to our natural areas, as this method does not impact the overall deer abundance of the area. However, it does remain a viable option for protecting high-value ornamental plantings, threatened populations of native species, or other areas of high conservation value. When fencing is used in landscaped areas and to protect newly planted trees the cost savings in terms of damage reduction and staff time justifies the cost. Over a six-year period from 1995-2001, CPB staff documented a total reduction of $70,400 to the value of our ornamental tree plantings due to deer damage which could have been prevented with the use of fencing (Section 9, Supplemental Information).

In our natural areas tree seedlings within the deer exclosures reach maturity without being damaged by deer-rub or browsing which improves forest regeneration rates. In conjunction with invasive species management efforts, these deer exlosures can also serve as repositories for native plant material to reestablish into the surrounding landscape. The deer exclosures are utilized by ongoing ecological research projects being conducted by both the University of Cincinnati and Miami University of Ohio. Currently there are 6 deer exclosures which have been constructed on park property. The five deer exclosures are located in California woods (2), Stanberry (1), Mt. Airy (1), Alms (1), and Drake Park (1).

Surgical Sterilization

In 2015 the community of Clifton received approval by the Cincinnati Parks Board of Commissioners and the ODNR DOW to conduct a three-year sterilization research project. The three-year research permit was subsequently renewed in 2018, and most recently in 2020. The objective of this ongoing research project is to determine if surgical sterilization of does is a viable method to stabilize the herd in a setting with potential for limited deer migration, as previous studies utilizing deer sterilization have been conducted on closed populations. The current study aims to identify if surgical sterilization alone can eventually reduce the population to a level below the ecological carrying capacity. This project is being funded privately through a combination of private donations from Clifton residents, grants obtained from the Humane Society of the United States, and other non-profit entities.

The parks where surgical sterilization is being utilized are Mt. Storm Park, Rawson Woods, and Edgewood Grove (hereafter referred to as Clifton Parks). The Clifton Parks are part of the ~1 mi^2 study area that is delineated by Ludlow Avenue to the southern boundary, Clifton Avenue to the east, and I–75 on the north and west. These properties can be categorized as a mix of wooded hillside, open lawns/meadow, limited ornamental plantings, and residential area. The parkland-

urban interface found in the Clifton Parks and surrounding neighborhood is considered one of the most difficult scenarios for deer managers, as this land use pattern provides excellent deer habitat, minimal predation pressure, and offers challenges to implementing other forms of deer management such as sharpshooting or bowhunting. Prior to initiating this research project in 2015 no management actions to control the deer population had been used in the Clifton Parks.

Capture, sterilization, release, and observation/population estimate methods utilized in this study are detailed in the operations protocol outlined in the Ohio Department of Natural Resources (ODNR) Scientific Collection Permit number 23–183 which is included in Section 11: Supplemental Documents. Following capture, technicians transport the deer to UCAN Nonprofit Spay & Neuter Clinic where surgical sterilization is performed. The site is located at 2830 Colerain Ave, Cincinnati, OH 45225. At this time some does are fitted with VHF radio-collars to enable follow up observation and mortality estimates.

After the procedure the deer are returned to near the site they were captured and observed for post-surgical complications after the sedative reversal agent is administered. Population monitoring is conducted using camera surveys over bait stations, with one camera placed per every 160 acres. This arrangement would ensure that all deer in the study area would overlap at least one baited location. Population estimates were created using three different population models (Jacobson's BDR (Jacobson et al. 1997), NOREMARK (White 1996), and a detailed census based on field and camera observations (Lancia et al. 1996.) All three approaches utilized the data collected by the camera surveys to generate their estimates.

Based the above population estimates the deer population of the Clifton Parks study area has declined by ~30% since 2015, with an ~6% average annual population decline. Based on the study's field observations and camera surveys, the lead researchers believe that the 50 adult females sterilized represent ~98% of the adult female population. This has dropped the recruitment rate from 0.65 in Year 1 of the project to 0.04 in Year 6. Based on this recruitment rate, the approximate number of female fawns, and the potential for immigration of unsterilized doe into the study area the lead researchers expect to capture ~3–5 females for the year 2021 (DeNicola 2021).

The known mortality rate based on VHF collar data remains low (~10.0% annual mortality). This is likely due to a combined lack of predation and hunting pressure in the area, as well as limited deer-vehicle collisions/mortalities due to the low travel speeds found in the densely developed neighborhoods. To date, the study has experienced only 11 known tagged female mortalities since. It should be mentioned that deer are long-lived (>12 years) and that sterilized female deer continue to negatively impact an area if the ecological carrying capacity is exceeded. Currently, the estimated population density within the study area is ~69 deer/mi^2 which is well in excess of the 20 deer/mi^2 target goal of our management plan.

Additionally, modeling has shown that removing a female deer (i.e., utilizing lethal methods) has anywhere from two to three times the impact on population growth than sterilizing a female deer. Even assuming a 100% sterilization rate, the gradual attrition of the deer population within the Clifton study area from DVCs and/or old-age means that reaching a sustainable deer population will likely take another 5-10 years as well as require continued ongoing maintenance to treat deer which migrate into the area. For reference, in 2020 volunteers participating in the study expended ~20 person-hours per darting. The continued support of local veterinarians, capture personnel, and volunteers will also be required for the foreseeable future of this program. Also, much of the management (darting, capture, and release) takes place on private property adjacent to park property with the express permission of the private property owners. Such an arrangement would be difficult to implement on a parkwide scale and present its own set of legal challenges. Lastly, managing a deer population largely through mortality caused by DVCs and old-age presents its own costs and risks to the local community that should be considered beyond the scope of this research study.

Sharpshooting

In 2007 we began utilizing sharp shooters as part of our deer management program. While the inaugural year resulted in our largest harvest to date, subsequent sharpshooting efforts in 2008, 2009, and 2019 were less successful as can be seen in Table 3 below. Due to the high cost associated with the sharpshooting program it has not been subsequently reimplemented. For comparison, the estimated cost of the sharpshooting program in 2020 would have been $83,128.86, which did not include the added costs of bait, additional weapons, and other incidental supplies. This was based on an average cost of $606.78 per deer harvested (labor and processing costs) and a target harvest of 137 deer, which would be the minimum needed to negatively impact the overall growth rate.

Because of this the cost/benefit analysis was not favorable when compared to the volunteer controlled bow hunting program and use of the DDCPs. While we still consider sharpshooting to be one potential facet of our larger deer management program there are currently no plans to reimplement it at this time.

Year	Mt. Airy	Cali/Mag	Ault	Alms	Total
2007	210	7	N/A	N/A	217
2008	26	1	N/A	N/A	27
2009	N/A	N/A	17	20	37
2019	36	N/A	N/A	N/A	36

Table 2. Sharpshooter harvests by year and park, as well as totals. The harvest for 2007 remains our single largest to date.The following management techniques are not currently utilized by the CPB, but included in this document for comparison:

Do Nothing
Not implementing any methods to reduce total deer abundance on CPB property is not a viable option, as it will result in the continued growth of the deer population. This continued population growth will lead to further degradation of habitat, irreversible loss of biodiversity, increased spread of invasive plant species, and negatively impact forest regeneration rates. This cascade will ultimately lead to irreparable damage to our natural systems and the extirpation of sensitive plant species in our area as well as the animals which depend on them.

Relocation
Managing deer herds by relocation is not legal in the state of Ohio. Additionally, relocation is generally not supported by wildlife management agencies or wildlife biologists. Beyond this, relocation is expensive and can increase the spread of pathogens, such as chronic wasting disease, while the availability of suitable sites for relocation far exceeds the supply of deer. While relocation is often considered a potential non-lethal option for deer herd management, numerous studies conducted on relocated deer suggest that the animals experience high mortality rates within the first year of release (Cromwell et. al. 1999, Ishmael et. al. 1995, Bryant and Ishmael 1991, Jones and Witham 1990, O'Bryan and McCullough 1985).

Regulated Commercial Hunting
Under current laws and regulations this method is not legal in Ohio. While there is a growing debate about the possibility of implementing regulated commercial hunting of deer that is guided by responsible practices and sustainable harvesting, most state wildlife management agencies are not interested in pursuing this option.

Predator Reintroduction
The reintroduction of large predators to areas within their historical ranges such as wolves, mountain lions, or black bears is unlikely to find much support due to public safety concerns as well as the questionable habitat suitability of suburban landscapes to these species.

One of the most frequently encountered questions regarding our deer management program is our stance relating to urban coyotes. The ecological roles coyotes play in urban areas are often overshadowed by sensationalized new stories which focus on negative interactions between humans and coyotes, as well as pet attacks. Just as with many negative interactions between humans and wildlife, the single largest contributing factor to negative human coyote interactions is the habituation of coyotes to humans by intentional feeding (Timm et al. 2004). As apex predators, coyotes serve important ecological functions in the urban environment. This includes maintaining the balance of prey and smaller predator species. Coyotes are also known to help with controlling Canadian geese populations through nest predation of eggs.

While coyote predation of deer does not appear to control overabundant deer populations (Boulanger et. al 2014) coyote are known to prey on deer, primarily fawns and juveniles (Rohm

et al. 2007). One survey conducted by the Illinois Natural History Survey examined fawn survival rates within the Chicago area and found that depending on the site coyotes removed 20-80% of the fawns from the deer populations, which can slow the population growth rate in high-density areas (Gehrt 2011).

In the study "Landscape use and diet of coyotes, *Canis latrans*, in the Chicago Metropolitan Area" conducted by Morey in 2004 over 1,400 scat samples were examined to determine the typical diet of urban Coyote living in the Chicago Metropolitan area. Morey found that up to 22% of the samples examined contained deer in their diet. While pet owners are often concerned about the risk Coyote pose to domestic animals, this same study found that only 1.3% of scat samples analyzed contained domestic cat while human-associated waste (food scraps, garbage, intentional feeding) was found in 1.9% of scat samples. The most frequently encountered food item (42%) in Coyote diets were small rodents (predominantly voles, but also mice, rats, and rabbits).

Capture and Euthanize

In the study conducted by Boulnager et al., deer were captured utilizing Clover traps and euthanized with a penetrating captive bolt. In most instances, these methods required contracting with professionals from USDA/APHIS/Wildlife Services, law enforcement, or private contractors. While effective, this method resulted in vehement opposition from a minority of local residents, with members of the Cornell study even receiving anonymous death threats. The capture-and-euthanize approach has also been halted by court order in some communities where attempted. (Boulanger et. al 2014). Because of these considerations we do not feel this method is a viable option for the CPB at this time.

Chemical Repellents

Repellents are classified into one of two categories; contact repellants and area repellants. Contact repellents (e.g., Deer Away®, Scram®, and Miller's Hot Sauce®) are those which are applied to vegetation to discourage deer from browsing. They are generally the most effective at reducing deer damage. Area repellents such as Hinder®, Ro-pel®, and predator urine repel by odor alone.

Chemical repellents such are short-term solutions which require reapplications to remain effective. In a limited setting they can be very effective at reducing browse damage to the landscape caused by deer, but they do not address the issue of reducing deer abundance. As such this method does not support our overall goal of managing our deer population below the ecological carrying capacity.

Contraception

Currently steroidal contraceptive drugs do exist but are not practical for free-ranging deer as the drugs persist in deer carcasses and can impact other non-target species after meat consumption, including humans. Because of these concerns it is unlikely that any steroidal drug would be registered by the U.S. EPA for use on free-ranging deer.

The National Wildlife Research Center (NWRC) has developed an immunocontraceptive vaccine (GonaConTM) that is EPA-registered for use on female deer. However, GonaConTM is not currently registered in the state of Ohio and many state wildlife agencies consider the GonaConTM vaccine experimental. Because of this, an ODNR Scientific Collection Permit would be required to capture, tag, and treat free-ranging deer. The current EPA label states the vaccine must be hand-injected, which would necessitate deer capture and immobilization. The efficacy of the vaccine diminishes after a year or two, after which time the same animals would need to be recaptured and administered a booster shot of the immunocontraceptive vaccine. Again, at this time there is not an available wildlife contraceptive registered for use in the state of Ohio.

Section 8: Evaluations

Each mangement technique will be evaluated based on the desired goal. Deer exclosures will be constructed and monitored, previously used exclosures will be repaired. This will be to determine wildflower survival, their vigor, and if biodiversity is increasing. Stocking studies will be performed to determine forests regeneration rates. Biennial IR surveys will be continued to track deer population densities. Future aerial IR surveys may be conducted in cooperation with Great Parks of Hamilton County to lower costs and coordinate our management efforts at the regional level. To date, population density estimates based on inf flyovers have shown that none of the parks being surveyed had deer densities below 20 per mi^2.

The initial deer impact assessments in 1995 established a need to reduce our deer population to reverse the over-browsing damage Park staff were observing in our natural areas. However, subsequent ecological impact assessments like those conducted in 1995 have been sporadic due to resource and staffing limitations and not followed a set methodology, making direct comparisons between years and data sets impossible.

While anecdotal evidence from Park's DNR staff and volunteers leads us to believe that we are seeing improvements to our natural areas in terms of tree seedling recruitment and the return of spring ephemeral wildflowers to some areas of our parks, there is a need to establish long-term ecological assessments to track our progress and gauge our success in meeting the programs defined objective of reducing the overall deer population to a level which will not result in over-browsing of the forest and other natural areas.

To this end, we are in the process of establishing our long-term assessment methodology in collaboration with the University of Cincinnati, Great Parks of Hamilton County, and the best management practices as recommended by the ODNR DOW. The end goal of this collaboration will be to have a common set of standards and measures which we can examine and compare at both the individual park and larger county or landscape level. This will allow us to fine-tune our program and better gauge the impact and success of meeting our ecological goals. The first year of data collection by UC graduate and undergraduate students resulted in the creation and presentation of four scientific posters to which presented their preliminary findings. These preliminary studies are part of the ongoing, multi-year research projects being conducted in collaboration between CPB and UC. The posters are included under Section 11: Supporting Documents "University of Cincinnati Scientific Research Posters, 2020".

Additionally, starting with the 2021-2022 hunting season, CPB aims to keep track of how many harvests are donated by hunters to support programs such as FHFH to better quantify the positive impact they are making in the community.

Section 9: Supplemental Information

Landscape Tree Damage Assessment and Valuation

Parks staff began studying deer population effects in response to excessive rubbing damage on newly planted landscape trees. Rubbing has a detrimental effect on the cambial tissue layer responsible for transport of water and nutrients within trees. This damage is linked to increased rates of tree mortality, long term disfigurement, and a longer period of establishment following planting.

To quantify the impact of deer rubbing damage a value of $200.00 was given to each tree surveyed and the trees were de-valued based on the degree of damage. Heavy rubbing damage (>50% of the trunk) was considered a total loss of the $200 investment, while moderate damage (<50% of the trunk) was assessed as a $50.00 loss. Over a six-year period from 1995-2001, Parks staff documented a total reduction of $70,400 to the initial value of our ornamental tree plantings. While the methods of the survey were relatively simple, they justified the use of staff time and operational resources to protect newly planted trees with deer exclosure fencing and maximize the value of the Park's investment in new tree plantings.

Deer Exclosures: To examine possible impacts to the herbaceous layer of the forest understory two deer fence exclosures were constructed. One was located in Mt. Airy Forest while the other was in California Woods. Initial qualitative data gathered from comparisons made between the flora found within the deer exclosures to paired survey plots outside of the exclosures. Findings supported other research literature on the topic, indicating that heavy deer browsing alters the composition of the forest understory, negatively impacts the reproduction and survival of many native wildflowers, and diminishes the recruitment of tree seedlings necessary for forest regeneration.

Stocking Surveys: To determine forest regeneration, stocking surveys were conducted using the methodology performed by McWilliams et. al 1995 in their study "Adequacy of advance tree-seedling regeneration in Pennsylvania forests" Four 6' circular plots were created, two in Mt. Airy Forest and two in California Woods. Data collected for these surveys included tree seedlings per plot, tree seedlings per acre, and species present. A weighting factor for the presence of honeysuckle was also applied. Plots with 25 tree seedlings or more were considered adequately stocked for future forest regeneration, while plots with less than 25 tree seedlings present were under the threshold needed to support future forest regeneration.

Of the 4 plots examined only one plot in California Woods was considered to be sufficiently stocked to support future forest regeneration. The findings of this assessment supported anecdotal evidence gathered from CPB staff that our forests were not regenerating as expected and would be unsustainable without a reduction in the deer population.

***Trillium grandiflorum* Browse Damage Study: A** browse damage assessment was conducted in California Woods Nature Preserve based on the methodology used by the NPS to measure deer impact in Cuyahoga Valley National Park. For this assessment the presence of browse damage and flowering height of white flowering trillium (*Trillium grandiflorum)* was recorded. *Trillium grandiflorum* is an excellent indicator species of deer ecological impacts because it is a preferred food source and is very sensitive to over browsing (Anderson 1994; USDI NPS 2001, 2016). A small metal wire deer exclosure was built surrounding a population of *T. grandiflorum* while an equal number of *T. grandiflorum* was left unprotected in the adjacent reference plot.

As was found in the Cuyahoga study, repeated browsing by deer reduced the overall stem height of *T. grandiflorum* which directly correlated to reduced flower set and seed production as well as an increase in overall plant mortality. This can be seen in the comparison of Figure 17 and Figure 18 below.



Figure 18. Deer exclosure located in California Woods Nature Preserve full of undamaged *Trillium grandiflorum.*



Figure 19. Unprotected reference plot located in California Woods Nature Preserve. The *Trillium grandiflorum* have been heavily browsed and over subsequent years were extirpated from this site. To date, the only remaining *Trillium grandiflorum* in California Woods Nature Preserve are those which were protected by the deer exclosure during this initial assessment.

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Section 11: Supporting Documents

Documents Included

- 2020 Aerial Infrared Deer Count Report prepared by Larry Davis
- Cincinnati City Ordinance Sec. 708-27.- Discharging Firearms
- Updated Harvests and Population Density Estimates by Park: The Deer Cheat Sheet
- Division on Wildlife Scientific Collection Permit 23-183
- Farmers and Hunters Feeding the Hungry Donation Inquiry
- University of Cincinnati Scientific Research Posters, 2020

Aerial Infrared Deer Count Report

Cincinnati Park Board

Cincinnati, OH

6 May 2020

Thirteen park areas of the Cincinnati Park system were the subjects of an aerial infrared (IR) deer count flight on the nights of 15, 16 and 17 March 2020. The IR imaging conditions were excellent (15 & 16) to very good (17 Mar) during the several nights of flying. Additional details can be found in the analysis notes below.

This report package includes this written report and mapping data of the deer count and dispersion within and near the count areas, as well as DVDs containing the raw infrared imagery from the flights. Deer are noted on the map by red-colored dots. The dots representing deer on the maps cover an area much larger than the actual deer so they can be seen and printed easily. Raw infrared imagery of the count will be maintained at Davis Aviation for at least one year from the date of this report.

	2020			2018			2017		
Park	**Total**	**In**	**Out**	**Total**	**In**	**Out**	**Total**	**In**	**Out**
Stanbery Park	**19**	**11**	**8**	12	5	7	19	9	9
Alms Park	**15**	**11**	**4**	13	5	8	17	6	11
California Woods	**20**	**11**	**9**	48	3	45	19	10	9
Magrish Preserve	**36**	**29**	**7**	36	16	20	6	1	5
Ault Park	**8**	**4**	**4**	38	19	19	29	18	11
Drake Park	**16**	**6**	**10**	12	1	11	9	9	0
Mount Airy Forest	**183**	**123**	**60**	137	91	46	96	45	51
Seymour Preserve	**41**	**17**	**24**	35	10	25	53	1	52
Mt. Storm, Rawson Woods, Edgecliff	**41**	**15**	**26**	36	31	5	30	11	19
Miles Edwards Park	**4**	**3**	**1**	7	0	7	0	0	0
Glenway Woods	**9**	**0**	**9**	13	0	13	9	1	8

Revised 6-11-2021

Results:

Analysis Notes3/15-17/2020

The aerial infrared imaging flight over Cincinnati Park properties was conducted on the nights of: 15 March between 2332 and 0306, 16 March 2020.

16 March between 0231 and 0301, 17 March 2020.

17 March between 2330 and 2352.

Imaging conditions were excellent on 15 and 16 march and very good on 17 March. Many small animals were easily visible on the ground and in trees in most parks, including animals of significantly varying sizes up to probable coyotes. On 17 march relatively few small animals were seen at Miles Edwards and Glenway Woods. Weather conditions on the the following nights were observed/reported as:

15 March - Winds on the ground 030 at 4 knots, sky overcast at 4400 feet, temperature 6 C, winds at imaging altitude of 1500-1600 above ground level were southeast at 6-10 knots. The ground was clear of snow and flight conditions were smooth.

16 March - Winds on the ground 050 at 5 knots, sky overcast at 4400 feet, temperature 4 C, winds at imaging altitude of 1500-1600 above ground level were from the north at ~5 knots. The ground was clear of snow and flight conditions were smooth.

17 March - Winds on the ground 050 at 2 knots, sky clear, temperature 2 C, winds at imaging altitude of 1500-1600 above ground level were southeast at 6-10 knots. The ground was clear of snow and flight conditions were smooth.

Mapping:

If the deer count number and dispersion information provided is destined for a Geographic Information System (GIS), I recommend importing the data from the accompanying Google Earth KMZ file. Otherwise the data can be displayed by opening the KMZ file in Google Earth.

Equipment:

This count was accomplished with a single-engine Cessna 182 airplane and using a high-resolution Mitsubishi M-600 thermal imager oriented ‘looking’ straight down through a camera hole in the belly of the airplane. The thermal imager NTSC video output is routed through a video encoder-decoder (VED) that labels the imagery with a continuous stream of GPS-derived position, time, date, speed and altitude information. A guide to the alphanumeric annotation seen on the accompanying infrared imagery may be found at the end of the specification block below. A bar code of the same GPS alphanumeric information is recorded on the far left side of the imagery although it may not be within the visible portion of a conventional TV screen. The bar-coded information is used by the VED during imagery playback and analysis. The annotated imagery is recorded with a Blackmagic Digital Video Assist 4K recorder using SD card recording media. The mapping program used for marking the count area borders, laying out the flight lines and doing analysis work is ExpertGPS by TopoGrafix.

Mitsubishi M-600 thermal imager specifications:

Detector	Platinum Silicide Schottky-Barrier IRCSD
Number of Elements	512 X 512 pixels
Detectable Wavelength Band	3 to 5 microns
Lens	Infrared, polarized f50 mm, F 1.2
NETD (Noise Equivalent Temperature Differential)	0.08 degrees C blackbody at 80.6 deg. F. (27 deg C) using f50 mm, F 1.2 lens
Field of View (using f50mm lens)	14 degrees horizontal X 11 degrees vertical
Field Time	1/60 second
Cooling Method	Stirling Cycle cooler
Image Display	Monochromatic, 256 gray levels
Video Output	RS170 video output (1 BNC port, 75 ohms)

Annotation Guide:



Flight Methodology:

The counts are flown at an average altitude of 1500 feet above ground level. The camera view directly below the airplane from that altitude is 400 feet wide on the ground surface. Flight lines are 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.

Analysis Methodology:

After the flight, I analyze the imagery using a TV monitor and a computer monitor. As the imagery plays, the VED decodes the bar-coded GPS signal that was received from the GPS during the flight. 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 over aerial imagery of the count area 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 entire recorded count imagery, pausing as necessary to identify the deer and mark them on the map. Generally, for each hour of imagery, three or more hours of analysis and reporting are required to complete the count. When I have viewed all of the imagery, I count the dots on the map to find the number of deer in and near the count area.

Deer usually appear as a fairly bright white dot or narrow line (similar to a grain of rice) 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 insulating 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 digital media.

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 infrared imagery. As I analyze the imagery, 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:

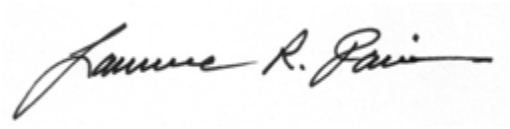
- there is usually a sizable quantity of deer in the area in which I am flying the deer count,
- there are other wild and domestic animals in the same area, usually in smaller numbers,
- deer don't climb trees,
- deer are somewhat 'brazen' in their occupation of human communities,
- domesticated animals are often corralled, fenced in, densely grouped or tethered,
- deer are notably larger than foxes, raccoons, skunks and many 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, cattle, 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 smaller nocturnally active wild animals such as skunks, raccoons, coyotes and foxes.

A. Experience, practice and experiments with the Michigan Department of Natural Resources and others in counting and identifying a variety of captive animal types have given me high confidence in identifying deer in their normal forest, rural 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. This includes deer bedding areas in light snow cover that contain melted through areas to the ground that approximate deer thermal signatures. Close examination of most infrared deer count imagery 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 definite 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, sometime worse. 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: I will retain the original digital imagery of this deer count for at least one year.



Larry Davis Kent, Ohio

Sec. 708-27. - Discharging Firearms.

1. No person shall discharge any kind of firearm or dangerous weapon, including handguns, rifles, air rifles or air guns by whatever name known.
2. No person shall discharge any cannon or explosive bomb from a mortar.
3. Section (a) of this ordinance shall not apply to:
    1. Any law enforcement officer, any agent, or employee of this or any other political subdivision or the United States if acting within the scope of his duties.
    2. Any member of the Armed Forces of the United States or any state militia if acting within the scope of his duties.
    3. Any person acting pursuant to Section 708-23.
    4. Any employee of the Cincinnati Zoo and Botanical Garden, acting within the scope of his employment, on the Zoo's property and who is currently authorized to discharge a firearm by the Chief of Police.
    5. Any individual both authorized by the Chief of Police and licensed as a private police officer pursuant to Chapter 857 of the Municipal Code who is acting within the scope of his duties as a private police officer.
    6. Any person acting in self-defense.
    7. Any person lawfully engaged in the Park Board hunting program using approved weapons as authorized by Section 708-26.
    8. Any person lawfully engaged in an archery program approved by the Public Recreation Commission or the Director of Recreation on property owned by the city of Cincinnati and using approved bows and arrows as authorized by Section 708-26A.
    9. Any person lawfully engaged in remote chemical immobilization of deer using an air-powered gun as a component of a deer fertility control study authorized by the Board of Park Commissioners and authorized by a permit issued by the Ohio Department of Natural Resources, Division of Wildlife.

(C.O. 718-24; renumbered to C.M.C. 708-27, eff. Jan. 1, 1972; repealed and reordained by Ord. No. 448-1988, passed Nov. 16, 1988; repealed and reordained by Ord. No. 38-1997, eff. March 14, 1997; a. Ord. No. 0186-2009, § 2, eff. July 17, 2009; Emer. Ord. No.

110-2012, § 2, eff. April 4, 2012; Emer. Ord. No. 344-2015, § 1, eff. Nov. 12, 2015)

Cross reference— Penalty, § 708-99-A.

Updated Harvests and Population Density Estimates by Park:
The Deer Cheat Sheet

Mt. Airy Forest:
1500 acres or 2.3 mi^2
Target Level = 46 deer @ 20 deer per mi^2

Infrared Counts:
3/17/00 = 196 deer or 85 per per mi^2
2/28/01 = 334 deer or 145 per per mi^2
3/4/06 = 175 deer or 76 per per mi^2
4/6/08 = 156 deer or 68 per per mi^2
2/24/09 = 228 deer or 99 per per mi^2
3/20/10 = 155 deer or 67 per mi^2
3/16/11 = 167 deer or 73 per mi^2
3/13/12 = 97 deer or 42 per mi^2
2013 survey not totaled
3/13/14 = 131 deer or 57 per mi^2
3/31/15 = 189 deer or 82 per mi^2
3/17/16 = 101 deer or 44 per mi^2
3/3/17 = 96 deer or 42 per mi^2
3/17/18 = 137 deer or 59 per mi^2
No survey flown in 2019
2020/21 = 183 deer or 80 per mi^2

Harvest Numbers:
Bow hunters harvested 68 deer in 2020/2021
Bow hunters harvested 36 deer in 2018/19 - Sharp shooters harvested 16, for a total of 52
Bow hunters harvested 66 deer in 2017/18
Bow hunters harvested 73deer in 2016/17
Bow hunters harvested 74deer in 2015/16
Bow hunters harvested 90 deer in 2014/15
Bow hunters harvested 88 deer in 2013/14
Bow hunters harvested 92 deer in 2012/13
Bow hunters harvested 104 deer in 2011/12
Bow hunters harvested 105 deer in 2010/11
Bow hunters harvested 109 deer in 2009/10.
Sharpshooters harvested 26 deer in 2008/09.
Sharpshooters harvested 210 deer in 2007/08.

Revised 6-11-2021

California Woods:
117 acres or 0.18 mi^2
Target Level = 3 deer @ 20 deer per mi^2

Infrared Counts:
3/17/00 = 36 deer or 200 per mi^2
2/28/01 = 39 deer or 216 per mi^2
4/6/08 = 24 deer or 133 per mi^2
2/24/09 = 19 deer or 103 per mi^2
3/20/10 = 12 deer or 66 per mi^2
3/16/11 = 19 deer or 103 per mi^2
3/13/12 = 60 deer or 240 per mi^2– First year combining California and Magrish - 0.25 per mi2s
2/17/13 = 63 deer or 252 per mi^2
3/13/14 = 49 deer or 196 per mi^2
3/31/15 = 66 deer or 264 per mi^2
3/17/16 = 37 deer or 148 per mi^2
3/3/17 = 25 deer or 100 per mi^2
3/17/18 = 84 deer or 336 per mi^2
No survey flown in 2019
2020/21 = 56

Harvest Numbers:
Bow hunters harvested 16 deer in 2020/2021 In California only
Bow hunters harvested 26 deer in 2018/19 In California only
Bow hunters harvested 6 deer in 2017/18 In California only
Bow hunters harvested 8 deer in 2016/17 In California only
Bow hunters harvested 10 deer in 2015/16 In California only
Bow hunters harvested 11 deer in 2014/15 In California only
Bow hunters harvested 4 deer in 2013/14 Hunting at night only. In California only
Bow hunters harvested 10 deer in 2012/13 In California only
Bow hunters harvested 4 deer in 2011/12. In California only
Bow hunters harvested 7 deer in 2010/11.
Bow hunters harvested 12 deer in 2009/10.
Sharpshooters harvested 1 deer in 2008/09.
Sharpshooters harvested 7 deer in 2007/08.

Magrish Preserve: California and Magrish data was combined starting in 2012
45 acres or 0.07 mi^2
Target Level = 1 deer @ 20 deer per mi^2

Infrared Counts:
2/24/09 = 36 deer or 514 per mi^2
3/20/10 = 26 deer or 371 per mi^2
3/16/11 = 36 deer or 514 per mi^2
3/13/12 = see California numbers
2/17/13 = see California numbers
3/31/15 = see California numbers
3/17/16 = see California numbers
3/3/17 = see California numbers
3/17/18 = see California numbers
No survey flown in 2019

Harvest Numbers:
Bow hunters harvested 4 deer in 2020/2021
Bow hunters harvested 1 deer in 2018/19 – flooded all season
Bow hunters harvested 6 deer in 2017/18
Bow hunters harvested 8 deer in 2016/17
Bow hunters harvested 6 deer in 2015/16
Bow hunters harvested 7 deer in 2014/15
Bow hunters harvested 2 deer in 2013/14
Bow hunters harvested 6 deer in 2012/13
Bow hunters harvested 6 deer in 2011/12 – Magrish was flooded for at least 4 sessions
Bow hunters harvested 16 deer in 2010/11
Densities are misleading since Magrish is surrounded by green space that deer use frequently.
Great Parks of Hamilton County has harvested 103 deer from Armleder since 2007.

Ault Park:
224 acres.
0.35 per mi^2
Target Level = 7 deer @ 20 deer per mi^2
Infrared Counts:
3/17/00 = 14 deer or 40 per mi^2
2/28/01 = 8 deer or 22 per mi^2
4/6/08 = 24 deer or 68 per mi^2
2/24/09 = 10 deer or 29 per mi^2
3/20/10 = 32 deer or 91 per mi^2
3/16/11 = 25 deer or 71 per mi^2
3/13/12 = 12 deer or 34 per mi^2
2/17/13 = 28 deer or 80/per mi2
No survey in 2014
3/30/15 = 22 deer or 63 per mi^2
3/17/16 = 24 deer or 68 per mi^2
3/3/17 = 29 deer or 83 per mi^2
3/17/18 = 38 deer or 108 per mi^2
No survey flown in 2019
2020/21 = 8 or 23 per mi^2

Harvest Numbers:
Bow hunters harvested 20 deer in 2020/2021
Bow hunters harvested 30 deer in 2018/19 – first two weeks then last two weeks, and night
Bow hunters harvested 10 deer in 2017/18 – first two weeks then two weeks of November, and night
Bow hunters harvested 8 deer in 2016/17 – first and last week of season and night
Bow hunters harvested 14 deer in 2015/16 – first and last week of season and night
Bow hunters harvested 4 deer in 2014/15 – first and last week of season and night
Did not hunt in Ault 2013/14
Bow hunters harvested 5 deer in 2012/13.
Bow hunters harvested 5 deer in 2011/12.
Bow hunters harvested 16 deer in 2010/11.
Sharpshooters harvested 17 deer in January 2009.

Alms Park:
94 acres or 0.14 mi^2
Target Level = 2 deer @ 20 deer per mi^2
Infrared Counts:
3/17/00 = 11 deer or 78 per mi^2
2/28/01 = 10 deer or 71 per mi^2
4/6/08 = 19 deer or 135 per mi^2
3/20/10 = 14 deer or 100 per mi^2
3/16/11 = 13 deer or 92 per mi^2
3/13/12 = 11 deer or 79 per mi^2
2/17/13 = 20 deer or 156 per mi^2
No survey in 2014
3/30/15 = 27 deer or 192 per mi^2
3/17/16 = 14 deer or 100 per mi^2
3/3/17 = 17 deer or 121 per mi^2
3/17/18 = 13 deer or 92 per mi^2
No survey flown in 2019
2020/21 = 15 deer or 107 per mi^2

Harvest Numbers:
Bow hunters harvested 3 deer in 2020/2021
Bow hunters harvested 13 deer in 2018/19 – first two weeks then last two weeks, and night
Bow hunters harvested 18 deer in 2017/18 – first two weeks then two weeks of November, and night
Bow hunters harvested 10 deer in 2016/17 – first and last week of season and nights
Bow hunters harvested 11 deer in 2015/16 – first and last week of season and nights
Bow hunters harvested 8 deer in 2014/15 – first and last week of season and nights
Did not hunt in Alms 2013/14
Bow hunters harvested 1 deer in 2012/13
Bow hunters harvested 3 deer in 2011/12
Bow hunters harvested 11 deer in 2010/11
Sharpshooters harvested 20 deer in January 2009

Stanbery Park:
126 acres or 0.2 mi^2
Target level = 4 deer @ 20 deer per mi^2
Infrared Counts:
2/28/01 = 15 deer or 75 per mi^2
3/4/06 = 44 deer or 220 per mi^2
4/6/08 = 23 deer or 115 per mi^2
2/24/09 = 23 deer or 115 per mi^2
4/9/11 = 29 deer or 145 per mi^2
3/13/12 = 32 deer or 160 per mi^2
2/17/13 = 15 deer or 75 per mi^2
3/13/14 = 44 deer or 220 per mi^2
3/30/15 = 40 deer or 220 per mi^2
3/17/16 = 20 deer or 100 per mi^2
3/3/17 = 35 deer or 90 per mi^2
3/17/18 = 53 deer or 60 per mi^2
No survey flown in 2019
2020/21 = 19 deer or 95 per mi^2

Harvest Numbers:
Bow hunters harvested 1 deer in 2020/21
Bow hunters harvested 6 deer in 2018/19
Bow hunters harvested 7 deer in 2017/18
Bow hunters harvested 5 deer in 2016/17
Bow hunters harvested 4 deer in 2015/16
Bow hunters harvested 5 deer in 2014/15
Bow hunters harvested 8 deer in 2013/14
Bow hunters harvested 19 deer in 2012/13

Drake Park:
66 acres or 0.1 mi^2
Target level = 2 deer @ 20 deer per mi^2
Infrared Counts:
4/18/14 = 40 deer or 400 per mi^2* need to measure area flown as opposed to park acreage
3/30/15 = 15 deer or 150 per mi^2
3/17/16 = 1 deer or 10 per mi^2
3/3/17 = 9 deer or 90 per mi^2
3/17/18 = 12 deer or 120 per mi^2
No survey flown in 2019
2020/21 = 16 deer or 160 per mi^2

Harvest Numbers:

Bow hunters harvested 5 deer in 2020/21
Bow hunters harvested 12 deer in 2018/19
Bow hunters harvested 15 deer in 2017/18
Bow hunters harvested 15 deer in 2016/17
Bow hunters harvested 15 deer in 2015/16
Bow hunters harvested 11 deer in 2014/15 – Area added to deer management program.

Glenway Woods:
30 acres or 0.04 per mi^2
Target level = 1 deer @ 20 deer per mi^2
Infrared Counts:
4/18/14 = 10 deer or 250 per mi^2* need to measure area flown as opposed to park acreage
3/31/15 = 23 deer or 575 per mi^2*
3/17/16 = 8 deer or 200 per mi^2
3/3/17 = 9 deer or 225 per mi^2
3/17/18 = 13 deer or 325 per mi^2
No survey flown in 2019
2020/21 = 9 deer or 225 per mi^2

Harvest Numbers:
Bow hunters harvested 4 deer in 2020/21
Bow hunters harvested 3 deer in 2018/19
Bow hunters harvested 3 deer in 2017/18
Bow hunters harvested 3 deer in 2016/17
Bow hunters harvested 3 deer in 2015/16
Bow hunters harvested 4 deer in 2014/15 – Area added to deer management program.

Rawson/Edgewood/Mt. Storm:
94 acres or 0.15 mi^2
0.98 per mi^2 = total area flown
Target level = 3 deer @ 20 deer per mi^2
Infrared Counts:
4/18/14 = based on park acreage 38 deer per per mi^2 or 37 per mi^2 using the area flown during IR survey
3/31/15 = 50 deer per mi^2 or 51 per mi^2
3/17/16 = 50 deer per mi^2 or 51 per mi^2
3/3/17 = 30 deer per mi^2 or 30 per mi^2
3/17/18 = 36 deer per mi^2 or 36 per mi^2
No survey flown in 2019
2020/21 = 41 deer

Harvest Numbers:
No hunting occurs in these parks. The Clifton community has opted to sterilize the deer and have been approved for a continuation of their 5-year research project until 2023.

Miles Edward:
38 acres or 0.05 mi^2
Target level = 1 deer @ 20 deer per mi^2
Infrared Counts:
4/18/14 = 8 deer or 160 per mi^2* used the park acreage rather than area flown
3/31/15 = 7 deer or 140 deer per mi^2
3/17/16 = 2 deer or 40 per mi^2
3/3/17 = 0 deer or 0 per mi^2
3/17/18 = 7 deer or 140 per mi^2
No survey flown in 2019
2020/21 = 4 deer or 80 per mi^2

Harvest Numbers:
Bow hunters harvested 2 deer in 2020/21
Bow hunters harvested 3 deer in 2018/19
Bow hunters harvested 2 deer in 2017/18
Bow hunters harvested 2 deer in 2016/17
Bow hunters harvested 2 deer in 2015/16
Bow hunters harvested 6 deer in 2014/15 – Area added to deer management program.

Seymour Preserve:
92 acres or 0.14 per mi^2
Target level = 2 deer @ 20 deer per mi^2
Infrared Counts:
4/18/14 = 45 deer or 321/per mi^2* using park acreage rather than area flown
Seymour was skipped during the 2015 flyover
3/17/16 = 30 deer or 214/per mi^2
3/3/17 = 53 deer or 379/per mi^2
3/17/18 = 35 deer or 250/per mi^2
No survey flown in 2019
2020/21 = 41 deer or 292 mi^2

Harvest Numbers:
Bow hunters harvested 12 deer in 2020/21
Bow hunters harvested 5 deer in 2018/19
Bow hunters harvested 5 deer in 2017/18
Bow hunters harvested 7 deer in 2016/17
Bow hunters harvested 8 deer in 2015/16
Bow hunters harvested 8 deer in 2014/15 – Area added to deer management program.

DIVISION OF WILDLIFE

Ohio Department of Natural Resources

Division of Wildlife Headquarters
2045 Morse Road. Bldg. G
Columbus, Ohio 43229-6693
1-800-WILDLIFE

Chief, Division of Wildlife: **Kendra S. Wecker**

WILD ANIMAL PERMIT: 23-183

SCIENTIFIC COLLECTION

ANTHONY J. DENICOLA
WHITE BUFFALO, INC
26 DAVISON RD.
MOODUS, CT 06469

DATE ISSUED
12/4/2020

Others authorized on permit
YES (SEE ATTACHMENT)

is hereby granted permission to take, possess, and transport at any time and in any manner specimens of wild animals, subject to the conditions and restrictions listed below or any documents accompanying this permit. This permit, unless revoked earlier by the Chief, Division of Wildlife, is effective from:

12/4/2020 to: 3/15/2023

The Chief of the Division of Wildlife will not issue permits for Dangerous Wild Animal (DWA) species (ORC 935.01 except native DWA, required for specific projects. The permit issued by the Chief does not relieve the permittee of any responsiblity to obtain a permit pursuant to R.C. Chapter 935 except as specified for the animals and purposes permitted herein. The permittee must adhere to all additional requirements under R.C. Chapter 935.

THIS PERMIT IS RESTRICTED AS FOLLOWS:

1. Permittee may collect up to 100 individuals of white-tailed deer (*Odocoileus virginianus*) for sterilization purposes. Live specimens must be released at site of capture.
2. Prior to the start of deer capture/immobilization, and annually thereafter, a deer population survey using scientifically-based methodology must be conducted. Following the initial population survey, mark/re-sight techniques could be utilized in subsequent years.
3. By the end of the project provide evidence that the 95% sterilization rate for female deer within the Clifton community has been achieved.
4. By the end of the project an accounting for any deer migration into the Clifton community must be documented.
5. Any deer that expires during the capture/sterilization process must be submitted for necropsy and disease testing to the Ohio Department of Agriculture laboratory in Reynoldsburg, Ohio.
6. Tick samples should be collected from live captured deer and submitted to the Ohio Department of Health for testing of the spirochetes that cause Lyme disease.
7. Twenty-four hours prior to collecting activities, permittee must contact the local wildlife officer to advise locations and duration of sampling.
8. Collection is prohibited on Division of Wildlife properties without explicit written permission from the Division of Wildlife.
9. Permittee must provide an annual report of collecting activities to the Division of Wildlife. Please submit a copy of any published papers resulting from this project to the Division of Wildlife.

Locations of Collecting:
HAMILTON COUNTY

Equipment and method used in collection:
REMOTE CHEMICAL IMMOBILIZATION.

Name and number of each species to be collected:
UP TO 100 FEMALE WHITE-TAILED DEER (Odocoileus virginianus) FOR STERILIZATION.

RESTRICTIVE DOCUMENTS ACCOMPANYING THIS PERMIT? YES

NO ENDANGERED SPECIES OR AQUATIC NUISANCE SPECIES MAY BE TAKEN WITHOUT WRITTEN PERMISSION FROM THE CHIEF

ATTACHMENT

This attachment to permit # 23-183 authorizes the following persons to conduct the activities listed on the permit, within the conditions and restrictions set forth. Each person must carry and exhibit upon request, a copy of the permit and this attachment when conducting any of the listed activities. The person named on the permit assumes full responsibility for the actions of the persons on this list and for completing and submitting all required reports.

Sub-permittee Name

DR. RANDY JUNGE, DVM

RYAN A. RODTS, CWB

VICKIE DENICOLA

GARRETT PARSONS



Cincinnati Park Board

Garrett Dienno

Thank you Garrett for your inquiry,

For 2018/2019, the combined donations for Hamilton County Great Parks and Cincinnati Parks was 31,600 meals donated from harvests. Unfortunately for this year I do not have them separated.

For 2019/2020, the donations from Cincinnati Parks were 10,600 meals from donated harvests.

If you have any more questions, feel free to reach out again.

Thank you,

Cory

Cory Brown

Farmers and Hunters Feeding the Hungry

(513) 409-3169

Corybrown50@gmail.com

Evaluating the Differences in Intensity of White-Tailed Deer (*Odocoileus virginianus*) Populations in Managed and Unmanaged Parks

Noah Bruce*, Jacob Lawrence*, Brittany Powers-Luhn, Jordan Gerda, Rhalena Seballos, Hannah Lynam, Lillian Braun, Evan Bold & Stephen F. Matter

Department of Biological Sciences, University of Cincinnati

Introduction

White-tailed deer (*Odocoileus virginianus*) have always been a landmark animal in the US, providing a large revenue from hunting as well as providing enjoyment for nature watchers and residents alike. However, the increase in white-tailed deer have had negative impacts on forests, other wildlife, agriculture and human health, resulting in increasing conflicts with humans, costing approximately $2 billion per year in the United States (Boulanger et al., 2014). There are several ways to manage urban deer populations. In the Cincinnati, Ohio area the most common practice is bow hunting. There is also a sterilization project in the Clifton area of Cincinnati. Deer in other Cincinnati city parks are not managed. Our research team wanted to know if these methods of deer management make a significant difference in the deer intensity within these parks. Our team chose to use camera trapping to record deer movement because it is one of the only monitoring approaches that can measure the intensity of use of the habitat by wildlife populations and how it varies over space and time (Keim et al., 2018). We hypothesize that the parks that have either bow hunting or sterilization management will have a lower intensity of white-tailed deer than parks that are unmanaged.

Methods

To evaluate how white-tailed deer management strategies affect deer intensity, we placed camera traps in 13 Cincinnati parks (8 managed with sterilization or bowhunting and 5 non-managed). We set up at least one camera trap within the park that would automatically take a 3-picture burst whenever any movement was detected within the camera's range. We sampled using the camera traps from November 2020 to March 2021. Cameras were placed for approximately one week at each location. Intensity was recorded as the number of deer per burst per hour.

We used a generalized linear model to compare mean dear intensity (deer in burst/hour) in each park based on management practice because sterilization had only one replicate. We used Tukey's HSD to evaluate differences among factor levels.

Results

Preliminary data from this study shows that bow hunting is the most effective form of population control for white-tailed deer (*Odocoileus virginianus*) in Cincinnati Parks, having an intensity of use of less than 0.025 deer in image bursts per hour. Parks that were unmanaged were shown to have deer intensity of uses of between 0.025 and 0.050 image bursts per hour. The sterilization management technique had the highest deer intensity of use between the three management styles that were studied. The one park that used sterilization, rather than bow hunting for population management had an intensity of use of almost 0.1 image bursts per hour, which is over double the intensity of both bow hunted and unmanaged parks (Fig. 2.). Bow hunting is significantly lower than sterilization management (p-value of 0.0067), but not significantly different from no management (p-value of 0.5889). No management did not differ from bow hunting, but this is largely an artifact of management only occurring in parks where there are

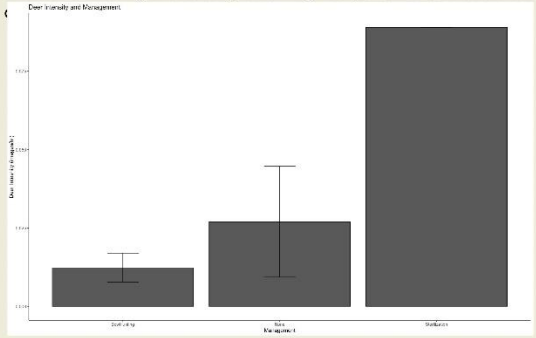


Figure 2: Plot of preliminary data, showing how deer management styles impact deer intensity of usage. Created in R Studio.

These results are part of a larger ongoing study, in conjunction between the University of Cincinnati, the Clifton Deer Program, and Cincinnati Parks, to discover which management style is the most effective for controlling urban white-tailed deer (*Odocoileus virginianus*) in Cincinnati Parks and what levels of deer abundance/intensity result in acceptable levels of impact and human interaction.



Figure 1: Example of a camera trap "burst" detecting movement, including white-tailed deer (Odocoileus virginianus).

Conclusions

As this is the beginning of a much larger ongoing study, these data are not necessarily the final result. The early data that has been gathered suggests bow hunting is the most effective management style for reducing white-tailed deer populations in urban park settings in Cincinnati. However, at this point, there is only one park that uses sterilization techniques for deer management, so there was no replication performed for the sterilization treatment, thus it is unclear if this is idiosyncratic to this site or reflective of the technique in general.

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Boulanger, JR, Curtis, PD, Blossey, Bernd. An integrated approach for managing white-tailed deer in suburban environments. *Cornell Study*. 2014; 1: 1-26.

Keim, JL, Lele, SR, DeWitt, PD, Fitzpatrick, JJ, Jenni, NS. Estimating the intensity of use by interacting predators and prey using camera traps. *J Anim Ecol*. 2019; 88: 690– 701.

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Evaluating the Effects of Exclosures on Spring Ephemerals in Cincinnati Parks

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Introduction

An overabundance of herbivorous white-tailed deer (*Odocoileus virginianus*) may have a negative effect on the abundance of native spring ephemerals in urban southwestern Ohio (Christopher et al. 2014). Cincinnati Parks built exclosures, two in California Woods and one in Alms Park, paired with control plots of the same size in order to evaluate the effects that meso herbivores have on the local flora. Our study seeks to examine the effects that herbivory has on spring ephemerals. We sampled ephemerals from each of the exclosures and compared them to samples from the matching control plots to estimate the effects that herbivores have on ephemerals. We hypothesize that spring ephemeral diversity and abundance will be greater in treatment than control plots due to greater herbivory in the control plots. We will continue to collect data throughout the season to assess additional effects on plants with later phenologies.

Methods

The exclosures were recently constructed in both Cincinnati Parks. To evaluate the effects of these exclosures **(Fig. 1 and 2)** on spring ephemerals **(Fig. 3)**, we counted the total number of individual plants of each species inside the exclosure and in a paired area of equal size adjacent to the exclosure. For ground cover where each individual plant could not be counted, the cover percentage of the exclosure was recorded. Sampling took place in mid-April 2021.

The data was analyzed using a paired T-test for both the effects of the exclosures on plant species richness and on total plant abundance.

Results

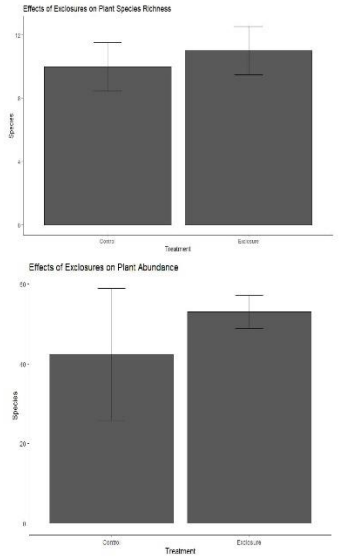


Figure 5: Mean plant species richness in controlled and exclosure conditions (top) and mean plant abundance in controlled and exclosure conditions (bottom).

The mean number of plant species recorded in the control plot (10 species) was not significantly different compared to the number of plant species recorded in the exclosures (11 species; $t = 1.73$, $df = 2$, $p = 0.22$).

The mean individual plant abundance recorded in the control plots (approx. 42 plants) was not significantly different than plant abundance recorded in the exclosures (53 plants; $t = 0.72$, $df = 2$, $p = 0.55$).



Figure 1. Exclosure in California Woods where data was collected.



Figure 2. Exclosure example drawing.



Figure 3. Spring ephemeral (Drooping Trillium).



Figure 4. Deer caught on camera near a California Woods exclosure.

Conclusions

- We found no evidence that deer and meso mammal herbivory affects the plant species richness or plant abundance of the spring ephemeral community.

References

Christopher, C., G. Cameron, & S. Matter. (2014). Individual and interactive effects of Amur honeysuckle (Lonicera maackii) and white-tailed deer (Odocoileus virginianus) on herbs in a deciduous forest in the eastern United States. Biological Invasions. (16)11.

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Evaluating the Impacts of White-tailed Deer Management Strategies on Spring Ephemerals in Cincinnati Parks

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Introduction

Urban and suburban deer population management is a problem that is more and more often landing on Parks Department desks. Deer may be *more* attracted to urban settings due to less prevalence of hunting (Conover, 1993). An overabundance of herbivorous white-tailed deer (*Odocoileus virginianus*) may have a negative effect on the abundance of native spring ephemerals **(Fig. 1)** in urban southwestern Ohio. In some Cincinnati parks bow-hunting or sterilization is used to manage deer populations. The efficacy of this practice is difficult to assess, as deer populations are very mobile and can live in thick growth, making sampling difficult (Kolowski et al. 2021). Simulations of bow-hunting have shown that 20-35 years of sustained, efficient hunting are necessary to control a deer population to a level that allows damaged forests to regenerate (Weckel & Rockwell 2013). As population control methods in Cincinnati Parks are approaching their 20th anniversary, our study seeks to investigate whether these management techniques affect the abundance of spring ephemeral plant species. We hypothesize that spring ephemeral abundance and diversity will be negatively related to the intensity of deer usage. We further hypothesize that intensity of deer will be lower in managed versus unmanaged parks.

Methods

To evaluate the impact of white-tailed deer management strategies on spring ephemerals in 13 Cincinnati parks (8 managed with sterilization or bowhunting and 5 non-managed) we first placed camera traps to help estimate deer intensity in each of these parks for approximately 6 weeks in Spring 2021. When the spring ephemerals started to emerge in mid-March, we began collecting vegetation data. To do this we established 50m transects. The elevation, coordinates and bearing at the beginning and end of each transect were recorded. We sampled 6 1m^2 quadrats **(Fig. 2)** spaced every 10m along the transect. Within each quadrat we counted the number of individual plants of each species present and estimated the percent cover of plants that could not be counted. Some cameras were placed so a quadrat was in their field of photography. Efforts were made to conduct the sampling in managed and unmanaged parks at a similar date to minimize the effects of the advancing season and weather (Christopher et al., 2014).

Because the sample sizes were uneven (only 1 park uses sterilization), we used a general linear model (GLM) to compare species richness (species/quadrat sampled) and mean plant abundance (plants/m^2) among management strategies. We related these variables to camera trap intensity (see companion poster for methods) using linear regression.

Results

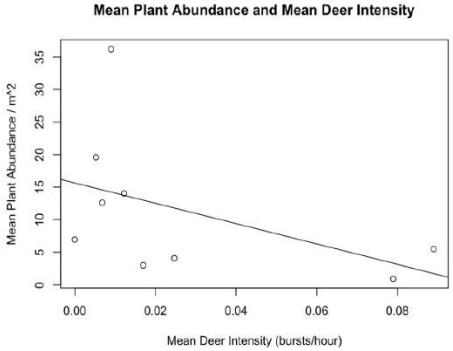


Figure 3: In our preliminary data, the evidence does not support a significant relationship between the mean deer intensity and the mean plant abundance ($p = 0.203$); however, there is a trend between the two indicating that bow hunting may be an effective form of deer management throughout Cincinnati Parks increasing plant abundance.

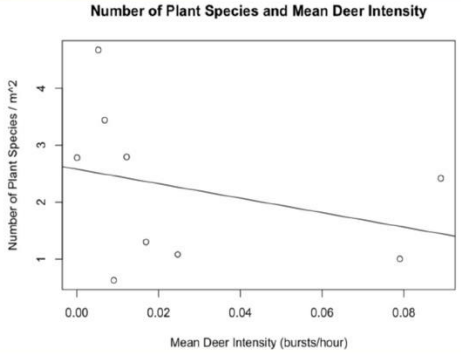


Figure 4: The preliminary data does not show evidence of a significant relationship between the mean deer intensity and the mean number of species per square meter ($p = 0.409$). There is a trend between the two indicating that bow hunting may be an effective form of management throughout Cincinnati Parks.



Figure 1. Spring ephemerals (Catchweed Bedstraw) (Toadshade).



Figure 2. 1m2 PVC framed transect placed at 0m with beginning flag and measuring tape in the center.

Conclusions

- Preliminary results show trends for greater spring plant abundance **(Fig. 3)** and species richness **(Fig. 4)** with decreasing deer intensity.
- Species richness may be more a function of park area than management strategy.
- Bow hunting (see companion posters) may be an effective strategy in Cincinnati to limit the effects of deer herbivory on vegetation as shown elsewhere (Weckel & Rockwell, 2013).
- Simulations of bow-hunting have shown that 20-35 years of sustained, efficient hunting are necessary to control a deer population down to a level that allows damaged forests to regenerate (Weckel & Rockwell, 2013).
- Data will continue to be collected and analyzed to better understand the impact white-tailed deer management strategies have on spring ephemeral abundance.

References

Christopher, C.C., Matter, S.F. & Cameron, G.N. (2014). Individual and interactive effects of Amur honeysuckle (*Lonicera maackii*) and white-tailed deer (*Odocoileus virginianus*) on herbs in a deciduous forest in the eastern United States. Biological Invasions 16:2247–2261.
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Evaluating the Relationship Between Camera Trap Intensity and Aerial Surveys to Measure White-Tailed Deer (*Odocoileus virginianus*) Populations

Noah Bruce*, Rhalena Seballos*, Evan Bold, Lillian Braun, Jordan Gerda, Jacob Lawrence, Hannah Lynam, Brittany Powers-Luhn, & Stephen F. Matter

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Introduction

An overabundance of herbivorous white-tailed deer (*Odocoileus virginianus*) in urban areas may have negative consequences including disease transmission, car accidents, and effects of herbivory on vegetation (Boulanger et al., 2014). In urban parks in Cincinnati, OH bow-hunting or sterilization is used to manage deer populations, while deer in other parks are not managed. The efficacy of management requires good estimates of deer density, but abundance is difficult to assess, as deer populations are very mobile and can live in thick growth, making sampling difficult. Cincinnati Parks contracts yearly aerial surveys in parks with management efforts at taxpayer expense. Cameras may be a relatively low-cost alternative (Keim et al., 2018) that can be crowed sourced from hunters and volunteers to estimate intensity relative to deer density. Here we compare the deer intensity observed in camera traps to the long-term aerial monitoring of population size to assess the general effectiveness of camera traps. We hypothesize that camera trap intensity will be positively related to deer abundance and provide a more cost-effective and crowd sourced way to estimate deer abundance in urban parks.

Methods

By splitting up into pairs of two, our research team conquered surveying the deer intensity of fourteen Cincinnati parks, from November 2020 to March 2021. This was done by placing camera traps in pairs of alternating parks, each with different management plans, never being placed in the same place twice to account for deer movements throughout the parks (Grund, et al. 2002). The number of image bursts every hour that recorded deer were compiled. We were then able to compare our compiled data of deer images to that of the city of Cincinnati's historical deer abundance data. The city of Cincinnati performs yearly aerial surveys across most of their parks in order to obtain an approximation of the current deer populations. Using this data and the data compiled from the camera traps, our research team used an ANOVA analysis to compare the two data sets, in order to find any correlation between them.

Results

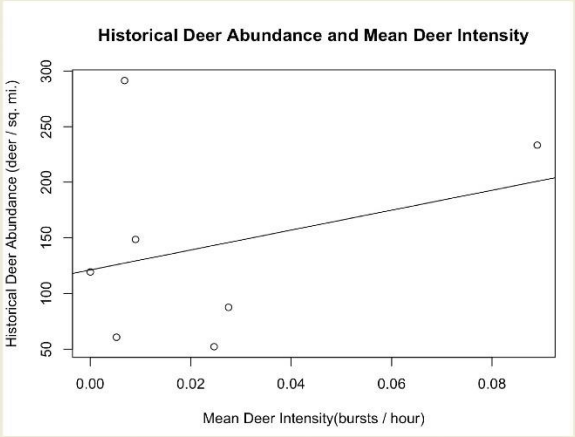


Figure 1: Our findings do not support a significant relationship between current mean deer intensity and the historical deer abundance (p-value= 0.505). It is important to note that aerial surveys have not yet been completed for this year. We plan to run our numbers against the new surveys when they are completed.



Figure 2: White-Tailed deer buck photographed in Mt. Airy Forest.

Conclusions

The results of the compiled data does not show a significant correlation between the historical deer abundance that Cincinnati Parks has provided and the camera trap intensity that our research group has compiled over the short term. This shows that our compiled data is not able to accurately predict long-tern abundance of white-tailed deer within the tested urban parks, based on past years' historical data.

However, the aerial camera surveys have not been completed for this year (2021), which may correlate more accurately with the recently collected camera trap data. The annual aerial surveys are completed by Cincinnati Parks for this year will be compared to the camera trapping intensities collected in the field. We hope to see a correlation between this year's aerial survey results and our recorded deer intensities. Continuing to collect data from camera traps around the parks in Cincinnati may also prove critical to this project, as a larger sample may provide more accurate data for white-tailed deer populations. Additionally, data from hunters may provide crowd sourced data needed to evaluate management.

This project is part of a collaboration between the University of Cincinnati and Cincinnati Parks, investigating deer management styles and how they can control urban white-tailed deer *(Odocoileus virginianus)*, the effect of deer enclosures on plant abundance, and how deer intensity of usage relates to abundance and number of spring ephemerals. Please see companion posters for more information.

References

Boulanger, JR, Curtis, PD, Blossey, Bernd. An integrated approach for managing white-tailed deer in suburban environments. *Cornell Study.* 2014; 1: 1-26.

Keim, JL, Lele, SR, DeWitt, PD, Fitzpatrick, JJ, Jenni, NS. Estimating the intensity of use by interacting predators and prey using camera traps. *J Anim Ecol*. 2019; 88: 690– 701.

Grund, M.D., McAninch, J.B., Wiggers, E.P. Seasonal Movements and Habitat Use of Female White-Tailed Deer Associated with an Urban Park. *The Wildlife Society* 66:123-130

Support provided by the University of Cincinnati College of Arts and Sciences and Cincinnati Parks