



STATUS REPORT ON THE HASTINGS-ON-HUDSON DEER IMMUNOCONTRACEPTION STUDY 2016

Summary

This document describes the results of the Hastings-on-Hudson Deer Immunocontraception Study as of 2016, the third year of a five-year viability study. It provides some background, and then describes what happened, what the study group (“Deer Team”) learned, the cost, how we track our results, what next year will look like, and potential risks to success for the study. Much thanks is due to the volunteers (including Hastings High School faculty members Melissa Shandroff and Jan Melillo, Irene Jong, Dick Leonard and others) who were involved in the effort. In addition to this report to the village, there is a detailed annual [report](#) to the NY State DEC that is available on the village website and which can be used for more in-depth review of the project³. Below is the list of accomplishments to date.

- During the first field season, beginning February 2014, the Humane Society/Tufts team captured and treated eight does with [PZP-22](#) which initiates an immune response against the ova, leading to infertility.
- In the second field season, the winter of 2015, 20 additional does were PZP-22 treated.
- From February 23, 2016 through March 31, 2016, the team successfully carried out a third season immunizing and tagging 20 additional does and bringing the project total to 50 captures and 48 treated does.
- Due to an anesthetic change in the third year, the duration of anesthetization and recovery from it was less than half of the two previous years.
- In field observations from August 1-4, 2016, 26 treated animals from the first two study years were positively identified, providing a minimum baseline fawning rate for the year. Camera trapping data and resident web reporting augmented field observations and together they lead to the conclusion that the overall fawning rate among immunized does of 8% or less is dramatically lower than the almost 95% pregnancy rate for animals prior to PZP treatment.
- Population estimates based on camera trapping and sightings of tagged and untagged females suggest close to 60% of the does in the village have been immunized and tagged.
- From September 24-25, 2016, does bearing tags #4, 5, 6, 30 (7), and 8 received one of the two vaccine re-treatments via dart injection without being immobilized with anesthesia.
- Three of the 48 tagged and immunized does are known to have died. Taken by a hunters were Doe #1 in 2014 in Dobbs Ferry, and Doe #10 near Teatown Reservation in July 2016. Doe #19 was impaled on a fence and had to be put down in December 2016. Does #2 and #3 could not be located during retreatment in September 2016.
- A fourth capture and immunization season will take place from March through September, 2017.

Bottom line: early study data are promising, but only after analysis of observations during the summer and fall of 2017 will results begin to be useful in evaluating the project’s outcomes.



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Background

The whitetail deer population in Westchester County has grown at an alarming rate over the past twenty years. The estimated annual cost of deer damage in New York State is \$324 million¹. Although the exact costs to Hastings residents cannot be calculated, the estimated costs are in the hundreds of thousands of dollars annually. One only needs to observe the rising deer fences that can cost over \$20,000 per property to appreciate the reality of deer-related expense to village residents. Other costs including deer-vehicle collisions with deer, eaten plantings and dealing with Lyme disease are less quantifiable, but significant. A major impact on the health of Hastings' parks and woods may have gone unnoticed by many residents. Deer, as ecosystems engineers, have played a dominant role in the current degraded state of the woods, destroying the understory and thus essential songbird habitat, eating native saplings before they can mature thus biasing the environment in favor of invasive species, and enhancing earthworm abundance that has caused a collapse of the ground litter food web. The remediation costs of this extensive damage is not known but will undoubtedly come to many hundreds of thousands of dollars over a number of years.

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The origins of the deer population rise are over a century old. The last deer in Westchester County was shot near Sing Sing in 1861². To reconstitute the deer population, game parks were created in late 1800s to raise deer, but they failed, and the deer were released. By the late 1800s 75% of New York land was cleared, with 240,000 farms and 23 million acres under cultivation. Subsequently the western movement of farmers in the 1900s left much of that cleared land to regrow and by 1935, 35% of the land was abandoned. This change happened quickly so even-aged forests came up simultaneously in many areas. Consequently, the deer population rebounded and in 1942 bow hunting began again in Westchester County. The regrown forest lacked open spaces so was not the best habitat for deer who are “edge” species and thrive where there is clearing associated with forest or woods. For that reason the expansion of suburbia and exurbia from the mid-20th century created the ideal habitat for deer who thrive in the edge environments that resulted from that extensive spread of residential development.

In 2013, in response to the deer population explosion and its impact, the Village of Hastings-on-Hudson, under the leadership of Mayor Peter Swiderski, began working with The Humane Society of the United States and researchers from the Cummings School of Veterinary Medicine at Tufts University on a five-year research project to study control of the area’s white-tailed deer population with the use of a [PZP](#) (porcine zona pellucida) immunocontraceptive vaccine. With financial support from In Defense of Animals and the Humane Society, the study seeks to determine whether this humane and non-lethal vaccine will substantially lower the birth rates of local does, bring down the population of white-tailed deer and most important, reduce their impact. PZP is a natural protein derived from pigs that, when injected into does, provokes an immune response against their ova that prevents pregnancy but has no other known effects. The



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formulation being used in this study is designed to release the substance over time and is expected usually to prevent pregnancy over a two-year period. To remain infertile, does need to be re-immunized every two to three years.

While prior research with the PZP vaccine has been carried out on islands or contained areas, this is the first effort of this sort in a non-geographically-isolated suburban community in this country. The village government examined a range of population-control approaches and decided to pursue immunocontraception as a non-lethal and sustainable method of reducing the impact of the deer herd. The [reasons for this decision](#) have to do with the nature of our densely human-populated community, limited feasibility or effectiveness of other approaches and community concerns about some approaches, particularly those utilizing lethal methods. The study seeks to determine whether the vaccine will lower the birth rates of local whitetail does sufficiently to result in measurable improvement in study indicators. The indicators include the annual number of car-deer collisions and survival time of hostas that are placed in the same location each year and monitored daily for survival.

It is important to note that the goal of the study is not to demonstrate a certain level of deer population reduction, since some population reduction may not result in a reduction in the indicators that matter to residents. While the deer population will continue to be quantitatively assessed, it is the assessment of the key impact indicators that will determine whether the immunocontraceptive approach is judged to be successful or not. This is the widely-accepted approach to assessing deer management projects. If key impacts of deer are not reduced sufficiently, then even a documented reduction in deer population will not be considered a useful success. Other indices that we are not using but that would be significant are native oak/plant survival, recovery of specific plant and animal populations, the density of ticks, the incidence of Lyme disease and social acceptance of deer.

In carrying out this study the Village has worked with the New York State Department of Environmental Conservation (DEC) to [define the experiment](#) and the DEC issued a “Permit to Collect or Possess” authorizing the study in December 2013. Under the approved protocols, deer are captured by immobilizing them with anesthetics delivered via darts. The deer are then ear-tagged, blood-sampled for pregnancy testing, weighed, measured, and administered an injection of the PZP vaccine. The darting was carried out by highly-trained professionals from the HSUS. Treated deer are being monitored for fawns to determine vaccine effectiveness and longevity for two to three years after initial treatment.

If the number of white-tailed deer, and more importantly their impact on our environment, are substantially reduced over the next five years, the Village will seek to move to a regular protocol in which a trained darting team would shoot the deer directly with darts containing the PZP agent without needing to immobilize them.



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Yearly Capture and Immunization Steps

Each annual iteration of the study is comprised of three phases:

1. **Pre-capture Phase:** The Deer Team came for a few days in mid-February to set up feeding stations around the village. The stations were intended to draw deer predictably to locations where they could be located and darted more easily. Residents were also solicited for permission to dart does located on their property.
2. **Capture and Treatment Phase:** After feeder placement the Deer Team returned after 10-14 days, and prior to the initiation of darting spent a few days becoming acquainted with the location and behavior of the deer. They then began darting and treating deer at the feeding stations and then elsewhere in the community as opportunities arose.
3. **Re-treatment Phase:** PZP immunization is expected to produce infertility for 2-3 years post injection, thus does must be re-immunized every other year throughout their reproductive lives. Re-treating does not require capture and is done with auto-injecting darts in the fall of the year before the mating season.

Pre-capture Phase

Over the course of several days in late January, four [feeding stations](#) were placed in a variety of locations, mostly in parks, around the Village. (Map of locations is in Appendix A.) The feeding stations held corn and that was dispensed for 5-7 seconds in the morning and the late afternoon based on a programmed timing controller. When the feeder is activated corn drops from the holding bin onto a spinning wheel that distributes it in a 20-30' diameter circle around the feeding station. Deer soon realize that the feed is being dispensed regularly and usually become habituated to the timing. An occasional observation has been that bucks can dominate the feeding sites, but given the radius of the dispersal, they can't prevent does from feeding as well. The DPW kept the feeders stocked with food and monitored their functioning prior to the Team's arrival for tagging and immunizing.

In addition to the automatic feeders, four homeowners provided access to their properties allowing for manual baiting. On these properties whole corn and apples were placed daily to establish routine feeding times.

In most locations, durable outdoor trail cameras were placed near the feeding stations, and aimed to capture shots of deer at the stations. They were strapped to a nearby tree and were triggered by the presence of a moving, infrared emitting source (e.g. large mammal). The Deer Team retrieved photos from the cameras to check for when deer were frequenting a particular feeding station.

Students from Hastings High School fanned out across the community to secure permission from homeowners to dart deer when observed on their property. Most homes were selected based on proximity to the feeding stations. Over 300 homeowners provided permission to the Deer Team to dart deer on their property. Those that gave permission in the areas of most active darting had small lime-green surveyor flags placed on their property so that the field team could see when driving by which properties had granted permission to dart deer.



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Capture and Treatment Phase

The tagging effort operated under strict safety protocols. Deer were only darted at close distances (typically under 30 feet, but maximally 50 feet) when there was no risk to people or pets in the line of fire. The team coordinated with the Hastings Police Department and interacted frequently with Trustee Dan Lemons, who was responsible for day-to-day coordination of the effort. A hotline was set up for passing along information from residents, and that sometimes allowed the team to take advantage of an unpredictable opportunity.

Adult female white-tailed deer were captured using the combination anesthetic BAM (Butorphanol/Azaperone/Medetomidine) delivered by a self-injecting dart. These barbed darts inject the anesthetic load upon impact and remain attached to the deer. The darted deer typically continue to walk for a few minutes before lying down and losing consciousness. A radio transmitter in the dart allows the Deer Team to hang back and avoid disturbing the deer while the drugs take effect, and then quickly locate the dart and the sleeping deer through radiotelemetry. Using the new BAM protocol in 2016 the average time under anesthesia for the 17 does immediately located was 62.9 minutes (omitting the three does that were not immediately located). The average time from administration of the reversal drug to release of the deer was 9.7 minutes. By comparison, the time under anesthesia during the 2015 season using a different drug averaged 144.4 minutes and the time for reversal averaged 71.1 minutes. Thus, anesthetized time in 2016 was dramatically reduced compared to previous years. Reducing this time reduces the stress on the deer and the number of complications. All deer recovered from the anesthesia under continual observation, and walked away from their treatment site under their own power.

All darts were collected immediately after their deployment and disposed of in a medical sharps container. No injuries were observed in association with the darting. All darted deer remained within 10 yards of the darting site, many returning to grazing within minutes after being darted.

Prior to reversal and release, PZP vaccine and timed-release pellets were injected intramuscularly and blood was collected for pregnancy testing. Each animal received an antibiotic injection administered subcutaneously. Body condition scores and measurements including weight, body length, girth, and distal hind limb were obtained and recorded when possible. Age estimates were made upon evaluation of body size and characteristics and dental assessment.

All captured deer were fitted with two yellow individually-numbered plastic livestock ear tags. As most residents have frequently observed, one of the tags is sizeable and the numbers on it are readable from 50 feet or more. This year, we started with the number “31” and proceeded upwards with each subsequent capture. Tagging allows us to identify which deer have been treated so none are recaptured. The tags provide information about who to call if the deer is found dead so we can track mortality. Every captured deer has a tag placed in each ear because the large numbered tags can occasionally tear off when snagged, and redundancy improves the chance that at least one tag survives. The “backup” tag is a small disc that does not protrude from the ear and therefore is much less likely to detach, but it can’t be read from a distance.

Capturing and immunizing the deer has no known long-lasting effects other than the immune reaction to the ova. If venison from an immunized deer were ingested by humans, the PZP protein



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that had been injected would be digested into constituent amino acids in the GI tract and would have no impact on the individual's personal or reproductive health. Furthermore, the PZP does not remain forever in the deer's tissue, and is only needed to initiate the immune response to the ova. Nevertheless, the ear tags alert a hunter to the immunized state of the doe, and in both cases where does were taken by hunters, the hunters contacted the DEC or local authorities to find out if the meat was safe to eat.

Re-treatment phase

Every fall, starting in year three of the study, does that were immunized two years prior must be reimmunized in order to sustain their infertility. Re-treating began in September of this year. Does being re-treated do not need to be captured. A self-injecting dart fired from an air rifle delivers the booster, subsequently falling to the ground for recovery. This significantly reduces the effort and time required, but it does necessitate locating all of the tagged does of the cohort.

Results after three full years of research

The year by year gathered data are critical and their usefulness and meaning is increasing with each new year of the study. The study design does not assume that preliminary findings are sufficient to draw useful conclusions, although they establish important baselines for comparison. Enough data for conclusive analysis will not be available until the mid-fourth through fifth years of the study when it will be possible to reliably document reduction in fawning rates and consequent changes in population density and impact. Initially the primary data available to use were the number of does immunized (8, 20 and 20 in each of the first three years, respectively), the survival duration of back yard hostas and numbers of car-deer collision. As previously noted, the latter two deer impact indicators are not expected to change until late in the study and for now they are establishing baselines. In year three we have begun to estimate fawning rates of does immunized in the first two years of the study, and to estimate the total number and density of deer. Although it cannot be systematically observed, reports of deer migrating outside their presumed Hastings home range is incidental data that is not systematically acquired, though it is still of value.

Number of does immunized and re-immunized

By the close of 2016, up to 45 tagged and PZP-treated adult female deer survived on site out of 48 immunized, although not all of them have been observed in the past 6-8 months. Over three years the death of three immunized does has been documented. We estimate that this number of immunized does represents about 55-60% of the adult female deer whose home ranges lie principally in the Village of Hastings-on-Hudson.

Re-treatment for the seven living does first immunized in 2014 resulted in does #4, 5, 6, 30 (7), and 8 receiving one of the two vaccine re-treatments via dart injection without being immobilized with anesthesia. Does #2 and 3 could not be located and their whereabouts is not known.



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Hosta survival duration

As anticipated, hosta survival duration was not consistently impacted by the project so far and overall survival was unchanged from year one to year two. Although it might be tempting to interpret the data as indicating a shift to longer survival between days 7 and >30, there was an insignificant impact on fawning between these years so the difference is more likely due to the variability of deer browsing patterns.

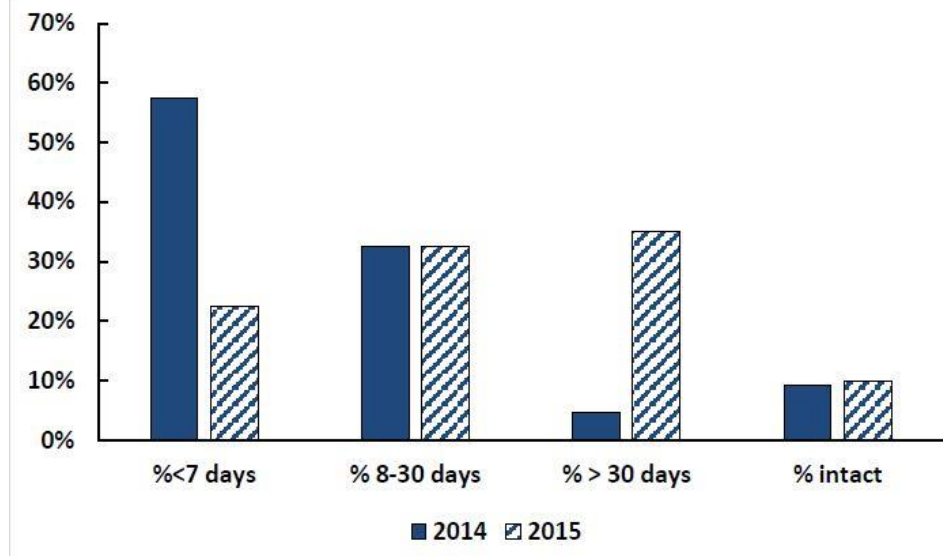


Figure 1. Hosta Survival duration in 2014 and 2015

Deer-Vehicle Collisions (DVCs)

The number of deer-vehicle collisions (5) reported to police in 2015 was lower than that reported in 2013 (12) and 2014 (>7). From a community viewpoint, this is a good development. However, because the number of DVC's is small, and subject to random fluctuation as well as causal variables unrelated to this project, DVC's may not turn out to be an effective metric of success for the project.

Estimated fawning rates

From photo capture data and direct observation we infer that none of the 2014-treatment does for which we have data (N=6) fawned in 2015. 60% (12/20) animals treated in year 2 (2015) were observed, and 1/12 had a confirmed fawn (8%). Thus, we think the fawning rate of immunized does is likely under 8%. By comparison, 94% (15/16) of newly captured does were diagnosed as pregnant at time of first capture. In addition, 16 untagged adult does were identified, accompanied by approximately 16–20 fawns. These data strongly support the study premise that PZP immunization would be highly effective at reducing doe fertility.

Estimated population size

Infrared-triggered camera trapping surveys are considered to be the most reliable method of estimating deer population size. For two years camera data have been collected and analyzed. In 2014, camera placement began on August 28, 2014 and continued through September 27, 2014. The timing of the 2015 camera placement was more standardized and more compressed than that of the 2014 camera grid. The analysis of the first year's data took a long time and the fall 2015 data are currently being compiled and analyzed. Comparing the two year's results may give some indication of whether the Village deer population was stable or continuing to increase prior to the onset of PZP treatments. The currently estimated deer density of ~17/km² is not extreme,



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and is in line with that reported by other suburban communities that are experiencing conflicts with deer. If the estimated number of resident females (~80) is accurate and has been relatively stable since 2014, we have tagged and treated nearly 60% of the adult female deer resident in Hastings-on-Hudson as of winter 2016.

The high pregnancy rates of untreated does combined with the low fawn:doe ratio observed in camera trapping studies suggest that either low litter size or relatively high early fawn mortality or both are limiting population recruitment.

Migration and neighboring deer herds

We have observed additional female deer that graze in Hastings-on-Hudson part of the time, especially entering Hillside Woods from the north from Dobbs Ferry, and from the Andrus School which occupies a parcel comprising both Hastings-on-Hudson and the City of Yonkers to the south. However, we know of only one instance in which a large distance was traveled by a tagged female deer. This was doe #10 who was taken by a hunter in July 2016 near Teatown Reservation, Ossining, a distance of approximately 19 miles from Hastings. Doe #1 was reported to the DEC as killed by a hunter just north of Dobbs Ferry in the summer of 2014, a little over a mile from where it was originally tagged.

Costs to date

This effort, as mentioned, is a cooperative project with the Humane Society of the United States and Tufts University. Those entities cover personnel and some expenses, and we cover the rest. (The particulars have been spelled out in a partnership agreement signed by the Humane Society and the Village.) The Village has spent a net of \$53,495.49 so far over the three years of the project. Appendix C lists all project expenses to date. The costs for field cameras and feeding stations that we plan to utilize in subsequent years will not reoccur, and the majority of the remaining costs were for rent of a house to lodge the Deer Team. Renting a house is not only considerably cheaper than housing four professionals in local hotels, but it also makes them more efficient by reducing their travel time. This year, we had a team of four plus a supervisor that was frequently in town and stayed at the house as well. We expect to rent housing in the same price range on a monthly basis for the fourth study year. As a point of comparison, Cayuga Heights, NY, spent \$150,000 in the first year of its deer surgical sterilization program. It is too early to know which approach is more effective, but clearly our investment in deer immuno-contraception is relatively low.

What happens in 2017

We continue to refine our procedures, and will be seeking to take advantage of what has been learned in the previous three years of the study. We will likely have two darting teams working independently over the course of four to five weeks, depending upon weather conditions and results. We may change our approach to permissions for darting on private property, but that has not yet been decided.

The teams will arrive that last week of February 2017 and will finish at the end of March. There will be another re-treating week in September for does immunized in 2015.



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Project challenges in the year ahead

Deer are extremely attentive to human intent and activity, and can tell the difference between a disinterested resident strolling out of their home and someone who is closely monitoring them. They can distinguish individuals and quickly learn the identity of the darting team and their car. They also quickly realize that unusual activity directed at them is underway and probably have a memory or previous years of darting. Hunters know that deer behavior changes dramatically within hours of the onset of a hunting season. So, although casual observation by residents may be that the deer are practically tame, in reality they only behave like that when they perceive the environment to be non-threatening. Hightened wariness is a major challenge to successful darting.

Now that approximately 60% of the resident does are immunized the remaining 40% will be increasingly more difficult to capture. There are fewer of them, they have observed what's happened to other does in their herd, thus becoming more skittish, and they probably have wised up to the techniques being used by the Team.

Another challenge for the Deer Team was the difficulty of darting in a dense suburb like ours. There is substantial activity everywhere, and at all times of the day, that disturb the deer and frequently make safe darting impossible. Off-leash dogs are a particular problem at all hours of the day, especially in the parks.

There are also a number of areas in the Village where it is difficult or unsafe to capture deer. These included steep ridges and rock outcroppings adjacent to the Saw Mill River Parkway on the east side of the Village, Zinsser Park, which is sandwiched between U.S. Route 9 and the Croton Aqueduct trail in the northeast corner of the Village, and the Andrus School on the Village's south boundary.

One of the largest challenges is not being able to capitalize on the unpredictable moments when deer are within darting range on private property, because it is unclear that the owners will permit it. In the three previous seasons we have pro-actively reached out to residents via email, the village website and going door-to-door, to gain permission to dart on their property. Well over 300 residents have given permission, and planted the red or green surveyor flags to mark their property as available. That has helped a great deal, but the gaps between these flagged properties has left many darting opportunities unusable. We need to find a way to expand the number of properties that are available.

Greater knowledge of the movement of deer should help us capture and treat a number of the untreated does in 2017. We will once again ask residents to log deer sightings, starting in late January.

Project Risks

It is important to continue to emphasize that this project is a scientific study that seeks to determine the efficacy of this particular method of deer population control. Based on the results of the study, we will then determine if it would make sense for us to continue on an ongoing basis. There is no guarantee of success. If we are successful the Village can be rightfully proud of having provided a significant tool to hundreds of communities like ours that suffer this problem.



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Westchester County held an all-day symposium in 2015 on managing the deer population with presenters mainly from upper Westchester or upstate communities. Over the course of the day it was clear that methods being tried north of Rt. 287 are not possible and are not likely to work south of 287. Dr. Rutberg was a presenter at the symposium and Dan Lemons participated in a panel. Many eyes are on Hastings because we are the only community piloting an approach that holds promise in suburban environments with dense human populations. It will be a number of years until we know if the promise of immuno-contraceptive control is fulfilled, but even in the more rural parts of the county where culling and hunting are being used as management tools, there is no certainty of success. One of the conclusions coming from the symposium was that the Westchester deer population explosion is a direct result of the way humans have altered the environment, and it will not be easily or rapidly reversed, no matter what methods are utilized.

Any well-run project should be clear-eyed about the immediate and long-term risks to its successful implementation. This is no different. We believe the following risks are the most significant risks to the project.

Execution Risk:

The Deer Team is unable to dart enough of the remaining unimmunized does to push the overall percentage of the doe population treated to a level that significantly reduces key deer impacts. This can occur because the deer are either inaccessible, excessively fearful of humans, or other reasons. This has been addressed over the last year by further refining the strategies used to attract deer to feeding stations and by gaining permission to dart on private property.

Immigration/Emigration Risk:

This is the primary risk of the project, and what this experiment seeks to answer. Can population numbers of deer be more rapidly suppressed through immunocontraception than they are increased by immigration from neighboring communities? Deer are thought to be relatively stable in their ranges, and to expand into new areas at a slow pace. Recall that it took them more than a century to return to Westchester after the last deer was killed near Sing Sing in 1861, arriving from slowly rebounding population redoubts located to the north and northwest. The project may suppress a hundred fawns from being born in a given year, but that result would be nullified if a hundred new deer immigrating from surrounding communities. We know there is a large herd in the Andrus School grounds and while we cannot capture deer there, it is certain that those deer wander frequently into the south part of the village. We do not have enough data yet to know if the immigration risk is fatal to the project, and that will only become clearer over many years. We do know by now that a small percentage of our deer wander from 1-20 miles away, but we don't know if they return, since in both known instances the deer were killed by hunters.

Sustainability Risk:

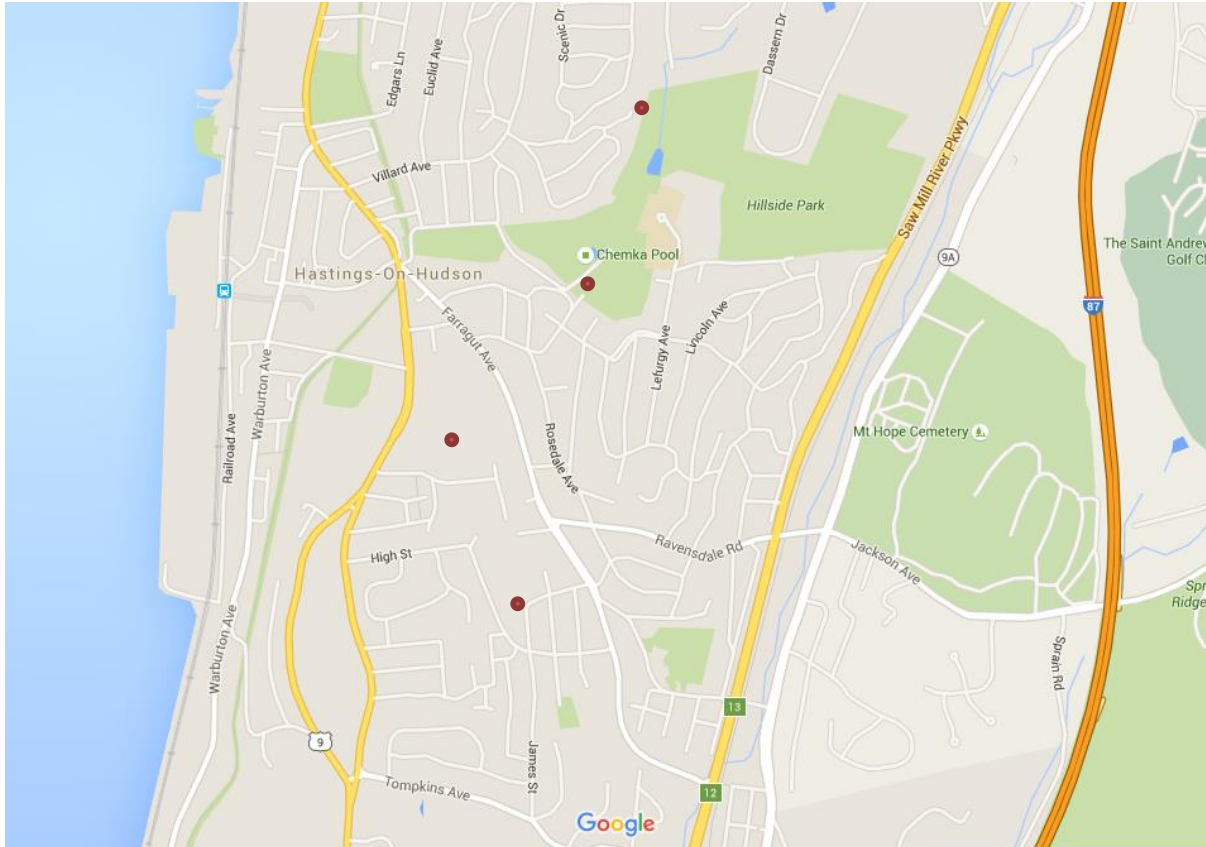
The study is being carried out over a five-year period and staffed by external darting teams. Beyond five years, if it is to become an ongoing method of deer population control, the effort will likely need to be sustained locally. It is not clear that the effort to directly dart deer with PZP can be sustained by trained residents of the village. Will we be able to identify enough capable volunteers or will we have to rely on paid professionals? While this risk is at least a year away, it is probably the most serious risk to sustaining the effort longer-term.



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Appendices

A: Feeding Locations



- Feeding station location



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B: Study success indicators

An essential part of the Immunocontraception Study is tracking a number of metrics we are using to verify the results of the effort. Some of the indicators being used are explained in more detail below.

Host a Hosta

Property damage is one of the most significant impacts that deer have on our Village. Just about anyone with a garden knows that certain plants (e.g. tulips) will typically never survive to flowering before being consumed by deer. Relying on anecdotal reports of property damage, however, is statistically useless. Modeling on a protocol established on the Cornell University campus (the “Oak Seedling Sentinel protocol”), we decided to deploy hostas throughout the community as a standardized way to track deer depredation in gardens.

Irene Jong, the resident who has volunteered to coordinate this effort, identified fifty volunteer homes to take a potted hosta. Each year, we are tracking how many (and which ones) survive. In theory, as the number of deer drop off, more hostas should survive the season. This is a scientifically rigorous way of tracking deer impact on private property. Since we do not expect to see a significant decline in the deer population for a few years, we are still acquiring baseline data.

On-line Tracking

We have developed a [website](#) for logging deer sightings that’s used by a number of residents who enter their deer sightings. The site, developed by a local resident, Richard Ryan, tracks a range of factors about the deer. A Google Maps utility, developed by a local student, Jordan Allgood, reads this data and creates “heat maps” displaying where the greatest numbers of sightings are occurring. Again in the coming year, we will use the deer-logging site to help the Deer Team track the movements of tagged females, and determine which females have fawns with them. With up to 60% of the does immunized prior to the fall 2016 mating season this data will become even more useful in assessing the efficacy of the PZP immunization.

Camera Traps

We need to know how many deer there are to know whether our efforts have worked to bring their numbers down. In the end, the best statistically valid way to count deer is to systematically photograph them and then, through statistical methods, analyze the photos taken and come up with a total. This is done by deploying what are called “camera traps” which are specially-designed cameras that are heat- and movement-sensitive and automatically triggered when a warm body passes within ten yards of their lens. These cameras are strapped to trees for a month and photograph every single creature that passes before them. The photos are then downloaded and analyzed. Seventeen cameras were deployed in 2014 in a grid around town (largely in park areas, but also on some private property where we would secure permission).. Pace University graduate student, Chris Johnson, used well-established protocols to determine to within a 5%



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margin of error how many deer reside here. Chris was supervised by Mark Weckel, who is an expert on this topic and has run camera traps in a number of projects.

Camera trapping data obtained in 2015 was analyzed by CUNY graduate student, Maria Gavrutenko. All data have been tallied from the images and are currently being analyzed. Photo trapping will be done every year for the duration of the project, It is important to note that while we need to track deer numbers, the key indicators of success are the reduction in deer impacts like deer-vehicle collisions and habitat destruction.

Exclosures

One of the biggest impacts of deer on our shared environment is the wholesale destruction of the understory in the Village parks. Deer are ecosystem engineers. Twenty years ago the parks had dense bramble and vegetation at ground level. A diversity of species lived in the understory, and the next generation of trees were nurtured there. The deer have chewed down anything native from six feet high (as far as they can reach) down - so it is possible to see most of the way through the woods. This is neither normal nor healthy for the woods - the next generation of trees is consumed before they ever mature, and a whole ecology of species that existed in the understory is gone. The earthworm population has also exploded due to deer over abundance and caused a collapse of the ground litter food web. If the deer population is lowered, we may see some of this vital portion of our shared environment restored as ground-cover plants, tree seedlings and animal species recover and thrive.

To track this, we established two exclosures (fenced areas that keep deer out) where we will track the return of native species to see what would happen if the deer were reduced in number. We have also staked out several plots next to the exclosures, that remain accessible to deer, and will count species there every year - and see if the numbers change over the course of the experiment. This effort is being run by Hastings high school AP Environmental teachers Melissa Shandroff and Marc Zelmanowicz. Ms. Shandroff initially received a grant from the Hastings Education Foundation to establish an exclosure where native plants could be allowed to regrow from in-ground seed stock.



C: Cost details

Deer Immunocontraception Costs and Income: 2014-2016				
<u>Date</u>	<u>Vendor</u>	<u>Description</u>	<u>Expense</u>	<u>Payment to HOH</u>
2/26/2014	Tractor Supply Co. (M. Gunther purchased)	50lb. PP Cracked Corn	\$212.00	
2/26/2014	Tolls to/from Portchester	To pick up Corn	\$20.50	
2/20/2014	Petchester Veterinary	Misc. drugs to administer to deer	\$676.13	
2/20/2014	Petchester Veterinary	Misc. drugs to administer to deer	\$198.86	
3/1/14 - 3/30/14	Mayor Swiderski	Misc. Expenses (hotel, dinner, signs, etc.)	\$4,714.77	
3/24/2014	The Science and Conservation Center	Shipping of PZP Vaccine	\$655.09	
4/1/2014	Irene Jong	50 Hostas (Valhalla Garden)	\$300.00	
4/10/2014	Ricky Eugene Naugle	Misc. Expenses (tags, game feeder battery, game feeder)	\$629.99	
4/16/2014	Humane Society of U.S.	25 sets PZP pellets	\$5,650.00	
5/27/2014	In Defense of Animals	1st Installment		\$6,000.00
8/4/2014	Humane Society of U.S.	Kayla Grams expenses (air travel, meals, equipment for deer)	\$2,548.92	
8/19/2014	Mayor Swiderski	Reconyx, Inc. Cameras (7)	\$3,499.36	
12/12/2014	Christopher Johnson	Reimbursement for mileage for camera setup	\$725.33	
2/1/2015	Bernard Berner & Carol Klein	Property Rental - 191 South Broadway - February	\$4,750.00	
3/1/2015	Bernard Berner & Carol Klein	Property Rental - 191 South Broadway - March	\$4,750.00	
7/17/2015	In Defense of Animals	Second Installment		\$6,000.00
1/8/2016	Richard Ryan	Deer Tracking Database	\$600.00	
1/20/2016	Humane Society of U.S.	Expenses for Winter 2015	\$8,862.53	
2/26/2016	John E. Andrus Memorial, Inc.	Property Rental and Deposit - 100 Old Broadway - February 20-April 1 (Rent 8,500/Deposit 2,000)	\$10,500.00	
4/13/2016	John E. Andrus Memorial, Inc.	Refund of security deposit for 100 Old Broadway Rental		\$2,000.00
6/13/2016	Humane Society of U.S.	Field Staff Meals, Supplies & Equipment, Travel for Kayla Grams	\$17,017.22	
10/27/2016	Humane Society of U.S.	Field Staff Meals, Supplies & Equipment, Field Staff Housing	\$1,184.79	
Three-year total			\$67,495	\$14,000
Three-year net cost			\$53,495	



Village of Hastings-on-Hudson, New York

D: Lyme disease

Lyme disease is a very real scourge in Hastings (and the region). We believe it has infected hundreds of residents, some repeatedly, and some very seriously, resulting in debilitating and even crippling injury. White-tail deer are intimately involved in the complex environmental loop that infects the ticks that bear Lyme disease. There is little question that as deer have recolonized areas, Lyme disease has spread as well. There is also evidence that once Lyme disease is endemic in an environment, it is very difficult to eradicate, though there have been a few cases where this was managed. Wild white-footed mice (peromyscus) and other small rodents endemic to the area play a major role in maintaining tick populations. Other communities have had success in lowering the incidence of ticks by distributing nesting material that is permeated with a compound that kills ticks.

While there is also evidence that a significant drop in deer numbers may lead to a decrease in Lyme disease cases, this is very difficult to track or prove and therefore it is not a part of the metrics in this study. Lyme is not a disease that the government mandates to be reported to a central database like those run by the CDC (Center for Disease Control). An individual is diagnosed at a doctor and treated there, with no reporting necessary. Residents use doctors throughout the metropolitan region and it would be almost impossible for the Deer Team to gather meaningful statistics that would show a decrease in Lyme disease incidence over time. As a result, while we have some reason to believe that should deer numbers drop significantly there may be a concurrent easing of Lyme disease in Hastings, we are not stating this as a formal objective of the project or a criterion of success.

References

1. The Hunt For Balance: Management Techniques and Policy Recommendations for Dealing with Overabundant Deer in the Hudson Valley of New York State, Brent Miller, Discussion Brief #15, Fall 2016, The Benjamin Center for Public Policy Initiatives, State University of New York at New Paltz, www.newpaltz.edu/benjamincenter.
2. History of Deer Populations in New York State, Rob Christie, presentation at Strategies for Deer Management in Westchester Suburban Communities: Understanding opportunities and challenges for your municipality, April 30, 2015, a symposium sponsored by Westchester County Parks, Westchester County Center, White Plains, NY.
3. 2016 Report to the New York State Department of Environmental Conservation, Allen T. Rutberg and Kali Pereira, Center for Animals and Public Policy, Cummings School of Veterinary Medicine at Tufts University and The Humane Society of the United States.