White-tailed Deer
Population Control Options

Mt. Lebanon, Pennsylvania

Submitted by

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INTRODUCTION

Mt. Lebanon officials have voiced concerns over deer vehicle collisions, risks of Lyme disease, and impacts to landscape vegetation because of a locally abundant deer population. The potential for the furtherance of these conflicts has prompted municipal officials to again consider addressing the abundance of deer.

The purpose of this report is to assist in identifying a management program that will reduce the deer population and then maintain this density long-term in a socially and biologically acceptable manner. The most appropriate method to manage deer can only be determined once a community sets its goals. If recreation, as part of a management plan, is a priority then hunting should be considered, but only if it will not compromise attaining the overall management objective. If however, the sole purpose of undertaking a deer management program is to reduce deer densities and conduct the program using the most humane methods possible, then other approaches may be more appropriate in developed areas.

The program should occur in 2 phases. In the initial phase the deer population should be reduced to a level compatible with local interests over a 1-2 year period. In Phase 2, a management program should be implemented to maintain the deer population at this reduced level.

SITE DESCRIPTION

Mt. Lebanon is located in western Pennsylvania, in the suburbs of Pittsburg, and contains approximately 6.1 miles^2. The Township represents one of the most challenging situations for deer managers. The community is nearing the point of being "built out" (as of the of 2000 census, there were 33,017 people, 13,610 households) with most of its land area covered by single family homes surrounded by wooded corridors. This provides excellent deer habitat and at the same time can be restrictive to the implementation of some deer management options. There is no hunting permitted within the community, and there are no non-human predators present that are capable of limiting a deer population. Given the favorable conditions, the deer population in the community has increased to a level that is incompatible with some local land uses. To date, limited management actions have been used to control the deer population including sharpshooting efforts in 2007 and 2008.

There were 342 deer counted within the municipal boundaries using FLIR methods in March 2013. This represents a bare minimum count. In addition, there likely has been a ~20-30% increase with the past spring fawning, resulting in a minimum of 400 deer (~70 deer/mile^2) in the community at this time. We cannot provide further insight into the contractor's detection rates for this particular initiative. However, based on consultations with several other communities that had used Vision Air, their counts are typically much lower than the actual number of deer present. A good example of Vision Air's technique's limitations was learned by Hemlock Farms Community Association in Pike County, Pennsylvania in 2006. Vision Air Research, Inc. estimated 264 deer in March, 2004, 141 in March 2005 and 149 in November

2005 after 89 deer had been removed by sharpshooters. The sharpshoot within this residential community eventually removed 379 deer, or more than 2 1/2 times the number of deer the aerial infrared survey reported was present. Following the sharpshoot removal, a ground survey that sampled less than 50% of the community area counted an additional 128 deer demonstrating that the property had at a minimum 507 deer, or 72 deer/mile^2, at the time of the initial count. The infrared aerial survey reported less than 1/3 of the deer present. There is further discussion in the Population Ecology section providing insight into the likely number of deer present in the Township.

POPULATION ECOLOGY

Although it is impossible to calculate actual deer densities because the FLIR contractor provided no insight into their detection probability in moderate to highly developed residential areas, we can use other data to provide guidance in deer management decisions. Mt. Lebanon has 13 years of data for dead deer removal by Animal Control. There is a strong linear correlation between deer abundance and the number of deer-vehicle collisions (DeNicola and Williams 2008). Therefore, this information can be used to set goals for deer management in addition to serving as a well correlated index to assess impacts of any deer management efforts. Animal control removal locations can also be used as a tool to determine areas of special concern, or areas where more effort is needed.

The insights that can be gained from Animal Control's dead deer collections can be summarized in the following example. Sixty two dead deer were removed by animal control in 2006 before any management activity occurred. Then in early 2007, 69 deer were culled by USDA and the number of dead deer removed by Animal Control stayed nearly the same (2007 - 64). Therefore, there had to be $\geq$300 in the community prior to the start of the culling program for that level of removal not to have any lasting population reduction (see Appendix A). In other words, the deer that were culled were quickly replaced by fawns that subsequent May and June (2007). The following winter/early spring (2008) 149 deer were removed from the population. The removal effort only resulted in a decrease in animal control's removal of dead deer to 48; a ~25% decrease. This reflects a population of at least 325 before the culling program (see Appendix A), based on well documented suburban deer demographics (DeNicola et al. 2008). Dead deer removals have since increased to a high of 99 in 2012. Therefore, the present population is likely ~60% greater than it was in 2007, resulting in a population of ~500 deer (~85 deer/mile^2). We would expect that if a similar deer removal initiative that occurred in 2008 (~150 deer) were implemented at current population levels, there would be a significantly lower reduction in Animal Control's dead deer removal then was experienced in 2008 (~25%), because a correspondingly lower percentage of the population that would be removed. In summary, the Township would need to have $\geq$250 deer culled to return to 2008 dead deer collection levels (i.e., 48 deer) given that there has been another birthing event since the 2012 dead deer collection data was completed.

Determining the actual biological carrying capacity (the level at which a population can sustain itself in perpetuity) for deer in a developed landscape is a difficult, if not impossible, task. Natural flora is replaced with an abundance of forage in the way of landscape plantings, spilled bird seed, and other resources which contribute to sustaining populations at levels above what traditional deer habitat can endure. Higher deer densities result in the degradation of

traditional deer habitat and natural flora as more deer seek these areas for cover, and supplement their nutritional requirements with prevalent resources in residential areas. Deer densities ≥150 deer/mile^2 have been documented in similar landscapes with limited effect on survival, reproductive output, or recruitment (White Buffalo, Inc. annual reports for Iowa City, IA, Cayuga Heights, NY, Peaks Island, ME). Due to the limited amount of traditional deer habitat in Mt. Lebanon densities would have to be <10 deer/mile^2 for comprehensive native flora species regeneration and establishment to occur. The lack of a prominent visible browse line on highly palatable forage in the majority of the Township suggests an ample food supply. Therefore, availability of forage is not a limiting factor in population growth at current levels, although degradation of native plant communities is most certainly occurring.

It is often social carrying capacity (the level at which deer/human conflicts reach an acceptable balance) that directs deer management in residential landscapes. By monitoring resident complaints, deer vehicle collisions, or other easily obtained human/deer interaction data it is possible to set tangible goals for deer management in these environments. For many communities a targeted goal of 25-30 deer/mile^2 provides a good balance between human/deer conflicts and cost.

NONTRADITIONAL DEER MANAGEMENT OPTIONS

In areas where traditional deer population control (i.e., regulated hunting) has limited application, management professionals have discussed several other options. The objective of this report is to identify potential management options for the initial phase (Phase 1) and Phase 2 (see Introduction). Below, each option is addressed regarding its applicability to Mt. Lebanon.

Little has changed in regard to "Deer Management Options" since the Township last managed their local deer population, except that we have refined a field surgical sterilization method that is significantly more cost effective than any existing fertility control vaccine (see the Fertility Control section). Therefore, the below summary of options as they pertain to the Township will be very similar to those described previously.

In addition to determining the actual methods to reduce the local deer population there should be a compliance and effectiveness monitoring components. Compliance monitoring is simply a formalized process of documenting that the treatments agreed to within a management/ monitoring program are being applied as designed and the data properly recorded. It is suggested that once a course of action is decided upon, Mt. Lebanon Township identify a compliance monitoring coordinator. This individual should develop compliance monitoring protocol for each aspect of the management program that is adopted and annually review monitoring and deer removal activities for completeness and conformity to the agreed design.

Effectiveness monitoring involves using a group of indicators to quantitatively measure whether your management program is successfully accomplishing the goals and objectives it was designed to do. In Mt. Lebanon, effectiveness monitoring could focus on 1) deer vehicle collisions, 2) deer impacts on vegetation, and 3) the number of cases of Lyme disease within the Township. If community goals are achieved, some treatments may be modified, gradually reduced or dropped to maximize cost effectiveness both in dollars and effort.

Phase 1 - Initial population reduction

1) Controlled hunting

Public hunting using firearms would be difficult anywhere in the community without creating safety issues. Public archery hunting with competent personnel would be safe in many areas of the community. Bowhunting is safer than firearms hunting because archers typically hunt from elevated tree stands and most shots are taken at distances less than 20 yards. However, archery hunting is a much less efficient then firearms hunting.

There are several factors that could prevent the overall success of hunting. First, negative reactions from the general public could prevent this approach from being authorized. Second, it is illegal to use bait to attract deer for recreational hunting. Third, limited access to significant portions of the community because of social, legal (i.e., discharge restrictions for hunting), and logistical constraints could create numerous "safe havens" for deer. Therefore, it is unlikely that a timely population reduction that met management objectives could be achieved using strictly hunting methods (Williams et al., 2013).

There would be minimal direct costs associated with hunting, but there will likely be indirect costs affiliated with the oversight of the program. If controlled hunting is selected as the most appropriate management approach, I would recommend that all hunters be strictly screened for proficiency and competence. Prior to being allowed to go into the field, all participants should go through a thorough orientation program.

2) Professional sharpshooting

Sharpshooting would be safe and effective in many areas where deer are present. Although typically more costly than conducting a controlled hunt, in many cases it is much less controversial. In addition, sharpshooting deer is considered to be more humane because deer are euthanized. If the state permits the use of a variety of field techniques (i.e., shooting over bait with suppressed firearms, using lights or night-vision equipment at night, etc.), this approach can be done humanely, efficiently, and with minimal cost. Depending on the number of deer to be removed, it will cost from $200-400/deer removed. The expense of butchering carcasses would be additional and typically costs ~$75 per deer.

Most people are familiar with traditional hunting. However, the lay public is unaware of the specific protocols used in nontraditional deer management programs (e.g., sharpshooting, trap and euthanasia, contraceptive treatments). To allow for a better understanding of sharpshooting specifically, I have summarized the procedures in the subsequent text.

The sharpshooting process begins by identifying locations where it would be safe and discrete to remove deer. Areas of human activity and locations of structures are noted in detail to ensure that these objectives are met. Bait (e.g., whole kernel corn) is used to bring deer to specific locations during a designated time period. Because deer have to be brought to specific areas, sharpshooting at this geographic region would be optimally conducted during the winter months (i.e., December - early-March) when natural food resources are more limited. Shooting lanes are then cleared to make sure that there are no obstructions in the trajectory of the bullet. In most areas sharpshooting activities may be conducted from elevated stands. Removal efforts begin a few hours before dark and continue until a few hours after sunset. Deer are euthanized with a single shot to the center of the brain (with a very small caliber projectile so that the bullet does not exit the deer's head) to ensure a humane kill, and so that deer do not exit the designated

area. Deer are transported to a local processor each evening for evisceration and processing for donation to food pantries.

3) Capture and relocation

Most information reported in the scientific literature depicts capture and relocation as an inefficient, inhumane approach to manage most deer populations. Deer are greatly stressed during the capturing process, which can result in significant losses to capture myopathy. Capture and relocation also has resulted in high post-release mortality, up to 85% after 1 year. I believe these ramifications also would apply to Mt. Lebanon, because techniques comparable to those used in the literature would be required. In addition, in most states there are a limited number of acceptable release sites. Costs would be substantially higher than a lethal removal, ranging from $600-800/deer depending on the distance to the release site. More importantly, the Pennsylvania Game Commission will not permit the capture and relocation of free-ranging deer at this time.

4) Capture and euthanasia

Capture with box traps, Clover traps, drop nets, or rocket nets followed by euthanasia has been assessed or considered in only a few locations. This technique can be used in areas where there is a concern about the discharge of a firearm. However, it is less efficient and more expensive, with a minimum cost of $400/deer. The expense of butchering carcasses would be additional. In addition, this technique would be significantly less humane than sharpshooting. Deer are greatly stressed during the capturing process as with the initial handling during capture and relocation. This approach may be used in conjunction with sharpshooting in some locations if high deer densities are present and there are concerns regarding the discharge of a firearm.

5) Fertility control

It is extremely difficult to reduce a population using strictly non-lethal measures. Therefore, fertility control methods would not resolve the present deer-human conflicts in the short-term. Furthermore, scientists have made only very modest gains in the development of more efficient vaccine-based fertility control technology. There is one fertility control agent (GonaCon) that is registered for deer management by the Environmental Protection Agency (EPA). However, efficacy is limited unless a booster injection is administered and deer may have to be injected >2 times in their life. An alternative approach is surgical sterilization, this method requires handling a deer only once and it is 100% effective. This method only requires a ~20% increase in cost relative to a vaccine injection because of veterinarian costs (GonaCon must be administered via a hand injection after a deer has been captured – this is a label restriction). Because deer are very approachable in the community it would be feasible to capture a high percentage of does (possibly all the females) using a combination of drop nets and darting technologies. Surgical sterilization costs ~$1000/doe.

Another point to consider is that for every doe that is not culled or sterilized it will produce and recruit on average one fawn per year. To cull that fawn the following year it will cost ~$300. So after 3 years, any doe that has been sterilized will pay for itself in fewer deer to be culled. Many female deer in suburbia live >10 years, so this can be considered a prudent investment when looking at long-term program management costs where access with lethal

methods are limited by development. In summary, fertility control methods are best integrated with lethal methods, applied initially, to expedite the reduction in deer numbers.

A research permit to trap and handle deer from the Pennsylvania Game Commission would be required in advance of using any fertility control method.

6) No action

This would result in the deer population remaining stable or slowly increasing within the community, followed by appreciable damage to native plants and a likely continuance/increase in other associated conflicts (e.g., vehicle strikes).

Phase 2 - Population maintenance

1) Controlled hunting

Public hunting using archery would not likely maintain densities below 50 deer/mile^2. However, it could be used to complement sharpshooting.

2) Professional sharpshooting

Sharpshooting would continue to be a successful means to maintain the target population density. Depending on the number of deer to be removed, it would cost from $300-400/deer removed. The increased cost is the result of diminishing returns with lower densities and higher fixed expenses relative (e.g., baiting) to the small number of deer to be removed. The expense of butchering carcasses would be additional.

3) Capture and relocation

Comments from above continue to apply. Costs would be substantially higher than from original figures. It would cost $\geq$$800/deer, because as with sharpshooting, there would be high expenses relative to the small number of deer to be removed.

4) Capture and Euthanasia

Comments from above continue to apply. It would remain inefficient and expensive, with a minimum cost of $500/deer. The expense of butchering carcasses would be additional.

5) Fertility control

Fertility control methods (e.g., surgical sterilization) may be useful in maintaining the deer population after an initial population reduction. As above, a research permit to trap and handle deer from the Pennsylvania Game Commission would be required in advance of using any fertility control method.

6) No action

This would result in a population rebound back to the original densities. Deer/human conflicts that occurred originally would arise again.

CONCLUSION

In summary, if the City wishes to: 1) reduce deer densities in a timely manner (i.e., 1-2 years), 2) be able to maintain the goal density long-term, I would suggest sharpshooting deer (with some possible capture and euthanasia) in conjunction with surgical sterilization during Phase 1. This could then be followed by either sharpshooting or surgical sterilization in Phase 2.

LITERATURE CITED

DeNicola, A. J., and S. C. Williams. 2008. Sharpshooting suburban white-tailed deer reduces deer-vehicle collisions. Human-Wildlife Conflicts 2:28-33.

DeNicola, A. J., D. Etter, and T. Almendinger. 2008. Demographics of non-hunted white-tailed populations in suburban areas. Human-Wildlife Conflicts 2:102-109.

Williams, S. C., A. J. DeNicola, T. Almendinger, and J. Maddock. 2013. Evaluation of organized hunting as a management technique for overabundant white-tailed deer in suburban landscapes**.** Wildlife Society Bulletin 37:137-145.

APPENDIX A

Harvest impacts on population size - These are general calculations to outline the relative harvest number as compared to the total population and corresponding deer-vehicle collisions.

2007: ~300 deer pre-cull – 69 deer culled = ~230 deer post-cull X 40% yearling/adult females in the population = ~90 fawns recruited (~1 fawn is recruited – survives until the fall - into the population for each yearling/adult female). This results in a population of ~320 post-fawning; nearly equal to the pre-cull population size. Dead deer collections did not change from the previous year. Immigration and emigration typically balance out.

2008: ~325 deer pre-cull – 149 deer culled = ~175 deer post-cull X 40% yearling/adult females in the population = ~70 fawns recruited (~1 fawn is recruited – survives until the fall - in to the population for each adult female). This results in a population of ~245 post-fawning, or a ~25% decline. Dead deer collections declined ~25% from the previous year.