

Fall 2013

# Deer Management Strategy Recommendations for the Town of Hamilton, NY

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## Recommended Citation

Baez, Mabel; Fagliarone, Christa; Hilling, Grace; Keller, Emilyann; Jensen, Kelsey; McGee, Mary; Shapiro, Alexandra; Sperling, Arielle; Lichtenauer, Charles; Heby, Evan; and Halper, Nicole, "Deer Management Strategy Recommendations for the Town of Hamilton, NY" (2013). *Upstate Institute Student Research*. Paper 9.

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## **Deer Management Strategy Recommendations for the Town of Hamilton, NY**

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Environmental Studies 390: Community Based Study of Environmental Issues

Fall 2013

Professor Catherine Cardelús

### **Introduction**

Given the data collected through our surveys of the local deer population and the Hamilton community (Baez et al. 2013, Halper et al. 2013, Jensen et al. 2013), it is clear that deer are overabundant in the Town of Hamilton, NY. In addition, deer are producing negative impacts on both the ecosystem and the Hamilton community. We used these data and our review of case studies taking place in similar areas to create the following comprehensive report of our management recommendations to reduce Hamilton's deer population. Our first and most fundamental recommendation is the creation of a deer-focused working group that continues to monitor the population. This working group would be committed to deciding upon and implementing scientifically-based and socially-responsible deer management strategies. We propose that this working group focus efforts on two intentional population reduction programs. The first recommendation is culling, which would be conducted either by professional marksmen or by local hunters that have passed a test to ensure safety. Culling would be conducted for several years to initially reduce the population to a healthy level that could be maintained by hunting. In concert with culling, our second recommendation is an increase in regulated hunting. This strategy would require an increase in the harvest targets for our Wildlife Management Unit to allow an increase in the issuance of traditional hunting permits. In addition, we recommend an increase in the use of Deer Management Assistance Permits and Deer Damage Permits to allow the working group to target specific land with high deer densities where these alternative permits can be implemented. Another possible strategy is the implementation of an Earn-a-Buck program to increase the harvest of the doe population on regulated land.

Current hunting regulations and harvest rates are insufficient to reduce the socially and ecologically overabundant deer population. Continuing without implementing new strategies will allow the deer population to increase in the near future. We might see our current density of 42.5 deer per square mile increase to as high as 114 or 180 deer per square mile, as in Princeton, NJ and Cayuga Heights, NY, respectively (Hopewell Valley Deer Management Task Force 2010, Chaisson 2011).

A culling program is a necessary first step to initially reduce the deer population to a healthy, biologically and socially acceptable level. Only then would altered hunting regulations allow local hunters to maintain this acceptable population level. Finally, venison donation programs should be implemented to provide food to the community. This paper discusses our management recommendations in more detail, as well as reviews other options we have investigated.

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### Current strategies

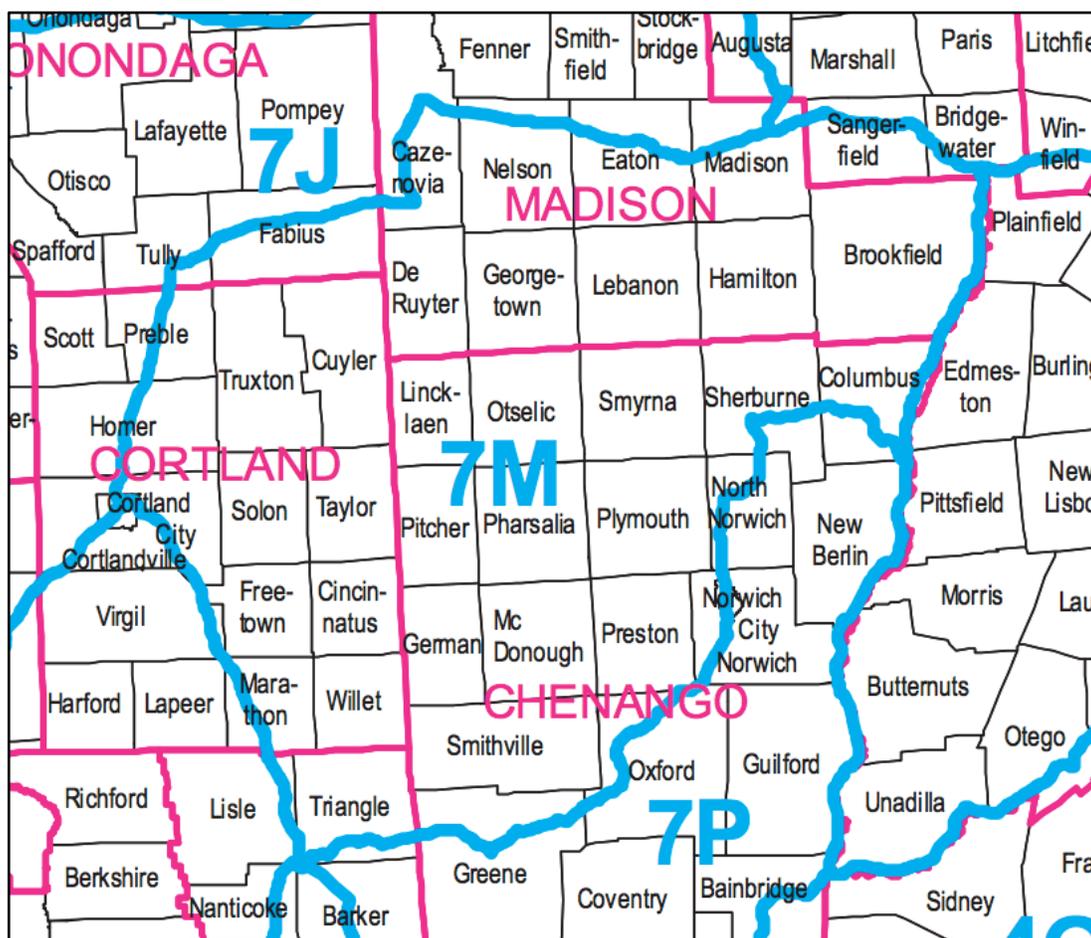


Figure 1. Map of Wildlife Management Unit 7M (NYS DEC 2013e).

The Town of Hamilton is in New York State Department of Environmental Conservation (DEC) Wildlife Management Unit (WMU) 7M (NYS DEC 2013d, Fig 1). Each WMU has its own Citizen Task Force (CTF), organized by the Bureau of Wildlife (BOW), which sets the deer population goal for that WMU (NYS DEC 2013a). 7M's CTF is supposed to meet every five years, but they have not met since 2006 (NYS DEC 2013b). This is obviously problematic, given Madison County's deer population growth rates. The CTF facilitator selects members from the different stakeholder groups that he or she has identified with the DEC. The facilitator is supposed to be unbiased towards deer management (NYS DEC 2013a).

The CTF meets two to three times in order to construct the deer population goal. At the initial meeting, DEC deer biologists "serve only as technical advisers" providing introductory information about deer and management options (NYS DEC 2013a). Afterwards, members of the CTF are to gather as much information as possible, through personal conversations, regarding the opinions of the WMU stakeholders. The different stakeholder groups include, but are not limited to hunters, landowners, foresters, and business owners. At the second meeting, members share what they found and establish the deer population goal they deem appropriate. Most often, the CTF comes to an agreement at this meeting, but if not, a third meeting occurs (NYS DEC 2013a).

The population goal upon which the CTF agrees informs management policies in the WMU. For example, the Buck Take Objective (BTO) and Desired Adult Female Take quotas are derived from the relationship between the actual deer population and the population goal set by the CTF. These quotas are the number of antlered and antlerless deer respectively that are to be harvested per square mile each year in order to meet the population goal. The Desired Adult Female Take serves as an indicator for how many Deer Management Permits (DMPs, or “doe tags”) the DEC will issue to hunters each year (NYS DEC 2013a, NYS DEC 2013c). When the CTF does not meet, the BTO does not change, and the DEC uses deer take information from the previous year to set the doe tag quota for the following year (C. Sprague, *pers comm*). Therefore, though deer density has increased, the BTO has remained constant since 2006.

Although increasing harvest targets is an important component of increasing harvest rates, it is not enough to reduce the overall deer population in the area alone. The current BTO and Desired Adult Female Take together amount to a desired take of about 5.5 deer per square mile (NYS DEC 2013c), which only results in a 13% decrease in the deer population. This strategy alone allows the deer population to recover from the hunting season annually, ultimately preventing population reduction. Clearly, these harvest objectives need to be increased. Even the 2012 harvest data (6.9 deer per square mile) (NYS DEC 2013c) only amounts to a 16% decrease, which is still not enough to effectively reduce the population. Additionally, because each buck impregnates many does before the hunting season starts, taking bucks (a cultural tradition) does not effectively reduce the population (Yarrow 2009). There is a shocking antlerless to antlered deer ratio of 23:1, which necessitates a higher adult female take objective.

Given the density and effects of the local deer population detailed in Baez et al. (2013), Halper et al. (2013), and Jensen et al. (2013), a targeted culling program must supplement regulated hunting.

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## **Culling**

The intentional culling of a majority of Hamilton's deer population is our foremost active recommendation. Culling is a process by which trained, professional (or tested volunteer) marksmen reduce the deer population significantly in a short time period in targeted areas. It is the most effective method of reducing overabundant deer populations. We suggest that culling be safely implemented within the village and also in other parts of the town to reduce the deer population. Based on our research, residents will have three main concerns: safety, cost, and local hunters' opportunity to volunteer. We will address these concerns by referring to six case studies and two academic papers specifying five case studies throughout this section.

### *Safety Concerns*

Culling will take place in designated areas to be determined by the discretion of the landowner and working group. We suggest targeting high-density areas. It is important to notify residents of scheduled cull times, which are most often performed at night, when deer exit the forest to feed. During this time period, human traffic around deer habitats is slower and deer herds tend to congregate near feeding areas. In order to cull the maximum number of deer, marksmen bait the deer with food over a period of a few days to their tree stands, where the shooting occurs. Shooting may also occur from the back of a truck. The elevation assures better accuracy and forces the marksman to shoot downwards. This means that stray bullets or arrows will hit the ground, not nearby objects (DeNicola et al. 2008).

### *Cost*

Costs of culling vary depending on an area's circumstances. Culling can range from \$88 per deer (1996 prices) (Frost et al. 1997) to \$500 per deer (New Jersey Department of Environmental Protection 2012). There are reputable professional culling firms in New York State. Furthermore, it is important to remember that although the short-term cost of culling is relatively high, the benefits outweigh the long-term costs of deer damage that occur with overabundant deer populations.

### *Duration*

Frost et al. (1997) and our case studies all indicate that deer culling must last at least 3 years to be effective in the long-term. If culling is not carried out for the fully prescribed time, then population levels will fully recover to pre-cull levels (Frost et al. 1997). This duration period is dependent on conditions of the local deer population and habitat, and would be the responsibility of the working group and culling firm to pursue. Culling periods usually take place during or between hunting seasons in the fall and winter for periods of 5-15 days (DeNicola et al. 2008). Once a sustainable population density is achieved (in Hamilton, 10 deer per square mile is biologically acceptable (Baez et al. 2013)), hunters must meet an annual harvest quota to prevent full population recovery. The quota will depend on the size of the reduced population and can be determined with statistical modeling (Frost et al. 1997).

### *Cull Rates*

DeNicola et al. (2008) cites four case studies detailing annual cull rates for programs lasting three or more years. Professional marksmen and tested hunters can cull up to 360 deer in ten days (DeNicola et al. 2008). Appraisals must be made specific to Hamilton. This is clearly

the most effective method of reducing the overabundant deer population in the Town of Hamilton.

### *Why Culling is Hamilton's Best Option*

As Baez et al. (2013), Halper et al. (2013), and Jensen et al. (2013) described, deer are overabundant at a population density of 42.5 deer per square mile (Baez et al. 2013). They measured overabundance by investigating a number of deer-related factors: high incidence of deer-vehicle collisions (DVC) (Halper et al. 2013); increasing prevalence of Lyme Disease in humans and pets (Baez et al. 2013, Jensen et al. 2013); reduced ecological biodiversity (Baez et al. 2013); significant property damage (Halper et al. 2013); and Hamilton residents' perception that the population is too high (Jensen et al. 2013).

The effects of the overabundant deer population in the Town of Hamilton are comparable to those in case studies of four private institutions and two municipalities which hired trained marksmen to cull their deer populations. The private institutions are Vassar College in Poughkeepsie, NY; Swarthmore College near Philadelphia, PA; the Cary Institute for Ecosystem Studies in Millbrook, NY; and Mohonk Preserve in New Paltz, NY. The two municipalities are Princeton, NJ and Cayuga Heights, NY.

Vassar's cull program began in January 2010 and recurs annually (density of 39-50 deer per square mile) (Vassar Farm and Ecological Preserve 2013). Swarthmore's cull program began in 2009 and also recurs annually (density of 29 deer per square mile) (Swarthmore College Crum Woods Stewardship Committee 2013). Cary's overall deer management program began 30 years ago, and a 50-60 hunter cull recurs annually (Cary Institute of Ecosystem Studies 2013). Mohonk received a deer management grant in 2007 and culling recurs annually (Mohonk Preserve 2013). Princeton, NJ began their culling contract in 2000 and ended it in 2006, reducing the deer density from 114 to 32 deer per square mile (Hopewell Valley Deer Management Task Force 2010). The village of Cayuga Heights had a deer density of 180 deer per square mile when their culling program was initiated; a culling program took place in the village and the surrounding Ithaca area (Chaisson 2011).

There are various reasons an administration (often a Citizen Task Force or working group) decides to cull the population. Mohonk, Vassar, Cary, and Swarthmore all cited ecological damage to be the main motivation for their deer cull programs. They named deer browsing of forest undergrowth as a major disruption of ecosystem integrity. The municipalities of Princeton and Cayuga Heights cited economic damage to residents as their culling programs' major motivator. Princeton attributed a high disease burden, a high rate of DVCs, and significant property damage to deer. Cayuga Heights' density was near 180 deer per square mile when it initiated its program, and researchers cited similar effects of deer. DeNicola et al. (2008) stated that elected officials' main reason for approving the use of marksmen in four different states was "public safety concern over increasing DVCs."

All the institutions in question realized that some of the public would oppose or misunderstand their practices. Opposition in Hamilton over the contracting of professional shooters will almost certainly occur by hunters. Therefore, we propose Hamilton follows the Cary Institute's model. Cary hires professional marksmen and, in order to meet the community's demand for hunting, also issues an annual invitation to local volunteer hunters to cull on their property. However, each invited hunter must meet the following criteria: demonstrated success in doe harvests; compliance with Cary's rules and regulations; and a positive attitude regarding the program and its goals. In order to satisfy this last requirement, Cary teaches hunters that "doe

culling is integral to stabilizing deer populations, and that hunting females does not result in fewer opportunities to take a buck, a long-held tradition for most hunters” (Cary Institute of Ecosystem Studies 2013). Applicants must also apply for an antlerless deer tag through the state licensing system; attend a pre-hunt orientation meeting; and pass a shooting proficiency test before an access permit is issued. Vassar and Swarthmore Colleges followed these regulations with positive results.

We propose that professional marksmen and skilled, volunteer hunters both be contracted to address deer overabundance.

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### Increased Harvest Targets (DMPs)

Currently, WMU 7M does have a deer take objective (harvest goal). However, culling is presently imperative because the set deer take objective has been inadequate for many years. A Citizen Task Force (CTF) sets this objective based on minimal biological data and disproportionate stakeholder representation (NYS DEC 2013a). In the following section, we outline our recommended modifications to the CTF and the harvest target of Hamilton's Wildlife Management Unit.

We recommend that the WMU 7M CTF meet soon. The Bureau of Wildlife (BOW) cited understaffing as justification for infrequent meetings (C. Sprague, *pers comm*). DEC has proposed that CTFs from nearby WMUs with similar conditions collaborate for meetings (NYS DEC 2011). This would allow the WMUs to meet more often, but it is unclear whether this will be more effective in choosing appropriate harvest targets.

Furthermore, we recommend that biologists play a greater role in establishing the population goal rather than just providing background information. We recognize that the target harvest should take into account the opinions of diverse stakeholders, but we do not think the decision should rely solely on public opinion, as it does currently. Overall, establishing harvest targets should be a more scientific process, especially when the deer population and its effects can be quantified, as we have shown in our research (Baez et al. 2013, Halper et al. 2013, Jensen et al. 2013). We hope that findings such as ours can be used to better inform CTFs on the deer populations they are regulating.

Increasing harvest targets would allow hunters to acquire more tags. Increased targets could be met by extending the hunting seasons. Beginning earlier would reduce reproduction rates as bucks could be hunted earlier in the mating season. Another way in which the Town of Hamilton can meet increased harvest targets is to promote the bow hunting season to increase the number of bow hunters. Because all WMUs in the state of New York allow early bow hunting, no changes in policies would be necessary (NYS DEC 2013b). These methods would result in increased harvest rates, which will be necessary to maintain a low population density.

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### **Alternative Hunting Permits**

Irrespective of the WMU's harvest rate, the DEC can issue alternative hunting permits to landowners who report deer damage or nuisance. There are two types of alternative permits, Deer Management Assistance Program (DMAP) permits, and Deer Damage Permits (DDP, or Deer Nuisance Permits). We envision a section of the working group identifying voluntary landowners who qualify for alternative hunting permits to hunt on their own lands and to issue permits to hunters who seek more hunting lands.

The Deer Management Assistance Program (DMAP) provides additional hunting tags to registered hunters to harvest antlerless deer during hunting season (NYS DEC 2013). The DEC can also issue Deer Damage Permits (DDP) to registered hunters for the lethal removal of nuisance deer outside of the regular hunting season. Both of these programs target landowners and require them to apply for these permits (NYS DEC 2013). These DEC permit programs can play an important part of the larger management strategy by allowing increased hunting on land with high deer densities, and by reducing deer property damage. Potential DMAP permits and DDP target areas can be designated through cooperation of private landowners, DEC (who appraises damage on state lands), and the working group.

The program is currently small. Only a small percentage of Hamilton Township landowners apply for alternative permits. From 2009-2013, 16 DMAP permits were issued, consisting of 245 tags, and 110 harvested deer. DDPs were issued to only 6 landowners, consisting of 24 tags and 20 harvested deer (A. Perry, *pers comm*). We propose that more landowners take advantage of these programs. These programs can be used to open more land to hunters. If a landowner is experiencing significant damage due to deer, but does not want to hunt any or all of those deer, he or she can invite other hunters to hunt on that land. The working group could facilitate this process by coordinating a registry to connect hunters to landowners with high deer densities. Ultimately, these programs will contribute to increased harvest rates and will help maintain a healthy deer population.

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### **Earn A Buck Program: Reducing the doe to buck ratio**

As previously mentioned, the 23:1 antlerless:antlered deer ratio is not conducive to population reduction. However, Hamilton's hunting culture demands "trophy bucks," or antlered deer. Because primarily targeting bucks does not reduce the deer population significantly, we suggest an "Earn-a-Buck" (EAB) program as our final managed hunting strategy to augment the limited harvest of antlerless deer.

EAB focuses on increasing the harvest of female deer to decrease the overall population. Boulanger et al. (2012) investigated the short term success of Cornell's EAB hunting program implemented in 2008 in order to mitigate the negative effects of deer overabundance in and around its campus. The EAB program requires hunters to take a minimum of two antlerless deer before hunting an antlered deer (buck). The ultimate goal was to reduce the female deer population, thereby reducing the campus' overall deer population by 50%. Boulanger et al. (2012) concluded that Cornell's EAB program was successful in increasing female deer harvest on the campus and the surrounding areas; throughout their study period, more female deer were harvested than bucks. This program's implementation ultimately allowed hunters and guns onto the University Campus under the control and revision of the campus police, with some self regulation among the hunters. To monitor the success of their program, Cornell required hunters to bring their harvested deer to the 24-hour check-in station located near the center of the hunting zone.

Boulanger et al. (2012) reported that hunters' initial response to the implementation of EAB was controversial and that some hunters did not participate due to the extra work associated with harvesting extra does. Their major concern was the increased cost of processing more than their normal number of deer in a season. However, Boulanger et al. (2012) describes that, by the conclusion of the season, many hunters felt safer and that their hunting practices were more ethical (Boulanger et al. 2012).

This program could be implemented in the forests of the Colgate University Campus. It would require strict regulation and notification of students as well as the community. It would open up new land for hunting, which addresses the issue of decreased huntable land in the Town of Hamilton. EAB would also make hunting easily accessible to Colgate students. In addition, involving local hunters in this program may promote the harvest of does elsewhere. Hunters could dispose of their increased take through venison donation programs, as discussed below.

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### Venison Donation

Our management recommendations will hold very little weight if hunters are burdened with an increased cost of deer processing. We aim to minimize resistance to changes in hunting practices by taking advantage of venison donation facilities that benefit the community. Therefore, increased hunting trends would not negatively affect hunters' lives, but would instead allow hunters to enjoy the sport and give back to their community. We suggest the use of venison donation to support the increased harvest strategies described above.

The Venison Donation Coalition (VDC) of New York was established by the Chemung and Steuben County Sportsmen's Federations in 1999. A coalition of butchers process donated deer harvested in NY by hunters with Deer Nuisance/Management Permits, free of charge. Venison is donated to local food banks, food pantries, soup kitchens, shelters, etc. The VDC has been highly successful, servicing 52 counties and providing an average of 300,000 highly nutritious meals (76,000 pounds of venison) to the hungry annually. In 2012, they surpassed four million servings of donated venison. The Food Bank of Central New York distributes venison for the VDC in this region. They are the primary food supplier for 261 emergency food programs in 11 counties, distributing over 13 million pounds of food in 2012. There are currently five member venison processors within an hour of Hamilton (Table 1).

Table 1. Members of the Venison Donation Coalition within an hour of the Village of Hamilton, NY.

Processor	Phone	Location	Distance
Farmer's Place	607-847-8324	S. Edmeston	30 minutes
Curtis Custom Cutting	315-363-2763	Verona	35 minutes
Country Meat Shop	607-334-7210	Norwich	45 minutes
Marsh Mill Ranch	315-633-2888	Kirkland	50 minutes
G&B Meats	315-656-7066	E. Syracuse	55 minutes

The VDC is a non-profit organization and all donations are tax deductible. Monetary donations can be made on the VDC's website, through NYS DEC via telephone, at the Town Clerk's Office, or anywhere hunting and fishing licenses are purchased. Of donations made to the VDC, 90% of funds are used to process and distribute venison.

We recommend that residents of Hamilton take advantage of the VDC in order to provide members of the community with food and to support increased hunting. Our survey results showed that the majority of residents support hunting as a management strategy, and some respondents expressed that hunted deer should be used as food (Jensen et al. 2013). Hunters that would otherwise only hunt what their family can eat can harvest more deer without wasting meat, and can do so at no additional cost to them. Members of the community and businesses can also donate funds to this cause. More importantly, we would like to see more butchers and processors in the area become members of the VDC and/or new donation programs established. The Friendship Inn Soup Kitchen and Hamilton Food Cupboard are organizations that provide food to people in need in Hamilton and could benefit from venison donation.

The Wolf Mountain Nature Center in Smyrna, NY (25 minutes from Hamilton) is a Nature Center with eight gray wolves, five eastern coyotes, and two arctic foxes. The center

educates the public about these species; ecosystem interactions, including those of ungulates and humans; and renewable energy: the Center is run entirely on wind and solar power. They offer educational programs for groups of school children that foster an appreciation of nature. They accept and appreciate donations of whole or partial, unprocessed deer, which is the preferred food of the wolves and coyotes. This is an excellent opportunity to support relevant environmental education as well as to make use of harvested deer.

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For more information, please visit:

<http://venisondonation.org/>

<http://www.foodbankcny.org/>

<http://www.thewolfmountainnaturecenter.org/>

### Protecting Natural Predators

Reintroduction of the native Gray wolf (*Canis lupus*) would be the most effective and ecologically sound management strategy, since it addresses a fundamental cause of deer overabundance. The ecological benefits of wolves are evident in Yellowstone National Park from their successful reintroduction in 1995 after a 70-year absence (Phillips and Smith 1997). Wolves reduce ungulate populations through predation and by reducing reproduction rates. They also mediate ungulate behavior by posing a predation risk, altering foraging behavior and further reducing overbrowse (Beschta and Ripple 2010). As a keystone species, wolves promote forest regeneration, biodiversity, and create positive impacts throughout the ecosystem (Ripple and Beschta 2012). Wolves buffer climate change by providing critical winter carrion to scavengers during shortening winters, allowing them time to adapt (Wilmers and Getz 2005). Wolf populations also modulate soil and community heterogeneity through a spatially and temporally heterogeneous distribution of their kills (Bump et al. 2009). Wolves are able to suppress disease in deer populations by preying selectively on weaker animals in addition to reducing their lifespan and density (Wild et al. 2011). Lastly, the presence of wolves promotes tourism and supports the local economy (Duffield et al. 2005). This solution would be long-term (would not have to be repeated annually) and would control deer populations year-round. Data from WI Dept. of Natural Resources and USFS Forest Inventory and Analysis show healthy forests in areas where wolves were never eliminated, suggesting that restoring “the balance of nature” may be the key to preserving ecosystems (U.S. Forest Service Northern Research Station 2012). Mladenoff and Sickley (1998) identified 16,000 km<sup>2</sup> of suitable wolf habitat in the Adirondack region of New York, and suggested that nearby landscapes be evaluated for potential wolf reintroduction as well. Favorable habitat in the Adirondacks exceeds that in Wisconsin, which has sustained a wolf population of 800 individuals (U.S. Fish and Wildlife Service 2013). Unfortunately, we decided it is unrealistic to propose reintroducing wolves to the area at this time due to negative human perceptions. However, coyotes (*Canis latrans*) also prey on deer (though less intensively than wolves), so we recommend that Hamilton residents stop harvesting coyotes. We strongly recommend that coyote populations should be preserved so that coyote predation of deer can significantly contribute to reducing and maintaining deer populations year-round.

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### **Applying to be a Deer Management Focus Area**

Once deer management strategies are implemented in the Town of Hamilton, becoming a Deer Management Focus Area (DMFA) could provide additional resources and support. A DMFA was established in Tompkins County in 2011 in effort to control the overabundant deer population in the area (J. Hurst, *pers comm*). This focus area is designed to intensify traditional hunting practices in order to increase harvest rates. For example, the specification of the focus area in Tompkins County authorizes registered hunters to take up to two antlerless deer during traditional hunting season in addition to their general hunting tags (NYS DEC 2013). Additionally, the DMFA establishes a special antlerless hunting season at the end of January. Hamilton could eventually apply for this type of specification (NYS DEC 2013). However, the town does not currently have any intentional deer management in place and needs to establish these strategies before the town can be designated as a focus area (J. Hurst, *pers comm*). Above, we suggest a number of programs that Hamilton could employ to control the local deer population, including the Deer Management Assistance Program, Deer Damage Permit issuance, and an Earn-a-Buck Program. Becoming a DMFA will give the Town of Hamilton more flexibility in policies, aiding in intentional management efforts.

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### **Surgical and Chemical Sterilization**

In the survey conducted by Jensen et al. (2013), Hamilton residents recognized sterilization as a deer management strategy they were familiar with. However, we found both surgical and chemical sterilization to be largely ineffective. Sterilization is a non-lethal deer population control method in which deer are rendered infertile by surgery or chemical injection. This method is appealing for locations where a close proximity of residences limits huntable space, such as within the Village of Hamilton. Surgical sterilization is one method that has been used to sterilize deer by tubal ligation. Tubal ligation utilizes laparoscopic procedures to sterilize deer (MacLean et al. 2006). Tubal ligation leaves the ovaries and uterus intact and is thought to have minimal hormonal and behavioral effects (Boulanger et al. 2012). Although this management method has been shown to work on small, relatively fixed (Tregaskis 2013) and closed (Merrill, Cooch, and Curtis 2006) populations, this method is impractical for a variety of reasons. The cost associated with one surgery is over \$1000 per deer (Boulanger et al. 2012), which does not include costs to train veterinarians to perform the surgery. Additionally, at least 50% of the doe population needs to be targeted in order for this method to be successful (Boulanger et al. 2012), and the method is not effective for populations with immigration (Merrill, Cooch, and Curtis 2006). Most importantly, surgical sterilization has been shown to increase deer vehicle collisions because sterilization reduces maternal tendencies and thus increases the home ranges of does. (Boulanger et al. 2012, Gilman et al. 2010). We dismissed the idea of surgical sterilization for the Town of Hamilton because of the many downfalls of the strategy.

Similarly, chemical sterilization can have significant negative consequences and is not an effective management strategy for the Town of Hamilton. This method requires hormones to be administered to deer annually via dart guns. This process is not very effective. Like surgical sterilization, this method is expensive, costing \$500-\$1000 per deer (Cambronne 2013). It also requires targeting a large portion of the doe population, and alters the behavior of does as described above. Additionally, the release of hormones into the environment produces negative impacts throughout the ecosystem. These negative impacts can include feminization of frogs and fish (Cambronne 2013). Lastly, a human female coming into contact with a lost needle could be rendered infertile for the remainder of her life (Cambronne 2013). A fear for the Town of Hamilton is the thought of a young child stumbling upon a dart filled with hormones while playing near a wooded area, and being rendered infertile for life. Our survey results support our assumption that safety of Hamilton residents is the biggest concern and ultimate priority (Jensen et al. 2013). Therefore, we do not recommend this method of sterilization due to potential adverse health and safety concerns, as well as the initial and maintenance monetary costs associated with this method.

Though sterilization may seem like a more humane option than culling or hunting to reduce the deer population, it is likely to have negative consequences on does, members of the human community, and the local environment. Thus, we do not recommend that sterilization be implemented locally.

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### **Conclusion**

We suggest that our proposed working group use this paper as a guide to implement management strategies that will effectively reduce the population of deer in the Town of Hamilton, NY. The Colgate University Department of Environmental Studies could serve as a resource for monitoring the effects of deer management through continuous student research projects in the future.