

Deer Management Goals for Binghamton University Natural Areas

1. Maintain white-tailed deer as a valued member of the native fauna of our natural areas by implementing a management program that mimics, as closely as possible, the population-stabilizing effects of natural predators on deer in order to restore the structure, diversity and function of BU Natural Areas.

Objectives: Reduce deer impacts that allow forest recovery and reintroduction of native understory. Maintain deer populations at levels that eliminate the effects of intense herbivory

2. Manage deer in a safe and humane manner.

Objective: Manage deer at population levels which allow maintenance of the full ecological integrity of the natural habitats at BU, while maximizing public safety and minimizing the suffering of deer

3. Continue a monitoring program to assess the extent of deer effects on biodiversity and ecosystem function.

The White-tailed Deer populations that exist today are mostly the product of past hunting and land-use practices. In the early 1900s, the White-tailed Deer population of the entire nation was estimated at only 500,000 individuals. This was largely due to unregulated hunting, which threatened to remove the White-tailed Deer from much of its native range. Unregulated hunting was also responsible for removing the large predators such as the Gray Wolf (*Canis lupus*) and mountain lions (*Felis concolor*), which once helped to control deer populations. Though overhunting by man was responsible for great reductions in deer populations in the early part of the century, the subsequent laws and restrictions placed on deer hunting throughout the 1900s have allowed their numbers to rebound to unprecedented levels. Protected areas and hunting-free preserves have helped contribute

Like almost all of the ecological problems we face today, the explosion of deer populations is a direct consequence of human actions. Together, the combination of reduced hunting pressure, lack of natural predators, increases in favorable habitat, and plentiful alternative sources of food has allowed deer populations to explode. In many northeastern forests, these populations are having a variety of broad ecological effects and will dramatically change the appearance and function of the forests of the future.

substances (chemicals poisonous to other species) (George and Bazzaz 1999). Thus, deer herbivory not only directly limits regeneration through browsing, but indirectly by promoting the establishment of ferns.

Many invasive species benefit from high levels of deer herbivory. Not only do deer serve as a mechanism for the dispersal of seeds of invasive and exotic species, but they also allow these species to exploit the niches left open by declining native species. In many cases, invasive species tend to be disproportionately resistant to deer herbivory when compared to native species (Rawinski 2008). Certain adaptations result in a competitive advantage for invasive species, such as the physical defenses seen in Japanese Barberry or the chemical defenses seen in Garlic Mustard. By avoiding unpalatable plants, deer help to increase populations of invasive species by consuming competing native plants. Once established, plant communities dominated by invasive species are often resistant to reinvasion by native species, meaning the ecological effects of high levels of deer herbivory may be exceedingly difficult to reverse.

Changes in forest structure caused by deer herbivory affect many other forest organisms. The most notable example is forest birds that rely on saplings and shrubs for nesting habitat. In North America, it has been shown that a loss of vertical structure can reduce the abundance and diversity of shrub-nesting birds and the densities of migrant birds (Rooney and Waller 2002). Ground-nesting birds can also be affected by exposure of their ground habitat from deer browsing. The loss of structural complexity in forests affects many species of birds indirectly as well. These open forests cause an increased vulnerability of birds to predators and a greater advantage to the Brown-headed Cowbird (*Molothrus ater*), a brood parasite that lays its eggs in

Sullivan 2001). Reducing local deer densities through population control has been shown to directly reduce DVC (DeNicola and Williams 2008).

Disease

difference between areas protected from deer and those subjected to deer browsing. Almost all of the understory in the CIW Woods has either been destroyed or shows evidence of deer browsing. Species not usually preferred by deer, such as American Beech, show evidence of extensive browsing down to 6 inch sprouts. Invasive species such as multiflora rose (*Rosa multiflora*), and autumn olive (*Elaeagnus umbellata*) and Christmas fern (*Polystichum acrostichoides*) are being browsed by deer. Japanese stiltgrass (*Microstegium vimineum*), white grass (*Leersia virginica*), white snakeroot (*Eupatorium rugosum*), and some fern species are swiftly becoming the dominant herbaceous plants in the understory of BU's forests. A recent study of seedlings in historically established plots showed zero seedlings of any species growing in any plot (Population Ecology course, Dr. John Titus, 2012). The only seedling-sized trees that were found were Beech sprouts that deer can't kill. However, Beech sprouts don't grow because deer eat them. Another recent study by the Conservation Biology class found no understory sapling under 5 years old and no canopy tree species under 20 years old.

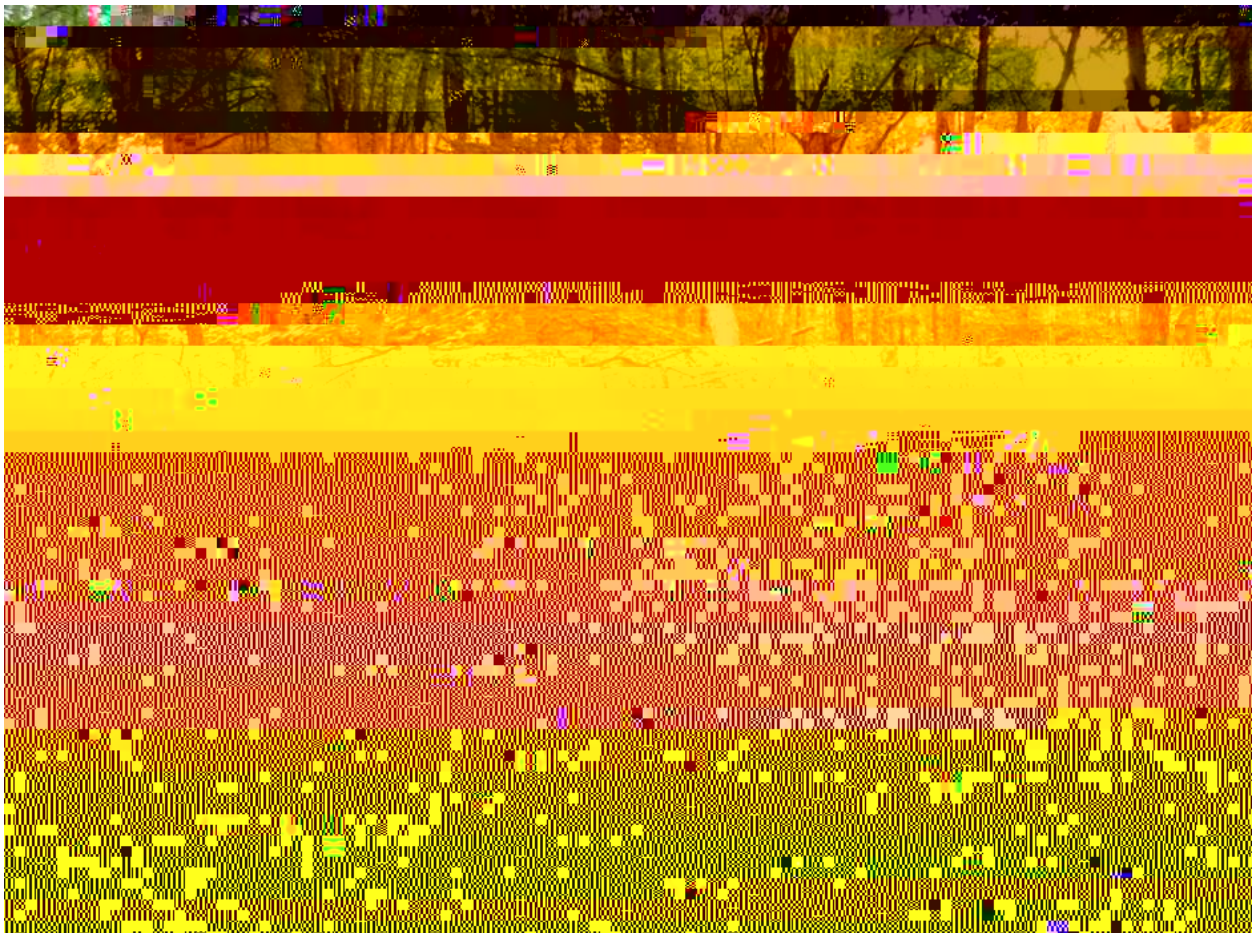


Figure 1. Typical view of the forest floor in Binghamton University natural areas. High light levels, yet very little vegetation and the distinct browse line.



Figure 2. Another area near the wetlands with just Japanese Barberry in the understory. Recently, Japanese stiltgrass has taken over.

Twelve species of forest-floor wildflowers formerly found in the BUNP have not been documented in recent years, which is due in large part to deer herbivory:

Forest wildflowers that have disappeared from Campus

- Wild ginger – Herbarium specimen 1977; last seen in Anderson Center Woods ca. 1997
- Blunt-lobed hepatica – Herbarium specimens 1957, 1962, 1964
- Canada violet -- Herbarium specimens 1961, 1966
- Long-spurred violet – several groups disappeared between 1995 and 2000
- Yellow forest violet -- Herbarium specimens 1961, 1964, 1968
- Round-leaved yellow violet -- Herbarium specimens 1962, 1964
- Barren strawberry – large clones all disappeared between 2000 and 2006
- Dwarf ginseng -- Herbarium specimen 1962; last seen in Anderson Center Woods in 1980s
- Yellow bead-lily – many clones in 1995, but all disappeared between 2000 and 2006
- Perfoliate bellwort -- Herbarium specimen 1964
- Yellow mandarin – last seen 1995
- White trillium – last seen 1995

Forest wildflowers that have decreased by >50% from Campus between 1995 and 2006

Wood anemone

Red trillium- last seen 2006

Painted trillium- last seen 2006

False Solomon's seal

Several species of ground-nesting birds that once nested in the Binghamton University Nature Preserve, has not been

our land is great enough that standard measurements of deer population actually overestimate deer numbers. Since deer tend to go into yards, the majority of campus deer migrate down from the upper elevations in the winter. Deer counts have been conducted by the Steward of Natural Areas every winter since 2006 using transects through each forested area amongst the buildings and lower elevation areas of the Nature Preserve. In the higher elevations of the Nature Preserve deer are more difficult to count as they are still shy of people and the terrain allows for more places to hide. In 2006, 45 deer were present. In 2008, the number of individual deer found on campus was 55 with the majority (40) found in and around CIW. In 2012, 59 deer were counted in the lower elevation with 43 in the campus natural areas and the remaining 16 in the lower elevations of the Nature Preserve. (Update: In 2014, 65 deer were counted.) The lower elevation counts amount to half the deer actually living on University land according to the FLIR. No matter what technique is used to count deer, from infrared imaging to visual count to capture, there will always be a percentage of the population which evades census (Haroldson et al. 2003.) Given that ~60 can be directly observed and there are most certainly more, previous estimates of 80 deer were quite conservative. Management efforts will concentrate on the most densely populated areas.

iii. CIW Deer Counts in 2011:

Though the distribution of deer populations varies temporally throughout the year as shifts in resource availability occur, an index of the campus deer population was taken in early 2011. A series of counts were performed in a 33 acre area known as the CIW Woods. The CIW Woods was chosen as a study site for its size and clear boundaries of campus roads. During the winter months, deer congregate in areas known as deer yards and tend to select areas with greater densities of evergreen trees that provide shelter from snow and wind. Deer select the CIW Woods for this reason, though there are numerous other suitable sites for deer yards in other campus natural areas.

Deer counts were performed visually and on foot. Campus deer tend to be relatively accustomed to the presence of humans, and deer can be followed with relatively little disturbance. Even when disturbed, campus deer tend to flee only very short distances. This allows deer to be driven in a certain direction with relative ease, and deer were followed until they congregated into larger herds. To avoid double counting, the results represent the maximum number of deer in field of view at one time. Using this method, the possibility of over-counting is avoided, and the maximum number of deer recorded in each entry represents the minimum number of deer present on the Binghamton campus at a given time. Some entries were omitted because deer fled the boundaries of the study site before they could be counted, and so data has been limited to reliable entries.

Date: Number of Deer:

March 15	16
March 24	31
March 27	26
April 6	22
April 8	23
April 13	11

Table 1. Numerous counts showing large numbers of deer in the CIW Woods.

Lethal methods of population control are often met with resistance, and so non-lethal control methods such as relocation are frequently attempted. Relocation involves the trapping and transport of deer, and has proven to be expensive and labor intensive with low rates of survival. An important requirement of relocation programs are suitable release sites capable of accommodating new deer. In areas already afflicted with deer overpopulation, these sites are usually rare or absent. Prior to capture, deer in overpopulated areas are typically in poor physical health due to competition with other deer. During capture and transport, exhaustion and high levels of stress often leads to a disease known as capture myopathy, causing delayed mortality in released deer (DeNicola et al. 2000.) Death from capture myopathy can occur up to 26 days after capture (Beringer et al. 2002). Mortality rates of 45 to 95% have been documented and reviewed by the Michigan Department of Natural Resources (2000). The capture and transport of deer also requires the use of expensive tranquilizers, most of which are controlled substances requiring special licenses from the U.S. Drug Enforcement Agency (DeNicola et al. 2000) Each deer costs several hundred dollars to relocate, with estimates ranging anywhere from \$400 to \$2,931 (DeNicola et al. 2000) This is a substantial amount considering the limited effectiveness of relocation and the low rate of survival in released deer. Relocation does nothing to prevent the immigration of new deer, and relocated deer may cause problems in the release area similar to those of the capture site.

At the present time, the Environmental Conservation Law §11-0505 (3) prohibits the trapping of deer except under special permit issued by the DEC for scientific purposes. A DEC permit is required to capture and relocate deer. Current laws and concerns about disease preclude such permits being issued.

c. Fertility Control

There are two major methods of fertility control, surgical sterilization and contraceptives.

Similar to other methods of non-lethal control, sterilization is both expensive and labor intensive, requiring a surgical operation performed by a licensed veterinarian. Many of the problems associated with sterilization involve the trapping of deer. Trapping of the deer increases likelihood of suffering and mortality. Sterilization requires the capture of fertile female deer, so the capture of males or previously sterilized females results in wasted capture effort (Merrill et al. 2006). Secondly, trapping affects the likelihood of recaptures in one of two ways. Previously captured females may avoid traps due to the associated stress of capture, resulting in a decreased number of recaptures. On the contrary, previously captured females may be attracted to traps due to the presence of bait, ultimately resulting in an increased number of recaptures, leading to an inadequate number of sterilized deer. (Merrill et al. 2006).

Despite optimistic reports by proponents of fertility control, most research suggests that contraceptive methods are effective only in populations with limited immigration (islands, enclosed herds), and even then only after many years. Fire Island National Seashore has shown

varied results: the most dramatic is one study area that showed a decline of deer by 60% over 10 years. (Naugle et al. 2002, Underwood 2005.) After a 60% reduction in one study area, the deer population is still greater than what BU is starting with. This is not consistent with our goals of reducing impact of deer herbivory on Binghamton University forests. Adding another ten years of intense feeding pressure to over 40 years of deer impacts puts forest recovery in jeopardy. In order for a population to decrease, it requires negative growth, meaning that the mortality rate must exceed the birth rate. Over time, fertility control programs may be able to achieve small reductions by reducing the number of fertile females, but this does not account for immigration in open populations. At Binghamton University, deer are easily able to migrate between the natural areas of campus and adjacent suburban areas, making the use of sterilization questionable. In populations with substantial rates of immigration, it is doubtful that fertility control will be able to reduce the population size, regardless of management effort (Merrill et al. 2006). Fertility control may be a useful tool in population maintenance, however, and may be more successful and cost effective following an initial major reduction in population numbers (Rooney 2010).

d. Controlled Hunting

More effective in maintaining balanced deer numbers after an initial reduction. Given that culling may not be an option, hunting is the “next best” strategy.

Though many identify hunting as the traditional means of controlling deer populations, the number of hunters in the U.S. has been decreasing since the 1970s (Brown et al. 2000) More importantly, there has also been an increase in lands where hunting is prohibited (Brown et al. 2000). This includes residential areas and areas like the Binghamton University campus. In these situations, controlled hunting can possibly be used to reduce deer populations. This requires hunters to obtain a special license to hunt within protected or residential areas and out of season. This is often accompanied by a skill test to ensure a hunter is proficient. Though the hunting technique used is dependent on the area, archery hunting is often the most practical method in populated areas. Compared to the use of firearms, archery hunting is less disruptive and the limited range of arrows makes it a safer option. Controlled hunting programs have the potential to be very cost effective depending on the hunters used. Groups of professional archery hunters do exist, however local volunteers can be used to reduce costs. Limitations of controlled archery hunting include possible lower rates of success compared to firearms hunting, meaning a longer time to reach target populations and increasing the likelihood of injured deer in residential areas. Specific to Binghamton University, the number of areas on campus at a legal distance from dwellings (500 ft. NYS, 1000ft. Vestal) is limited. Also, a controlled hunt with a significant reduction in deer numbers would necessitate closing most of the Campus Natural Areas and Nature Preserve for a substantial period (several weeks or more), preventing access by University students, staff, and the neighboring community. Controlled hunting programs have proven safe (Doer et al. 2001), but the nature of access to university property would necessitate a special out of season permit to hunt in the safest time period of winter break when students are away and the least number of people are likely to be in the natural areas.

e. Drive to adjacent privately owned legal hunting properties

Requires a large number of “drivers”, but may be effective if the deer move.

In the Binghamton University Nature Preserve, it may be possible to do a drive. A drive involves a number of people attempting to move (drive) deer in the direction of waiting hunters. All involved must have hunting licenses whether or not they are handling firearms/bows. The goal of the drivers is to move the deer calmly, so that the deer are moving far ahead of the drivers to allow hunters to make safe shots. Deer drives are rarely published as a control method, but have been used to count deer before intensive traditional hunting (Berhend et al. 1970.) It's possible to do a drive during established hunting seasons, but would likely be safer and more effective with a special season similar to controlled hunting above.

f. Culling with Sharpshooters

Cornell University in Ithaca, New York implemented a management program incorporating multiple methods to reduce deer populations on campus and surrounding suburban areas, agricultural lands, and woodlots. The following information has been obtained from the 2007-2010 Progress Report prepared by Curtis and Boulanger assessing Cornell's deer management program. Sterilization is used near campus where hunting cannot be used as a management tool, and hunting is used in surrounding areas where state regulations do not prohibit the discharge of firearms. The hope is to reduce deer populations in the hunting zone, to prevent immigration that interferes with sterilization efforts in the sterilization zone. Seventy-seven deer have been sterilized since October 2007 at a cost of \$1075 per deer. The surgical costs were \$550 per deer, and labor costs for capture and marking amounted to an additional \$525 per deer. This was practical for Cornell because surgical costs were donated to the program by the College of Veterinary Medicine, but the costs of sterilization may be too high for other institutions. The controlled hunting efforts required DEC Deer Management Assistance Program permits, allowing hunters to take only antlerless deer to reduce the reproductive potential of the deer herd. Beginning in 2008, the controlled hunting program harvested 69 deer during the 2008 season and 112 deer during the 2009 season with the increase in harvest due to additional lands added to the management area. These combined efforts have begun to show moderate success, and the population density has been lowered from 52 deer/mile² in 2009 to 46 deer/mile² in 2010. Currently, Cornell is using intense deer hunting on several properties to manage the deer at lower levels.

Vassar College in Poughkeepsie, New York has also recognized the need to reduce the deer herd on its 530 acre Farm and Ecological Preserve. Research at Vassar has shown that overpopulated deer are preventing forest regeneration. Flyovers using infrared photography revealed 100 deer in the management area, translating to a population density of around 125 deer/mile². The goal set forth in the Vassar Management plan was to reduce deer population density to 20 deer/mile², meaning a population of 15 deer on the Farm and Ecological Preserve areas. Vassar acquired a Nuisance Deer Permit from the NYSDEC and contracted the non-profit organization White Buffalo, Inc. to remove deer using a sharpshooting program (Henry 2010). A total of 64 deer

were removed from the management area in January 2010 in two nights of sharpshooting. Now that the deer population has been reduced, the Vassar management plan hopes to maintain the population using controlled hunting. In January, 2022 Vassar have reduced deer to 36 deer/mile² and are conducting a cull implemented by the U. S. Department of Agriculture. By reducing the deer populations to ecologically healthy levels, Vassar College is protecting ecosystem health and the future use of the Farm and Ecological Preserve for education and research.

Binghamton University should follow suit and adopt an active management program with the goal of reducing and maintaining deer populations at densities low enough to prevent negative impacts to the campus environment. This management plan recommends a combination of methods: fencing areas where feasible or with higher priority vegetation and culling by sharpshooters with the goal of reducing deer numbers to below the threshold at which the forest may begin recovery (below 13 deer/ mile²). The true indicator of population management success will be the recovery of forest understory, the presence of new tree seedlings, and wildflowers.

Though management programs involving lethal control are controversial, they are justified because they are the most successful method to accomplish these goals. Sharpshooting programs like that of Vassar College have received a certain amount of publicity, but programs like these are valuable because of the immediate results. More importantly, these programs can be safely implemented on a college campus. The constant presence of people on the Binghamton campus and in campus natural areas creates a need to limit the actual time spent removing deer.

Sharpshooting efforts can limit the number of harvests and can be carried out at night to limit disturbance. For this reason, sharpshooting is a more practical alternative to controlled hunting, which requires a longer hunting period and may not initially achieve the same results. However, given that culling had been blocked, controlled hunting was the closest alternative. Controlled hunting programs with archery have been implemented in many municipalities and have proven safe.

Any control efforts should occur during break periods throughout the year when students are absent from campus with the winter break period being the most critical. During winter break from December to January, visibility is high and there are a minimum number of visitors in the Nature Preserve, improving the safety of the program. Also at this time, deer are concentrated in deer yards, allowing for easy and efficient removal. After an initial population reduction, population densities should be monitored and could be maintained accordingly using a similar harvest program during the winter break period every 3 to 10 years. As with other programs, a portion or all meat harvested can be donated to local food shelters for distribution (depending on desire of the food shelter or CHOW), and so a local reduction of the deer population would not only greatly benefit Binghamton University but the surrounding community as well.

control to preserve ecosystem health, while animal rights advocates are strongly opposed to any form of management involving lethal control. When discussing the ethics involved in deer management, it should not go unnoticed that human activities are responsible for the increase in deer populations that have led to current overpopulations. These activities have altered nature's course, and allowing nature to follow this altered course has led to the current overpopulation problem. Natural methods of population control have been removed and at the same time land use practices have created vast amounts of high quality food and favorable habitat for deer. We are responsible for the extirpation of natural predators from the Northeast and so we should be responsible for assuming the role of predators in northeastern ecosystems. This entails ensuring sufficient deer mortality which is essential in promoting herd and ecosystem health.

Still, there will always be those who believe that it is morally wrong to kill a deer in any situation. It is also morally wrong to allow deer overpopulations kill an entire forest. The ecosystem as a whole is far more important than individual deer, and the continued existence of other species may be dependent on reducing deer populations. Deer will continue to thrive even when management efforts are needed, and deer harvested in these programs can be donated to feed the hungry, meaning that nothing is wasted. Finally, we can draw upon the words of Aldo Leopold. "A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise." This is the goal of deer management programs, and we should be fully committed to this sort of ethic. Despite the stigmas associated with management programs involving lethal control, they ultimately result in more good than harm.

X. Past Actions

a. Exclosures

Eight deer exclosures have been created over the years. In 2007, a student built 3 exclosures, two of which were placed in areas where classes could easily access them as a demonstration. Two more exclosures were created in 2011 for the purpose of planting native wildflower species, such as trilliums. A gap habitat demonstration fence was completed in 2012. Finally, two larger exclosures were created in 2015 for research purposes. Only the gap fence has had dramatic results, with the light exposure from creating a gap in the canopy. Most of the exclosures contain species and/or tree seedlings that do not survive outside the fenced in areas such as hemlock, sassafras, and deer berry. This shows hope that native plants can recover if relieved from the herbivory pressure. All of these exclosures combined make up 1% of our natural areas.

A new set of larger exclosures has been constructed in March 2022 through the Regenerate New York Forestry Cost Share Grant Program. Infected and dying ash trees have been cut in order to allow sunlight to reach the forest floor and spur plant growth. The three exclosures surround approximately 17 acres (3% of the area of our natural areas.)

Northeastern forests are being affected by a multitude of stressors, and the added stress of overpopulations of White-tailed Deer places the health of these forests in serious danger. There is no question that deer herbivory is capable of having a negative impact on forest ecosystems. Deer are capable of causing severe, long term impacts that are difficult to reverse, and populations should be controlled before any such impacts become apparent (Cote et al. 2004).

At Binghamton University, these impacts are already severe, and it is crucial that immediate action be taken to prevent further damage to the ecosystem and begin the healing process. In the natural areas of the Binghamton campus, deer browsing is preventing tree regeneration, and little tree reproduction has occurred here in the past 50 years. Native herbaceous vegetation has been virtually eliminated and is being replaced with an increasing amount of invasive species. These changes in forest structure and composition have a variety of effects on the broader ecosystem, and other campus wildlife will be affected as well. As long as the campus deer population is allowed to exist at such high numbers, the health of campus forests will continue to decline.

Though deer management programs are essential to preserve forest health, they remain highly controversial. As previous experience has shown, any deer management program involving lethal control will be met with intense public resistance at first. This is especially true in a university setting and any form of management at Binghamton will be almost certainly be protested by university students and the public. Regardless, Binghamton University has both the ability and ethical responsibility as a steward of its lands to prevent further harm caused by its overpopulation of White-tailed Deer. This involves an active management plan aimed at reducing the deer population to a density low enough to prevent damage to the Binghamton campus, nature preserve, and natural areas. If Binghamton University fails to address this problem, much of the natural, educational, and recreational value of the Binghamton University campus will be lost.

