Natural Lands Trust

Deer Management Options

Before severe modification of the landscape by European settlers, white-tailed deer populations were primarily controlled by hunting by Native Americans and natural predators (wolf, mountain lion, and black bear). With the virtual elimination of animal predators and Native Americans from the southeastern counties of Pennsylvania, the deer population on any property is primarily determined by the type of property (urban, suburban, rural), its size, and the management goals and activities of the landowner and his or her neighbors. Many landowners in suburban and rural areas of the region have witnessed the effects of a high deer population including overbrowsing of crops, landscape plants, and forest vegetation, along with vehicular collisions, and Lyme disease. They are confronted with the decision of whether to reduce the deer population and how.

Landowners desiring more information on the deer issue in Pennsylvania are referred to *Managing White-tailed Deer in Forest Habitat From an Ecosystem Perspective: Pennsylvania Case Study*, which is available through Pennsylvania Audubon (http://pa.audubon.org/). This brochure will instead focus on the various options for managing deer populations. The first choice is between passive or active management. Passive management allows existing environmental conditions and human activities within the local landscape to influence deer survival and reproduction. Active management involves human intervention to directly influence deer access to and use of a property. This publication is designed to help a landowner determine which option or options are most appropriate for his or her property.

PASSIVE MANAGEMENT

Passive deer management is an option if natural factors (predators, disease, famine) and human activities (hunting, car accidents) within the area are maintaining the deer population at a level that does not adversely affect important natural or cultural resources. The other basis for passive management is the landowner's belief that wild animals should not be harmed and that nature will balance and restore itself without human intervention.

Although a passive management strategy is a legitimate position—a necessary component of the deer management discussion and perhaps an effective long-term strategy for lowering deer populations—there is extensive evidence in our region that it leads to the short-term loss of agricultural crops, landscape plantings, and important plant resources that support other wildlife species. Landowners with conservation priorities that include wildlife habitat, natural plant communities, or timber harvesting are likely to see

those priorities compromised by the consequences of a passive management strategy. Unfortunately, it is impossible to predict how long, if ever, it would take for the population to naturally lower to objectively judge the costs and benefits of this strategy.

A good example of the short-term effects of a passive management strategy is a 3,400-acre preserve north of Carlisle, PA, managed by Natural Lands Trust. This property has suffered from extreme deer overabundance (densities up to 400 per square mile) since the late 1960's when hunting was prohibited by the donor's will. The deer population has remained high—despite the nearly total lack of native understory vegetation—through the consumption of the annual mast crop (i.e., acorns, beech nuts, hickory nuts, etc. from the existing canopy trees), tree seedlings, and agricultural crops on adjacent farm fields. As a result the forest resembles a park with canopy trees and a carpet of exotic stiltgrass spread by deer disturbance of the soil (see photo below). Studies of forest gaps—the usual site of dense regeneration—by Dickinson College show the absence of tree seedlings. Computer models confirm the obvious: in the best case scenario, i.e., one without a major wind event or forest pathogen, the forest will gradually degrade into a savannah community as the current canopy trees decline and die.

Under a passive management scenario, perpetuation of some semblance of natural forest communities will require the use of artificial regeneration (i.e., planted trees and shrubs) to regenerate the forest until the deer population collapses through disease or starvation. Trees and shrubs will need to be tall enough (>5') when planted to escape browsing of terminal buds and be planted in numbers sufficient to maintain a closed canopy under pressure from other pests and pathogens. The landowner will also need to accept the loss of the native herb layer.

A passive management strategy can result in a park-like forest with only canopy trees and an herbaceous layer dominated by exotics.

ACTIVE MANAGEMENT

Active methods to control deer overbrowsing can be grouped into two categories: those that restrict or deer deer access to desired vegetation and those that reduce the deer population within a tract of land. The current tools used to actively modify white-tailed deer behavior include barriers, repellents, contraceptives, trap and transfer, and lethal removal.

Barriers

Barriers physically restrict deer from interacting with vegetation in the treated area. Options under this method include tree shelters, netting, and deer fencing. Tree shelters and netting protect individual trees or shrubs; fencing excludes deer from all the vegetation in a specific area. Physical barriers have proven to be effective in protecting trees and shrubs in formal landscapes and forest vegetation although they can be expensive if used over a large area.

Tree shelters are useful to protect seedlings in open areas (estate areas, forest gaps and edges) until they reach six feet in height and are above normal browsing height of deer. However, given their cost and maintenance requirements tree shelters have limited application for most landowners. A 5' tree shelter with support stake costs $5 to $6 depending on the quantity purchased. A per acre cost at a 12' by 12' spacing will therefore run $1,500 to $1,800, plus tree seedlings and installation. Tree shelters also require periodic monitoring and maintenance as they are attractive to deer as rubs and are sometimes targets of vandals.

Fencing holds more promise as a deer management tool, but it involves significant up-front expense and frequent monitoring to ensure the integrity of the fence. Deer fencing is typically 8' high and constructed of box wire, plastic mesh, or electrified wire. Bowman's Hill Wildflower Preserve in Bucks County, PA fenced

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80 of its 100 acres with electrified wire in the early 1990's and effectively protected its wildflower collection. Tyler Arboretum, near Media, Delaware County, PA, in 2000 installed a 12' tall, 2-mile-long deer fence around 105 acres of its collection at a cost of $350,000 (including more than $50,000 to provide vehicular access). In addition to its high initial cost, fencing requires constant monitoring to quickly repair any breaks caused by falling limbs or vandals and restricts not only deer movement, but also the movement of several other animal species. Cost estimates for large scale fencing projects are about $8–$10 per running foot of fence, including installation.

Costs and monitoring are complicated by internal roads, paths, or streams, requiring gates and stream crossing devices. One option that minimizes the cost is to fence large (quarter to half the forested area) sections on a rotating basis to protect vital forest regeneration from deer browsing while still maintaining most of the forest accessible for management and recreation. However, once tree regeneration is established and the fence is moved, the previously fenced areas would likely be degraded again by deer over-browsing.

Fencing can also be used as an instructional and monitoring tool. At a relatively low cost (approximately $300 per exclosure), the landowner can use deer fencing to create small (10 meter square) deer exclosures that are monitored and compared to the existing forest. These study areas provide a picture of the forest's potential when browsing impacts from deer are removed. They also provide an alternate and perhaps more understandable barometer of deer overabundance than deer density. The state of the forest within the exclosure can guide deer management outside.

Repellents

Repellents create unpleasant sensory experiences that discourage deer from physically interacting with vegetation in the treated area. Repellents include periodic loud sounds, bright lights, or foul-tasting foliar sprays. Repellents can be effective in small areas where the goal is to reduce browsing damage to tolerable limits.

The main drawbacks to repellents are cost (approximately $150 per acre, plus application) and their short-term effectiveness. Deer, particularly those in dense populations, quickly adapt to these tactics. The manager must be committed to continually monitoring application needs and experimenting with new products as deer adapt. Although foliar sprays may be useful for landscape and other special plantings, repellents are usually impractical for natural lands.

Contraceptives

Contraceptives are available to prevent pregnancy in deer. The two major types of contraceptives are immunocontraceptives and hormonal contraceptives.

Immunocontraceptives "vaccinate" an animal against egg proteins. When an ovary releases an egg, the deer's immune system views the egg as a foreign body and rejects it before it can implant itself within the uterus. Although very expensive and labor-intensive, immunocontraceptives have proven effective in arresting deer population growth under certain circumstances, such as on islands or within fenced parks or zoos where deer are confined to a relatively small area.

At present, the cheapest and most common method for administering immunocontraceptives is through the use of dart guns—close-range arms that are accurate to about 40 yards. Most population biologists feel that in order to stop herd growth in deer, i.e.,

prevent pregnancy in 90% of the female population, immunocontraceptives may have to be readministered periodically.

Hormonal contraceptives work primarily by preventing ovulation in does. The most effective method for administering this type of contraceptive is through subcutaneous implants. Although one treatment can be effective for multiple years there are logistical and health related issues associated with the use of hormonal contraceptives in natural areas on free-ranging deer. The first is the need to immobilize each deer to apply the treatment. Potentially more problematic is the unknown consequences of introducing these hormones into the food supply.

Currently, there are no contraceptives for free-ranging deer that are approved by the FDA or any other governing body. Also, the effects of deer contraceptives on other animals (including humans) have not been studied. Because deer in southeastern Pennsylvania are free ranging, there is a high probability of human consumption of treated animals. It is even more likely that hormonal contraceptives will enter the food chain when treated deer die and are consumed by other animals, e.g., raccoons, birds, or turtles. Introducing hormonal contraceptives into the environment and food chain could have unknown and far-reaching effects.

The use of contraceptives to manage the deer population within natural lands in southeastern Pennsylvania is problematic at this time due to the high cost (over $1,000 per doe annually for immunocontraceptives), the potential health risks of hormonal contraceptives, and the high mobility of the local deer herd. The fact that deer are free-ranging (entering and leaving properties at will) throughout the region makes treating enough of the right animals almost impossible.

Trap and Transfer

Trapping or darting deer (requiring a permit from the Pennsylvania Game Commission) and moving them to another location is the most expensive, difficult, and ineffective deer control method. It is an option fraught with problems, the greatest of which is finding a location willing to accept more deer. This problem has become more difficult with the recent spread of Chronic Wasting Disease (CWD) to nearby states (West Virginia and New York). Attracting well-fed deer into baited traps is the next challenge. Finally, survival rates of transported deer have been low. For these reasons trap and transfer is a least preferred option for managing deer.

Lethal Removal

Hunting is the most frequently used and most effective reduction method commonly available to landowners. Other lethal removal options, including deprivation permits for farmers and the use of sharpshooters are available, but tightly controlled by the Pennsylvania Game Commission.

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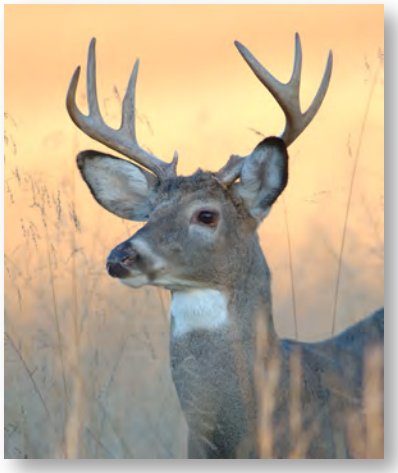
The foremost issue is the safe use of firearms or archery in a region with a growing population and increasing use of natural lands. This is a particular concern in communities where natural lands are part of the common open space that is used by the local community. Any hunting program should be closely monitored by the land manager and controlled by restrictions that minimize the potential conflict between hunters and other users of the natural areas. These should include limitations on hunting areas and times, notification of appropriate persons when hunting is in progress, and an easy way to identify permitted hunters by other users. Most importantly, all hunters should be carefully screened for firearm proficiency and a history of ethical hunting practices. A hunter who violates any program rule should be immediately removed from the program.



Ideally, hunting can lower the deer population to a level where only a few deer need to be removed each year to maintain the population at a level that allows healthy regeneration of the forest. Achieving this maintenance level is often complicated by ongoing development in the surrounding landscape, which will concentrate more deer on the remaining natural lands. If this is the case, it will probably require an extended period of more intense hunting until the development of unprotected natural areas in the landscape is complete. Perpetuating a maintenance level is also complicated by the fact that with a lower population, it may take hunters as much time to remove a few deer as it now takes to remove a few dozen deer. The landowner will need to engage proficient, dedicated hunters to maintain the population at acceptable levels. Until additional options become available, hunting will be a long-term method of keeping the population in check and allowing for limited forest regeneration until a point where populations stabilize in the surrounding area, which could be decades.

There are several potential alternatives and modifications within the lethal removal option that can be employed to reduce deer populations. The first is the use of archery, particularly on small properties or properties with numerous residential structures on its borders. This would greatly expand the hunting area (the safety zone for archery is 50 yards; firearms require a 150 yard safety zone) and extend the hunting time during the year by several weeks. An added benefit of allowing expanded access by hunters is that permitted hunters will monitor for unwarranted hunting while they are in the field.

In some situations, it is more efficient to engage a local hunting club to implement the program described above. They can handle all program administration, including proficiency tests, the scheduling of hunting times, and data collection. The group should provide proof of insurance and be in close contact with the property landowner or manager to avoid conflicts with other activities in hunting areas.

Another alternative for expanding the number of deer harvested each year is enrollment in the Pennsylvania Game Commission's Deer Management Assistance Program (DMAP). This program provides additional permit applications (coupons) to landowners that they can then give to hunters. One coupon is granted for every 5 acres of farmland and every 50 acres of other land cover (forest, meadow, successional). Additional permits above the standard formula are available if the landowner submits a management plan with their request. Unlike in past years, the landowner is no longer required to open their land to the general public.

A final option is the use of sharpshooters to harvest deer. Under this option qualified professional sharpshooters are hired to harvest a high quantity of deer from a property. This requires a special permit from the Pennsylvania Game Commission. The process is very rigorous and requires the landowner to prove that hunting within current game laws is not a viable option for managing the deer population. However, this is probably the safest (removal is often done at night over bait piles) and quietest (sharpshooters use rifle silencers) removal method and would be the most effective option for reducing the deer population in the shortest time.

Summary of Active Deer Management Options

METHOD	COMMENTS	MOST APPROPRIATE APPLICATIONS
Tree Shelters	High cost and maintenance requirements	Converting small open areas to forest. Protecting landscape plantings.
Deer Fencing	Significant up-front cost, frequent monitoring	Establishing tree regeneration in overbrowsed forest areas. Creating demonstration areas. Protecting collections (arboretums).
Repellents	Impractical in natural areas	Protecting landscape plantings in small areas.
Contraceptives	High cost, permit/license	Maintaining populations in areas enclosed by fencing or isolated by significant natural boundaries (e.g., water, mountains).
Trap and Transfer	Expensive, difficult, transfer location, permit/license	Removing deer that are in an area that puts humans or themselves in immediate danger.
Lethal Removal	Currently most effective, safety concerns	Reducing and maintaining populations in areas large enough to provide appropriate safety zones.

ESTIMATING DEER IMPACT

Monitoring vegetation indicators is a practical way to assess the effect of deer on forested areas. Vegetation can be assessed by two methods: (1) comparing the overall influence of deer browsing on existing vegetation to an established index or (2) quantitative sampling. The US Forest Service and Penn State University have developed a five-level deer impact index to visually assess the level of deer influence on forest health:

Deer Impact Index 1
Very low: No deer browse. Occurs only within a well-maintained deer exclosure.

Deer Impact Index 2
Low: Species composition and height of regeneration is determined mainly by available light, nutrients and seed source. There is a well-developed shrub layer and native wildflowers are abundant and grow to their full size.

Deer Impact Index 3
Moderate: Evidence of browsing is common with a greater reduction in height and abundance of the most-preferred species than of the least-preferred species.

Deer Impact Index 4
High: Preferred species are sparse or absent and all plants are nearly the same height as a result of browsing. Vegetation in the shrub layer is sparse except for the least-preferred species (e.g., spicebush, American beech).

Deer Impact Index 5
Very high: A pronounced browse line is evident with virtually no vegetation below the browse line except for two rhizomatous fern species, hay-scented fern and New York fern.

The deer impact index is a qualitative measure; its utility for detecting change over intervals as short as one or two years is weak and its usefulness depends heavily on the level of experience and knowledge of the evaluator on food-plant preferences of deer, expected maximum sizes of various plant species under a variety of habitat conditions, and how to distinguish signs of deer browsing from plant damage caused by other animals and causes other than herbivory.

Quantitative sampling is more time-consuming but its interpretation involves less judgment and specialized expertise. A quantitative approach could include periodic surveys along a transect or cataloging vegetation change within fixed plots. The latter could be used in conjunction with the construction of deer exclosures. Methods need to be scientifically rigorous

if the results are to be sufficiently credible to serve as the basis for labor-intensive and potentially costly deer management procedures. For example, the protocol should include:

- random selection of areas to be sampled,
- areas sampled are large enough and sufficiently dispersed to include the variety of plant resources found within the property,
- sufficient replication of treatments, for example, deer fencing, repellents, hunting, across entire sampling area, and
- sufficient number of samplings, to increase the likelihood of early detection of relatively subtle differences.

The data gathered within sampling plots or along transects may include:

- percent cover of each plant species below 6' above ground surface (maximum height of deer browse),
- number of seedlings and saplings of each tree species, and
- special measures of indicator species (forest-floor species known to be vulnerable to deer but somewhat tolerant of moderate levels of browsing, e.g., Canada mayflower, Indian cucumber-root, and several trillium species); measures may include height of tallest plant or length of longest leaf in the plot, and number of flowering/fruiting individuals versus number of non-flowering/fruiting individuals of each indicator species in the plot.

NATURAL LANDS TRUST'S DEER MANAGEMENT PROGRAM

At Natural Lands Trust, our goal is to preserve and enhance the plant communities within our preserve system to maximize wildlife benefits. With that goal in mind and based on an understanding of the requirements of the state wildlife code, we have instituted a deer management program that focuses on reducing deer populations to a level that will allow forest regeneration and survival of native herbaceous species.

Proficiency testing and a map of hunter locations are among the aspects of NLT's deer management program emphasizing safety for both hunters and preserve users.

While we employ exclosures to protect certain plants and for demonstration purposes, we implement controlled hunts to reduce the numbers of deer.

The rules that hunters must adhere to reflect an overriding concern for safety, not only for the participants of the management program, but for other preserve users such as walkers and bird-watchers. A mandatory proficiency test assures that hunters are familiar and competent with their sporting arm and a flagged map locates hunter positions for the preserve manager and other hunters. Participants wear bright NLT armbands that allow preserve managers as well as others to tell from a distance if a hunter has permission to hunt. The rules place due emphasis on removing does from the population. Preferentially harvesting does brings populations to tolerable levels far more quickly than would a random removal strategy.

Operating the program requires relatively little staff time to administer. In fact, staff time expended in administration is readily made up through time saved by the reduction in staff patrolling time during the hunting season. Permitted hunters monitor unwarranted access to the preserve during the hunting season, enabling managers to attend to other responsibilities.

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