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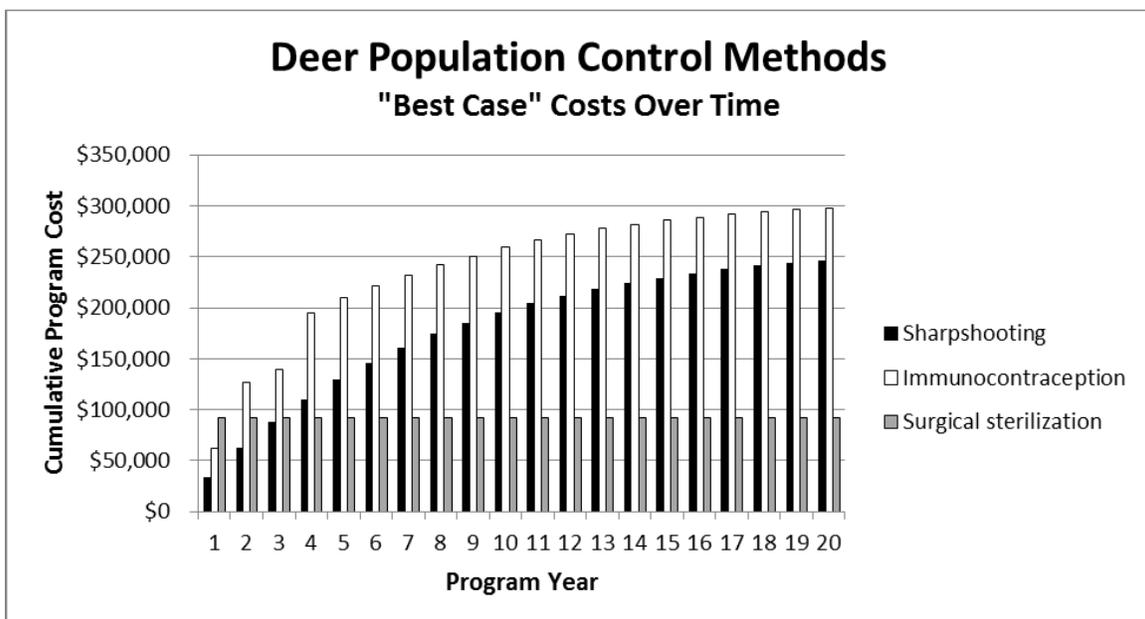
Deer Population Control Methods – Cost & Effectiveness Comparison

Summary

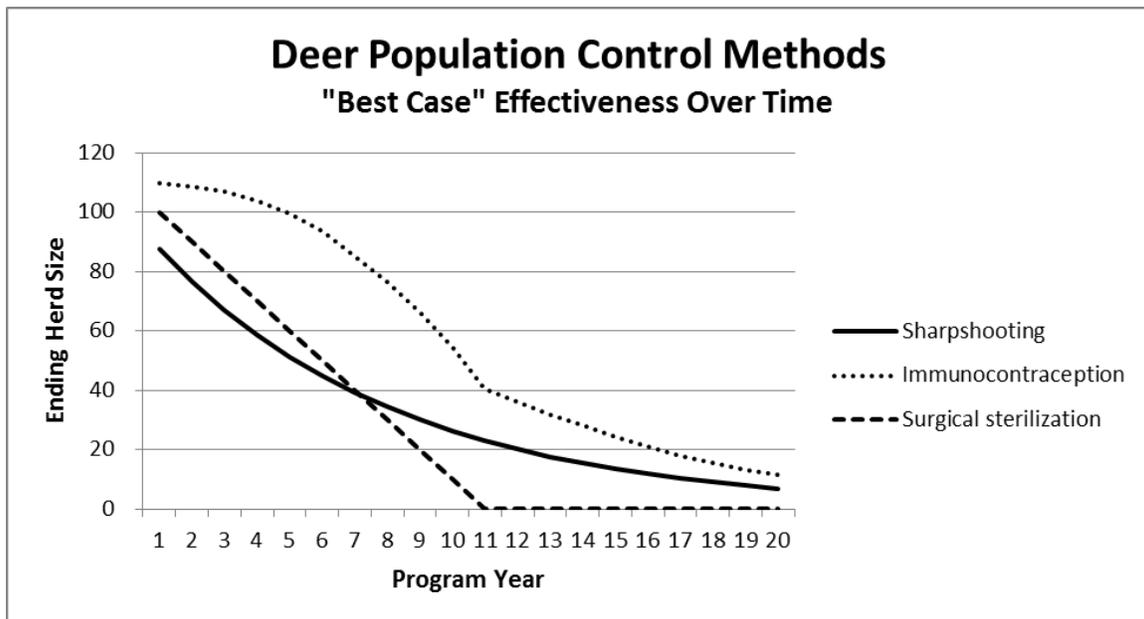
This document reviews three methods of deer population control – sharpshooting, immuno-contraception and surgical sterilization – including an evaluation of each method’s unit and cumulative cost as well as relative effectiveness over time.

The costs and effectiveness of each method were compiled from real-world data, peer-reviewed research and interviews with subject matter experts such as biologists, forest ecologists and natural land managers. Costs of sharpshooting are an average of Essex County’s expenses since the beginning of its program in 2008 and include security / traffic management, venison dressing and deer population tracking. Immuno-contraception and surgical sterilization were evaluated using “best case” assumptions – 100% of target deer are treated, New Jersey’s 2,000-foot permission rule is lifted, and zero re-immigration from neighboring uncontrolled herds – in order to identify lowest possible costs for those methods (under ideal conditions).

Sharpshooting has the lowest unit cost – about \$600. Surgical sterilization costs about \$1,800 per deer, and immuno-contraception has the highest unit cost – \$5,000+ (primarily labor). Over time, the cumulative costs of sharpshooting outweigh the costs of surgical sterilization, due to the need to continue the sharpshooting program year-over-year. At no point, however, are costs for immuno-contraception ever lower than the other two methods (see chart below).



Sharpshooting is the fastest / most effective way to reduce overall herd size, primarily because high numbers of both male and female deer are removed immediately. Surgical sterilization becomes more effective starting in the 7th year of a program, due to gradual die-off of the mature-but-sterile females from old age. However, at no point is immuno-contraception ever more effective than either sharpshooting or surgical sterilization – this is due to continuing herd fertility even after 100% of adult does are treated, and the ongoing need to locate and treat subsequent new female deer (see chart below).



Based on this information, sharpshooting is the least expensive and most effective deer population control method available to Essex County, at least in the short- to medium-term. In theory, surgical sterilization would be less expensive and more effective in the long-term, but New Jersey’s 2,000-foot permission rule effectively prevents any such program on most County lands. Even if / when that rule is lifted in the future, a surgical sterilization program would not be successful unless 100% of the female deer in the reservations are treated, and unless every single town surrounding the reservations is simultaneously controlling its own deer population. To date, only one of the eight municipalities surrounding the South Mountain, Eagle Rock and Hilltop Reservations is doing anything to control the deer living inside their town borders (Millburn conducts an occasional bow-hunt).

Introduction and Assumptions

There is a lot of back-and-forth discussion on the topic of deer population management in public forums, but it's mostly emotion-driven rather than fact-driven, with misconceptions and even bad science used to justify positions. In order to get good, unbiased information I had to spend several months reading through dozens of peer-reviewed research papers and interviewing biologists, wildlife managers and other subject matter experts. Below are my findings.

With no natural predators like cougars, bears or wolves to keep deer populations in balance with their habitat, deer will continue to increase in number until they overwhelm an area.¹ The main reason we're not overrun by other herbivores like groundhogs, chipmunks and voles is that we already have resident hawks, owls and foxes to keep their numbers in check. Man eliminated large deer predators from most of New Jersey more than 100 years ago, but managed to keep deer numbers down for the next 60 years or so through subsistence and recreational hunting.²

However, once hunting began to decline in popularity during the 1970s, deer numbers began to surge. Simultaneously, large tracts of land were developed into suburban housing, providing a year-round source of food and a safe, predator-free haven where deer could reproduce. And boy, did they ever – DEP estimates put NJ's current deer population at more than 50% higher than it was in the year 1500³ – even with 8 million more people in the state!⁴

Our forests and the many other animal species that depend on them have suffered as a result of too many deer eating everything in sight, including the understory needed for birds and small mammals to survive. Because deer, like other herbivores, do not control their own numbers, and because the re-introduction of large predators would pose a public safety hazard, it is up to man to step in and restore ecological balance by actively managing deer populations.⁵

My investigations focused on three methods of deer population control -- sharpshooting, immuno-contraception and surgical sterilization. I did not review sport hunting (either via bow or gun) or "trap & transfer" – capture and inter-state relocation of deer is no longer allowed due to concerns over exporting / importing disease, and the lack of organizations and sites willing to accept more deer (healthy or otherwise).⁶

My overall objective was to develop a minimum base case for each of these three methods so that people could better understand them and then compare their relative costs and effectiveness. To do so, I assumed a hypothetical herd of 100 deer in an unfenced wooded preserve, comprised of 50 males and 50 females evenly distributed in age. I further simplified the model by using several additional assumptions, which in the real world would make immuno-contraception and surgical sterilization programs very difficult to deploy in New Jersey:

¹ W. Ripple et al, "Large Predators, Deer and Trophic Cascades in Boreal and Temperate Ecosystems"

² L. K. Halls, White-Tailed Deer Ecology and Management

³ NJ Division of Fish & Wildlife estimates

⁴ US Census data

⁵ R. E. Latham, PhD, Managing White-tailed Deer in Forest Habitat from an Ecosystem Perspective. Pennsylvania Case Study, January 2005

⁶ S. Predl, Principal Biologist, NJ Division of Fish & Wildlife

1. 100% of the target deer are treated during the primary years of any program. If any of you have ever had to chase down a single deer through a wooded area, you'll realize that is a VERY big assumption. Due to the high reproductive capacity of deer (a single female is responsible for more than 25 new deer in her lifespan), and their low mortality rate (~10%, due to lack of predators), more than 90% of the target deer would need to be treated in any program – otherwise the herd will continue to increase in size (albeit more slowly), and efforts to attain a number more in balance with the ecosystem will be unsuccessful.
2. New Jersey's 2,000-foot permission rule is lifted. Currently, prior written permission is required from every private property owner within 2,000 feet of a potential mobile dart gun tranquilization site before the DEP will issue a community-based deer management program (CBDMP) permit.⁷ Programs involving immuno-contraception or surgical sterilization would use dart guns to tranquilize the target females so they could be safely immunized or sterilized. Non-mobile capture methods such as netting or box-trapping are inefficient, expensive, risk injury and / or trauma to the deer, and are non-selective (meaning non-target deer can wander in). Nets and box traps are also subject to public interference and vandalism. In theory a newly-darted deer could travel almost 1/3 of a mile before succumbing to the tranquilizer, possibly onto surrounding private property. In order to legally access the property and retrieve the tranquilized deer, program participants are required to have the owner's permission. As the 2,000-foot rule is essentially the radius of a circle, any target area must be at least 300 acres in size before program participants are able to avoid the prior written permission requirement – and the program could be implemented only within the acreage more than 2,000 feet from any private property. Very few tracts in Essex County meet those requirements. So, as the rule is interpreted today, all it would take to nullify an immuno-contraceptive or surgical sterilization program is for a single homeowner in a target management area to refuse to give their permission for access. The end result of this statute and its interpretation by the DEP is that any deer population control method using mobile dart gun tranquilization is operationally impossible in most suburban New Jersey locations.
3. No immigration into the target area from neighboring herds (e.g., from Verona, Cedar Grove, the Caldwells). Since deer have an average territory of one square mile⁸, if neighboring towns are not actively managing their own deer herds, deer currently living in those towns will eventually wander in and re-populate the target area. Re-immigration could be prevented by fencing off the Hilltop, but at \$20 per linear foot⁹, this would cost taxpayers almost \$250,000 (and require self-closing gates, etc. to retain public access).

The above assumptions define a “perfect world” base case. The results from this base case analysis therefore equate to “the lowest possible cost and the highest attainable effectiveness, under ideal circumstances.” Applying real-world conditions such as younger average herd age, a majority of females, less than 100% treatment success, existing legal impediments for mobile

⁷ NJ DEP interpretation of N.J.S.A. 23:4-42.3, Section 2 of P.L. 2000, c. 46

⁸ L. K. Halls, White-Tailed Deer Ecology and Management

⁹ Deer Fencers, LLC

dart gun usage, re-immigration from neighboring herds, etc. would significantly increase potential costs and result in lower effectiveness rates. But now at least we have a starting point for comparison and discussion.

Sharpshooting (a.k.a. culling) –

Assumptions:

- Historical / actual costs of Essex County's community-based deer management program are used.¹⁰
- Program consists of volunteer sharpshooters using shotguns and slugs from fixed-location baited tree stands during (mostly) daylight hours on specific weekdays.
- Program is executed in 3 separate unfenced wooded tracts with relatively few roads, and surrounded by suburban housing
 - South Mountain, Eagle Rock and Hilltop Reservations
- Security component is required for public safety and traffic management.
- Deer carcass transportation and processing costs are included.
- All resulting dressed venison is donated to NJ Community Food Bank, other than 40 pounds per sharpshooter for their services.
 - To date, 818 deer have been removed from the three nature preserves, and more than 13 tons – 26,113 pounds – of venison has been donated to the Food Bank as a result of the County's program¹¹

Conclusions:

- High fixed cost vs. variable cost component, driven in part by security costs, but also by number of locations and nature of program restrictions.
- Unit costs average more than **\$600** per deer.
- Herd size is steadily reduced over time, but partially offset by productivity of remaining female deer.
- Initially, sharpshooting is the least expensive and most effective way to reduce herd size of the three methods.
 - However, as resident deer populations are reduced over time, numbers harvested will decrease while fixed costs of the program remain static
 - Long-term, this will drive up both the unit cost and the cumulative costs, to where they approach and then exceed the costs of a surgical sterilization program

¹⁰ D. Bernier, Final Report, 2012 Deer Management Program, Essex County

¹¹ T. Vogel, Director of Food Sourcing, Community Food Bank of New Jersey

Immuno-contraception (including GonaCon) –

Assumptions:

- New Jersey's 2,000-foot permission rule for mobile tranquilization is lifted.
- Hypothetical herd attributes:
 - 100 deer, with even sex and age distribution
 - Reproductive lifespan of 10 years
 - Mortality rate of 10%, all in (no cougars, no bears, very few coyotes)
- No re-immigration into target territory from neighboring herds.
- All adult females are captured and treated during a single program, which is implemented in years 1, 2 and 4
 - An initial shot of vaccine, a second-year booster, and a four-year refresher shot are needed to attain an overall effectiveness rate of 90+%¹²
 - The remaining 10% of treated does for which the vaccine does not “take” will remain fertile and bear 1.75 fawns each per season¹³
 - Fawns < 1 year of age cannot be given the vaccine. About 30% of those immature females will become pregnant, bearing 1 fawn each¹⁴
- Security component is required:
 - Estimated at 80% of average from sharpshooting program, and applied to years of high program activity (years 1, 2 and 4), but not to years of low program activity (i.e., treating the additional female offspring from 10% of does and 30% of female fawns)

Conclusions:

- Majority of costs are variable in nature.
- Unit cost is at least **\$5,300** per deer.
- Hypothetical herd size does not fall below starting number until year 5 of program.
 - Ten years of steady application are required to attain a 50% reduction in the herd
 - Cumulative costs to treat the herd approach \$300,000 by the end of the program
- Immuno-contraception is the most expensive (both on a unit and cumulative basis) method for reducing the deer herd. Costs are driven by the year-over-year series of shots and labor required to achieve sufficient fertility reduction.
 - Quotes that put GonaCon costs at \$10 per dose are misleading – equivalent to saying that the County’s sharpshooting program only costs \$3 per deer because one can order a 5-count box of shotgun slugs online for \$15
- Immuno-contraception is the least effective method for reducing deer numbers. Due to the high reproductive capacity of the still-fertile female deer in a treated population, the overall rate of growth is slowed, but requires almost 15 years before the population is significantly reduced.

¹² A. DeNicola, PhD, President, White Buffalo, Inc.

¹³ S. Predl, Principal Biologist, NJ Division of Fish & Wildlife

¹⁴ S. Predl, Principal Biologist, NJ Division of Fish & Wildlife

Surgical Sterilization (either tubal ligation or ovariectomy) –

Assumptions:

- New Jersey's 2,000-foot permission rule for mobile tranquilization is lifted.
- Herd assumptions are identical to those of the immuno-contraception model.
- No re-immigration into target territory from neighboring herds.
- All females, including fawns, are captured and surgically sterilized during a single program in the first year
 - Tubal ligation or ovariectomy procedures performed in a mobile facility¹⁵
 - Skilled labor from large-animal veterinarian(s) and equipment are included
- Security assumptions are identical to those of the immuno-contraception program.

Conclusions:

- Majority of costs are variable.
- Unit cost is at least **\$1,800** per deer.
- Hypothetical herd size is steadily reduced by assumed mortality rate, attaining 50% reduction by year 5 of program.
- If 100% of target females are treated in the first year of the program, after 4 years the cumulative costs of surgical sterilization approach the cumulative costs of sharpshooting. Ending herd size equals that of sharpshooting in year 7 of the program.
- Surgical sterilization reduces overall herd size more slowly than sharpshooting, but over the long-term surgical sterilization results in lower cumulative costs.

¹⁵ A. DeNicola, PhD, President, White Buffalo, Inc.