HOPEWELL VALLEY
DEER MANAGEMENT PLAN

Submitted to the Hopewell Township Committee

by the

Hopewell Valley Deer Management Task Force

PRIORITY READING

September 2010

Hopewell Valley Deer Management Task Force Members

Hopewell Township Committee Liaison: James Burd

Denise Moser, Private Resident, Co-Chair
William Cane, Private Resident, Co-Chair

James Amon, D&R Greenway Land Trust
Francesca Calderone-Steichen, Hopewell Township
Phyllis Echternacht, Private Resident
James Gambino, Hopewell Township Environmental Commission
Drew Haftl, Private Resident
Robert Hoch, Private Resident
George Kerr, Hopewell Township Environmental Commission
Carol Kleis, Hopewell Township Open Space Advisory Committee
Moira Lawrence, Private Resident
George Meyer, Hopewell Township
Robert Miller, Hopewell Township
Jess Niederer, Hopewell Township Environmental Commission
Judy Niederer, Hopewell Township
Robert Ongradi, Private Resident
Morton Rosenthal, Private Resident
Barry Taylor, Private Resident
Michael Van Clef, Friends of Hopewell Valley Open Space
David Van Selous, Private Resident
James Waltman, Stony Brook - Millstone Watershed Association

Executive Summary

In September 2009, the Hopewell Valley Deer Management Task Force ("Task Force") was created by the Hopewell Township Committee to develop a plan to mitigate negative deer impacts on the quality of life of its residents and the ecological integrity of its forests. Specifically, the Task Force was charged with: 1) Initiating a public education program, 2) Creating a comprehensive deer management plan, and 3) Determining requirements for long-term sustainability of a successful deer management plan.

The Task Force conducted eight public meetings since November 2009 and presents this plan containing its recommendations to the Hopewell Township Committee. In addition to the meetings that involved a variety of stakeholders, the Task Force engaged in several vital activities. Public outreach included the creation, distribution and analysis of a public questionnaire; 71% of respondents felt that "deer cause many problems and solutions are needed". It performed a night-time spotlight survey of the deer population and published several informative articles in local newspapers.

White-tailed deer are often considered one of the most beautiful large mammals commonly encountered in the Hopewell Valley. However, the dramatic rise in the deer population during the last century resulted in significant adverse impacts in recent years. Negative impacts include a variety of human health, economic and ecological issues. Lyme disease, deer-vehicle collisions, agricultural losses, and landscape planting damage all adversely affect the quality of life for residents of the Hopewell Valley. Forests are also adversely impacted by overabundant deer that eat native plants. The long-term maintenance of forest cover is in jeopardy because new trees are eaten before they can replace those that fall.

In response to the foregoing, the Task Force recommends a set of five comprehensive goals to remedy the situation. It also offers eleven specific strategies to meet those stated goals (See "Summary of Goals and Strategies" on the following page). The recommendations represent a consensus of Task Force members, but some members did not agree with all of some of the recommendations. All goals are quantifiable and continual reporting should be based upon three-year cycles to evaluate plan success.

For simplicity, goals suggest a simple 25% reduction for each measurable impact over the next three years and 75% reduction within nine years. Reducing deer impacts will depend upon reducing the size of the deer population - the 2010 survey indicated an early spring population of 37 deer per square mile. An informal deer herd goal that assumes a one-to one relationship between deer numbers and stated goals would suggest a herd reduction of 25% by 2013 (28 per square mile) and a 75% reduction by 2019 (9 per square mile). However, some strategies could lessen the need to reduce herd size in order to achieve many stated goals. Therefore, success should be measured by stated impact reduction targets and not based upon measured deer population size.

The Task Force requests approval from the Hopewell Township Committee for the following:

1) The assignment of a permanent Deer Management Task Force to implement the plan. This body would meet periodically and have ongoing responsibility to implement strategies that achieve stated goals with assistance from Hopewell Valley municipalities and other stakeholders from public and private sectors.

2) The ongoing commitment of the Township Committee and staff to implement the plan. Examples include initiation of a Township-led deer management program on municipal lands and utilization of the Township website for public outreach/communication. Most recommendations are 'budget neutral', but all require commitment from elected officials and municipal staff.

3) Provide an annual contribution of $5,000 as seed money to establish a venison donation program. This would allow the donation of 50 deer (equivalent to 5,000 pounds of venison or 20,000 meals). The Task Force would seek additional funding from public and private sources to grow the program.

Summary of Goals and Strategies

Goal #1: Reduce Lyme Disease Cases
There has been an annual average of 170 reportable cases of Lyme disease from 2007-2009. The Task Force recommends a 25% reduction goal by 2013 (128 cases) and a 75% reduction goal by 2019 (43 cases).

Goal #2: Reduce Deer Vehicle Collisions
There has been an annual average of 567 deer-vehicle collisions from 2007-2009. The Task Force recommends a 25% reduction goal by 2013 (425 collisions) and a 75% reduction goal by 2019 (142 collisions).

Goal #3: Reduce Agricultural Losses
The public questionnaire results suggested that 27% of respondents had crop losses exceeding $5,000 per year. The Task Force recommends a 25% reduction goal by 2013 (20% of respondents) and a 75% reduction goal by 2019 (7% of respondents).

Goal #4: Reduce Landscape Planting Losses
The public questionnaire results suggested that 55% of respondents had severe or moderate landscape damage. The Task Force recommends a 25% reduction goal by 2013 (41% of respondents) and a 75% reduction goal by 2019 (14% of respondents).

Goal #5: Reduce Ecological Damage
Local forest health has been monitored through two science-based protocols called 'sentinel seedlings' (measuring deer browse on planted tree seedlings) and 'forest secchi' (measuring the density of forest understory vegetation). The average browse on planted tree seedlings has been 59% from 2006 - 2009. The average amount of native understory vegetation has been 21%. The Task Force recommends a 25% improvement by 2013 (44% browse on planted seedlings & 26% native understory cover) and a 75% improvement by 2019 (14% browse on planted seedings & 37% native understory cover).

The Task Force recommends three sets of strategies to obtain these stated goals (See Section V for details):

Strategy Set #1: Improvement of Hunting Access
- 1A) Encourage and facilitate hunting access on public and private lands
- 1B) Develop strategies to access "pocket deer" in residential areas

Strategy Set #2: Improvement of Hunting Efficacy
- 2A) Encourage and facilitate coordinated hunting activities among neighboring landowners
- 2B) Encourage and facilitate use of Agricultural Depredation Permits by farmers
- 2C) Encourage and facilitate Deer Management Programs that focus harvests on female deer
- 2D) Encourage and facilitate program for venison donation to local food banks
- 2E) Consult with the NJ Division of Fish & Wildlife and other wildlife professionals to facilitate strategies 1A through 2D

Strategy Set #3: Avoidance of Deer Impacts
- 3A) Improve awareness of methods that reduce Deer Vehicle Collisions
- 3B) Improve awareness of methods that reduce Lyme disease
- 3C) Improve awareness of methods that reduce landscape damage
- 3D) Discourage the intentional feeding of deer in non-hunting situations

Table of Contents

List of Tables, Figures and Appendices

List of Tables

List of Figures

List of Appendices

I. Introduction

White-tailed deer are often considered one of the most beautiful large mammals commonly encountered in the Hopewell Valley. However, deer population numbers rose dramatically during the last century and impacts of deer have become significant in recent times. Deer impacts range from human health issues and property losses to degradation of forests. Deer-vehicle collisions, Lyme disease, agricultural losses, and landscape planting damage all directly impact the quality of life for residents of the Hopewell Valley. Forests are severely impacted by overabundant deer through the preferential browsing of native plants, which facilitates the spread of invasive weeds that are unpalatable to deer - the long-term maintenance of forest cover is at jeopardy because new trees are eaten before they can replace those that fall.

History and Accomplishments of the Hopewell Valley Deer Management Task Force

The Hopewell Valley Deer Management Task Force ("Task Force") began as an informal conversation among various Township officials and staff, members of the Environmental Commission, Open Space Advisory Committee, Agricultural Advisory Committee, and others during the summer of 2009. Various deer impacts were discussed (e.g., deer-vehicle collisions, agricultural damage, landscaping damage, Lyme disease and forest health) and the need to determine the scope of the problem and potential solutions was deemed an important activity that might bring together a wide range of Hopewell Valley stakeholders into a formal group. At the request of former Mayor Vanessa Sandom, a request to form the Task Force was presented to the Township Committee by Michael Van Clef (Friends of Hopewell Valley Open Space) in September 2009 and their acceptance of the proposal led to the formal creation of the Task Force. Over 20 members representing various stakeholders were recruited, along with James Burd acting as the Township Committee liaison. The Task Force was charged with several key functions including the creation of the Hopewell Valley Deer Management Plan. Task Force activities were to include: 1) Initiate a public education program, 2) Create a comprehensive deer management plan, and 3) Determine requirements for long-term sustainability of a successful deer management plan.

The first Task Force meeting occurred in November 2009 and was initiated with a conversation regarding the existence and severity of deer impacts with the majority of members agreeing that impacts were present and severe on multiple fronts. There were a total of seven additional meetings throughout 2010 that included discussions of multiple topics that are included in this plan. Task Force accomplishments since inception included preparation of four articles published in local newspapers, development, distribution and analysis of a public questionnaire to determine extent of deer impacts on residents of the Hopewell Valley, and a survey of the Hopewell Valley deer population. Much of this information is provided at the Hopewell Township website (http://www.hopewelltwp.org/current-topics.html). Task Force activities culminate in background information and recommendations provided in this plan.

II. Deer Population in the Hopewell Valley

Introduction

This plan section provides background information on the natural history of white-tailed deer, current and historical statewide deer population size, and results of the 2010 Hopewell Valley deer population survey performed by the Task Force.

Natural History of White-tailed Deer

Information in this section was obtained through NatureServe (2001), unless otherwise noted. White-tailed deer (*Odocoileus virginianus*) are found throughout North America, Central America, and northern South America. Currently, the species is expanding its range northward in Canada. Adult males range in size from 50-350 pounds (average is 125 pounds), while females range from 50-250 pounds (Burt 1976, Webster et al. 1985). Habitat varies from forests to fields with adjacent cover, swamps, open brushy areas, and suburban landscapes. Diet varies seasonally and consists of twigs, shrubs, herbs, grass, fruit, and fungi. Grasses dominate the diet in spring, flowering herbs in early summer, leaves of woody plants in late summer, acorns and other fruit in fall, and evergreen woody shrubs and other woody twigs/buds in winter. Agricultural crops are also commonly consumed.

Deer breed from late October to mid-December with a peak in November. Young are born in May and June. Females can begin breeding at 6 to 7 months of age, but usually breed at 18 months. Males become sexually mature at about 18 months. Deer generally have a 10-year life span in the wild. Deer home ranges can be small - capture and marking studies in Hunterdon County, New Jersey (January 1970 to July 1976) indicate that home range size of deer in this area of New Jersey is generally one mile or less. In this study, the largest percentage of deer (68%) were recovered within one mile of their original capture locations; 27% ranged from one to eight miles and 5% ranged from 10 to 19 miles (NJ Division of Fish and Wildlife 2002).

Bucks and does exhibit different territorial behaviors and patterns of movement. Bucks tend to be solitary for most of the year and are more mobile than does. Does form herds consisting of a related family group with a rigid matriarchal hierarchy (Matthews 1989, McNulty et al. 1997). The herd is dominated by a single eight- to ten-year old doe and one or two sub-dominant five- to seven-year old does. Younger does and recent offspring (both male and female) make up the remainder of the herd. The size of the deer population within a given area is primarily a function of the density of individual matriarchal herds occurring within that area and their annual reproductive output (McNulty et al. 1997, Miller and Ozoga 1997, White and Bartmann 1997). These matriarchal deer herds are strongly territorial and display a very strong tendency to remain within their established territories and aggressively defend them from other deer herds (Jones et al. 1997, McNulty et al. 1997).

Historic and Current Statewide Deer Population

The historical analysis of the white-tailed deer population density in North America (pre-European colonization) is 10 per square mile (McCabe and McCabe 1984). Figure 1 shows the estimated statewide population size based upon the historical estimate for North America and deer population estimates reported by the New Jersey Division of Fish & Wildlife (http://www.state.nj.us/dep/fgw/deer.htm). By 1900, deer were nearly extinct in New Jersey because of unregulated market hunting for the sale of venison. The recovery of deer population, through the implementation of various game regulations, is a

significant conservation success story. However, the deer population mushroomed during the 1900's and peaked in 1995 with 3X more individuals than pre-European estimates. In 2006, there were 2X more individuals than pre-European estimates. In the late 1990's, the NJ Division of Fish & Wildlife implemented changes to reduce the deer herd (e.g., "Earn-A-Buck" program that encouraged harvest of antlerless deer) (Figure 2). Although there have been other recent and upcoming changes to facilitate hunting success (e.g., Sunday bow hunting, use of crossbows, reduction in the bow hunting safety zone), population levels continue to exceed pre-European densities with noticeable impacts (See Section III).

Figure 1. Historic and Current New Jersey Deer Population Estimates

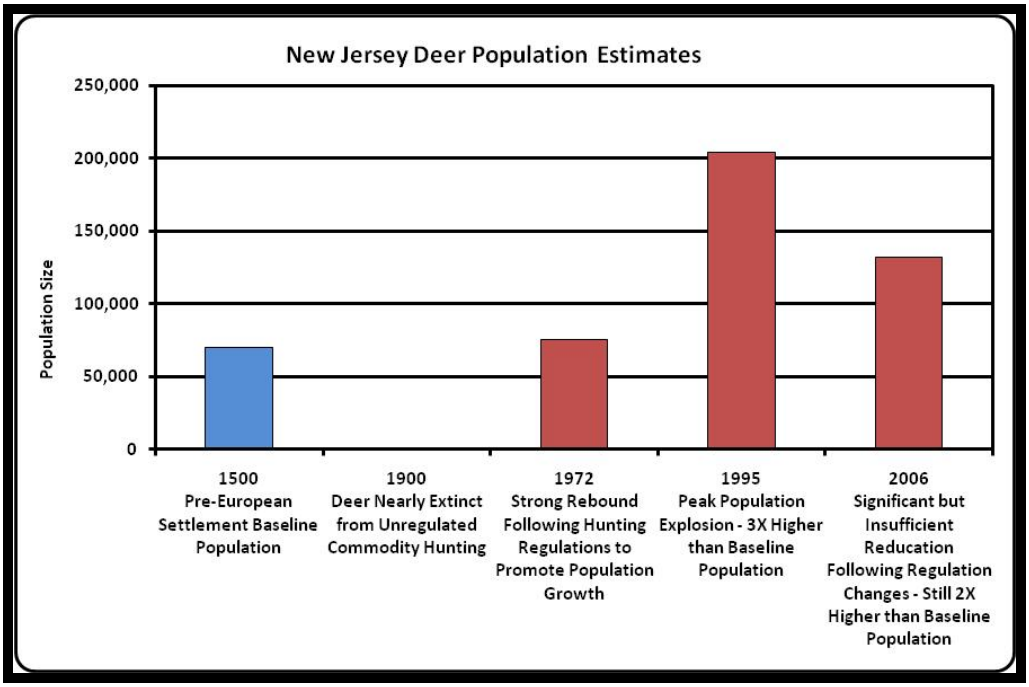
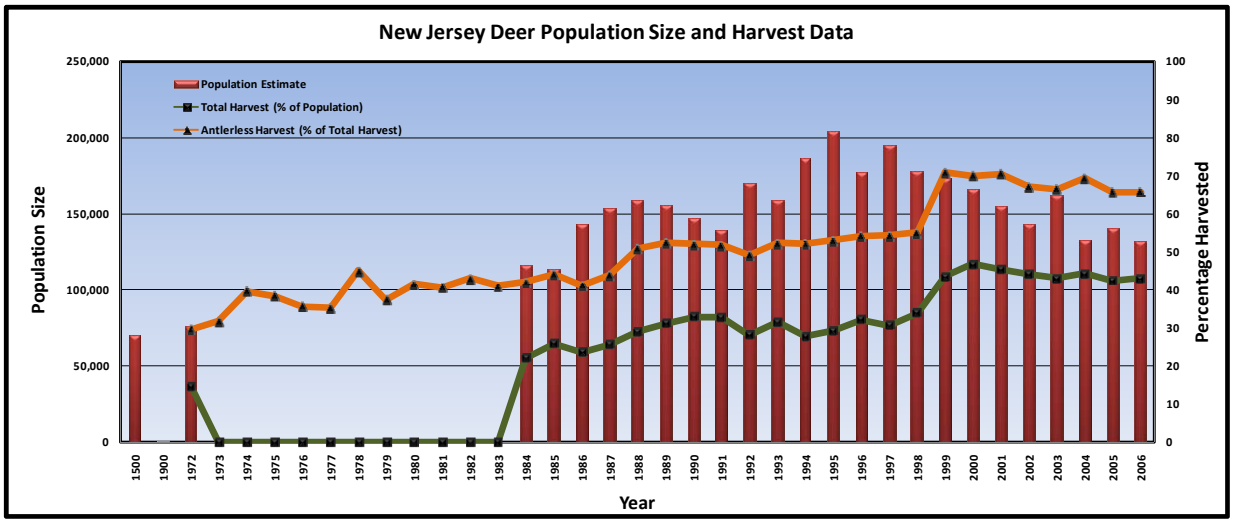


Figure 2. New Jersey Deer Population Size and Harvest Data



A simplified explanation of deer management issues and consequences are depicted in Figure 3. All deer management efforts must consider the current habitat conditions that serve deer population growth. Deer prefer forest edges and fields for feeding and utilize forests for cover and supplemental feeding (See Figure 4 depicting abundance of forest edges in Hopewell Valley - forests shown in green represent 15,000 of the 40,000-acre Hopewell Valley). Deer also utilize agricultural crops as food sources and residential areas for both food and cover from hunters (state regulations prohibit hunting within 450 feet of an occupied or potentially occupied structure). Both restrictions on hunting access and limited hunting efficacy, relative to the ability of the landscape to serve as excellent incubator for deer population growth, have made deer management difficult in recent times.

Figure 3. Deer Population Growth Factors and Impacts

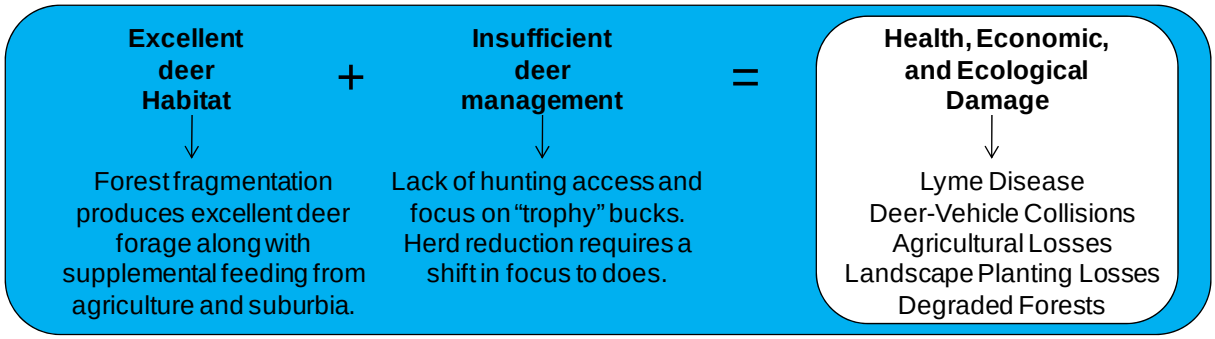
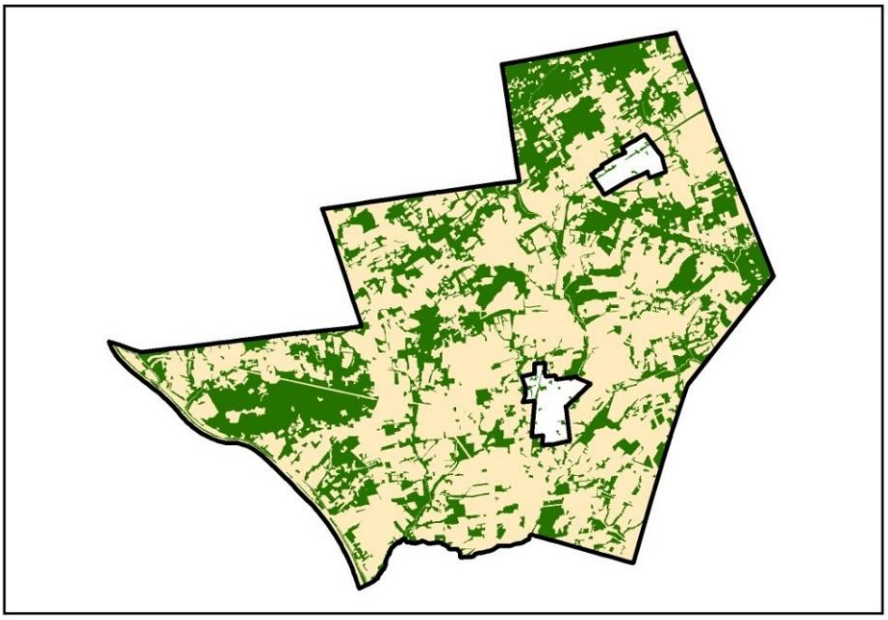


Figure 4. Forest Fragmentation in the Hopewell Valley



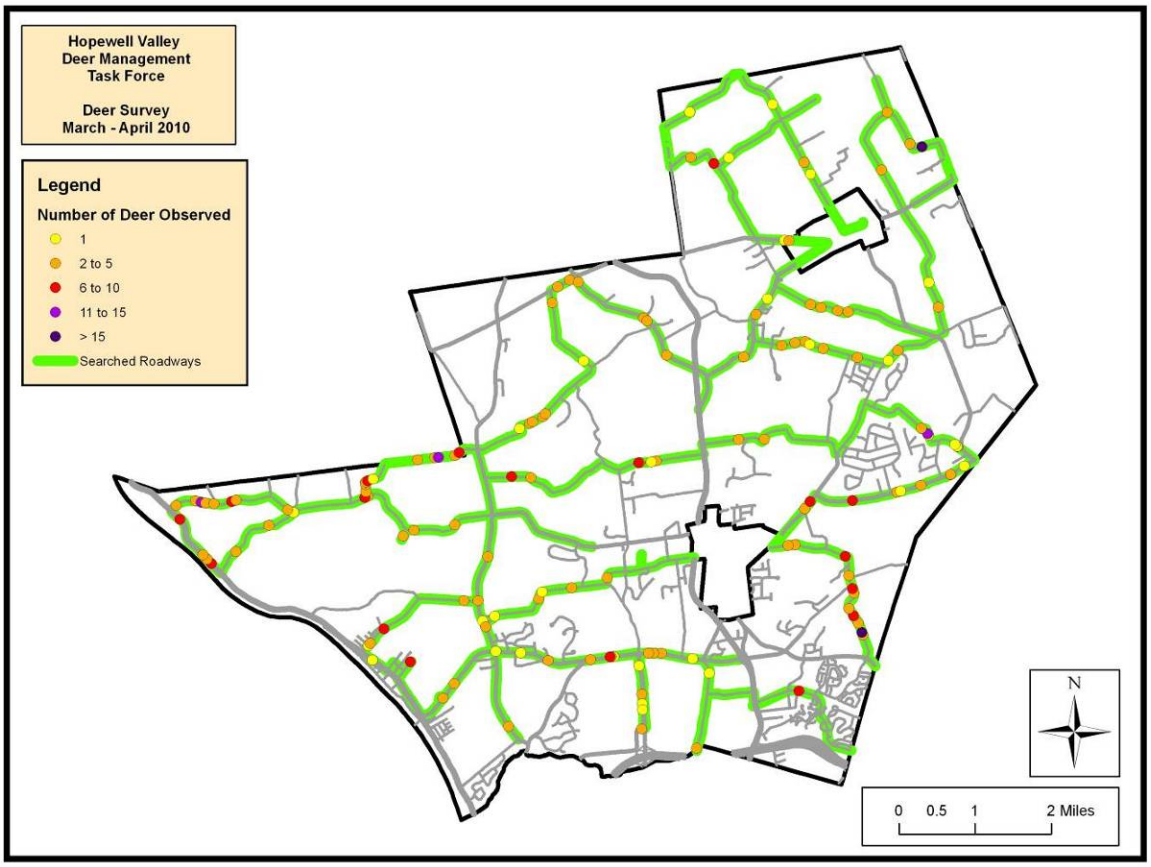
Hopewell Valley Deer Population - 2010 Survey

A determination of the Hopewell Valley deer population was performed by the Task Force to understand the scope of the problem relative to known deer impacts. While the use of deer population size alone is not adequate to measure reductions in deer impacts, population estimates are useful in setting goals for deer herd reduction (See Section V).

There are two major counting methods that are accepted by wildlife biologists. The first is "Forward-Looking Infrared Radar" that uses an infrared camera mounted on an aircraft to count deer on winter nights. This method is costly (estimated at over $100,000 for the entire Valley). There is a less expensive method called "Distance Sampling" that is considered just as reliable by wildlife professionals (S. Predl, NJ Division of Fish & Wildlife, personal communication). Members of the Task Force and other interested private citizens drove over 70 miles along Valley roadways over four nights in late March/early April using spotlights and an electronic rangefinder. They collected information on the number of deer observed and their distance from the roadway. This data was input into a computer program, which provided a statistically reliable population estimate. Figure 5 depicts deer observations (by group size) and travelled roadways during the 2010 Hopewell Valley deer population survey.

The population estimate was 37 deer per square mile (or nearly 2,300 total deer). This number represents the lowest point of the year for the deer population because it followed hunting season and a very snowy winter. Because deer are very prolific, the summer density was expected to grow to over 3,400 deer after spring birthing (equivalent to 54 deer per square mile). For reference, wildlife researchers have estimated that deer densities of 10 per square mile were typical prior to colonization of the United States (McCabe and McCabe 1984) and impacts to forest health become noticeable above this level (deCalesta 1994, deCalesta 1997). See Section IV for additional discussion on ecological impacts of overabundant deer.

Figure 5. Hopewell Valley Deer Population Survey (2010)



III. Deer Impacts in the Hopewell Valley

Introduction

The impacts of deer in the Hopewell Valley were determined through a public survey, interviews with local farmers and review of existing data on Lyme disease, deer-vehicle collisions and ecological monitoring of forest health. Public survey methods are described below. A brief literature review of impacts, along with Hopewell Valley data, is provided in three categories: Human Health Impacts, Economic Impacts and Ecological Impacts.

A recently completed, comprehensive study of the costs of deer impacts in Fairfield County can be found at http://www.deeralliance.com/index.php?pageID=3&articleID=154. Although this level of analysis has not been performed in Hopewell Valley, estimates for individual municipalities within Fairfield County ranged from $1.9 to $17 million per year (included Lyme disease, tick control efforts, deer vehicle collisions and vegetation damage).

Public Questionnaire Methods and Results Summary

The Task Force prepared a questionnaire to determine the impacts of deer to the general public (See Appendix A for a complete list of questions and responses and Appendix B for results presented as charts). An open-ended comment section was also provided with the questionnaire (See Appendix C for a complete set of comments). Particular sets of questions were specifically designed for farmers (impacts and issues related to agriculture) and hunters (hunting activity and constraints). A total of 5,000 questionnaires were printed by Hopewell Township and Task Force members made them available through several venues including Pennington Quality Market, Mercer County Library - Hopewell Branch, Rosedale Mills, and Pennington Farmer's Market. The questionnaire was also made available on-line through the Hopewell Township website (http://www.hopewelltwp.org/current-topics.html).

The questionnaire results cannot be considered a statistically valid representation of the entire Hopewell Valley because the questionnaires were not randomly assigned to recipients. In all cases, interpretation of the results is confined to respondents (e.g., 'a certain percentage of *respondents* have reported Lyme disease' as opposed to extrapolating the results by saying 'a certain percentage of *Hopewell Valley residents* have reported Lyme disease'). A total of 575 questionnaires were submitted to the Task Force between June 1 and July 10, 2010. Complete questionnaire responses are detailed in Appendices A and B and key results are categorized within this and subsequent plan sections. The majority of responses were received from Hopewell Township (74%), followed by Pennington Borough (19%) and Hopewell Borough (7%).

Overall, deer impacts were considered significant – 71% of respondents felt that "deer cause many problems and solutions are needed." It is important to note that while the overwhelming majority of respondents are looking for action to reduce deer impacts, a minority of respondents were strongly opposed to hunting (See discussion of population control methods under Section IV).

Responding households reported deer impacts including Lyme disease (26%), deer-vehicle collisions (28%), landscape damage (24% reported severe damage and 31% reported moderate damage), and bird feeder damage (17%).

Households with hunters constituted 11% of the respondents. The majority of hunting households (80%) harvest less than four deer per year. The single largest factor restricting an increased harvest was "more places to hunt in Hopewell Valley, including public lands" (22%). An increased availability for venison

donation was also significantly limiting (18%), while increased time to hunt was least important (10% of responding hunting households).

Households with farmers constituted 12% of the respondents (60 responses), but only 8% of all questionnaire respondents were currently farming - 39 farming households). Ten percent of responding farmers stopped because of deer predation, while 25% stopped farming for other reasons. Crop losses from deer were common (52%). The majority of damage was less than $5,000 per year (73%). Nineteen percent of damage cost between $5,000 and $25,000 per year. Approximately 8% of damage was greater than $25,000 per year. Other impacts included stopping the production of particular crops due to deer damage (37%), planting of sacrificial crops that are used to deter deer from feeding on higher value crops (8%), and utilization of fencing (51% of responding farmers). The use of hunting on farmland may be impacted by land ownership / lease arrangements (11% of responding farmers do not own any land). Fifty eight percent of farmers that own their own land allow hunting. Sixty four percent of respondents that lease land have landowners that do not allow hunting on any of their leases – an additional 16% lease some lands where hunting is not allowed. Agricultural depredation permits are utilized by 17% of responding farmers (88% of these permits are utilized on lands owned by farmers).

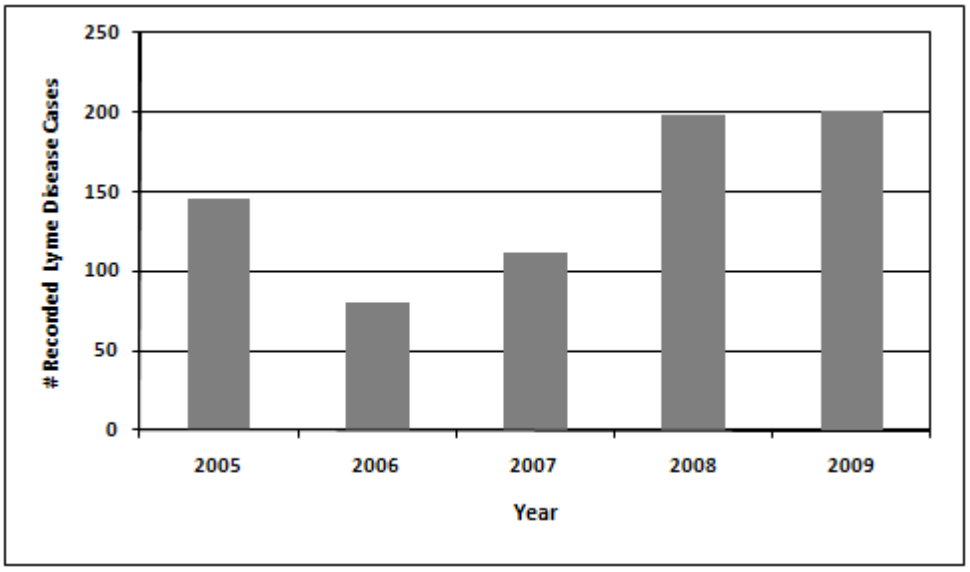
Human Health Impacts

Lyme Disease

Lyme disease has become a significant problem across the United States and is particularly prevalent in the Northeast (Centers for Disease Control 2010). New Jersey ranks fourth in the nation with over 35,000 reported cases between 1990 and 2007 (NY, PA, and CT reported the three highest number of cases). According to a study reported from Connecticut (Stafford 2007), deer population size is linked to incidences of Lyme disease. This relationship is dependent upon a threshold deer population size, requiring a population size of 10-12 deer per square mile to show substantial reduction in human cases of Lyme disease. Although deer do not directly transmit the disease bacteria (*Borellia burgdorferi*), they support large populations of the deer tick (*Ixodes scapularis*) that perpetuates the disease primarily through their other important host, white-footed mice (*Peromyscus leucopus*). In essence, deer act as an incubator to support tick population growth, which then become infected through contact with mice and subsequently transmit the disease to humans. Readers may refer to various sources for additional information on Lyme disease – See Fairfield County Deer Alliance, www.deeralliance.org or the Centers for Disease Control and Prevention, www.cdc.gov.

Hopewell Valley Lyme Disease data is reported in Figure 6. These cases include all residents from Hopewell Township, Hopewell Borough and Pennington Borough that were diagnosed with Lyme disease by their physician (and confirmed through blood testing). The average number of annual cases since 2005 was 147. It is important to note that many cases are unreported because physicians often diagnose and treat the disease without the blood testing required for formal tracking purposes. The public questionnaire results indicated that 26% of responding households had at least one case of Lyme disease over the last three years.

Figure 6. Reported Lyme Disease Cases in the Hopewell Valley
Source: Hopewell Township Health Department



Economic Impacts

Deer Vehicle Collisions

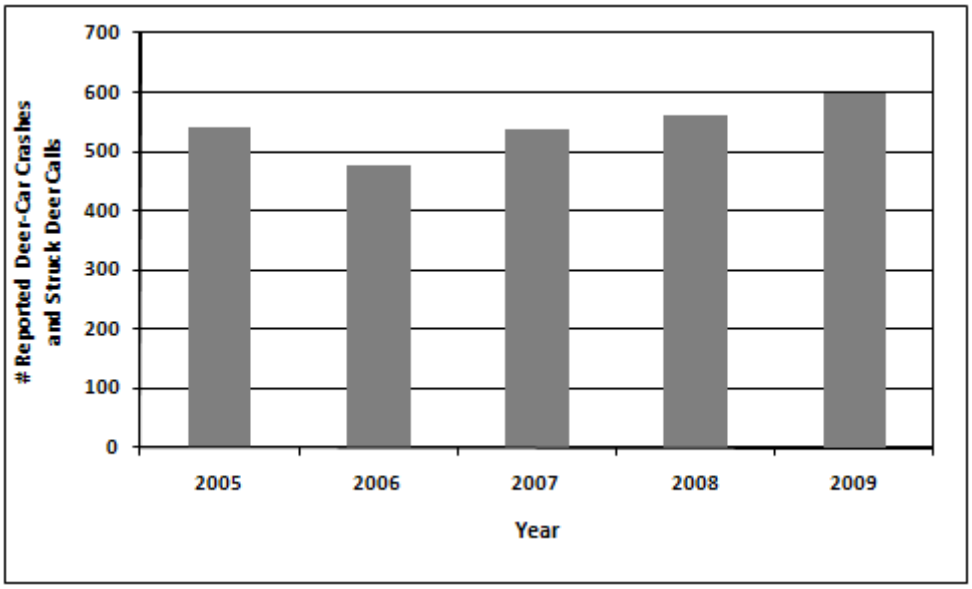
Deer Vehicle Collisions (DVC) occurred at the rate of 100,000 per month nationwide (State Farm Life Insurance Company 2009). Although New Jersey does not rank in the top ten for total DVC's, the state had a 54% increase in collisions over the last five years (highest in the nation). New Jersey has approximately 15,000 collisions per year at an approximate cost of $3,050 per collision – total annual statewide cost is $45,750,000 (J. Baldino, State Farm Life Insurance Company, personal communication).

DeNicola and Williams (2008) report a one-to-one reduction in DVC's with reductions in deer density. Through the use of sharpshooting, deer herd size reductions led to DVC reductions in Iowa City, IA (76% population reduction, 78% DVC reduction), Princeton, NJ (72% and 75%, respectively), and Solon, OH (54% and 49%, respectively). In Princeton Township, the pre- and post-culling deer density was 114 and 32 per square mile, respectively (Culling activities were conducted from 2000 - 2006). Additional information on DVC's can be found at Deer Crash (http://www.deercrash.com/index.htm).

Hopewell Township tracks DVC's through two methods – reported deer-car crashes and struck deer calls. The average number of reported deer-car crashes over the last five years is 159 crashes per year. It is important to note that all deer-car crashes do not result in a formal police report (see discussion on 'Struck Deer Calls' below). In all years, reported deer-car crashes represent approximately 20% of the total number of reported car crashes (G. Meyer, Hopewell Township Police Chief, personal communication). The number of struck deer calls is drawn from dispatch records. A struck deer entry is made whenever a dispatcher receives a call for a struck deer on or near the roadway and there is no striking vehicle present. A struck deer entry is also made when a motorist comes to police headquarters and reports that they struck a deer (in such cases a police crash report is NOT filed, so they are not double counted). These people are provided with a State of New Jersey form so they can file their own report. This is done because there was no police response to the accident scene. The average number of struck deer calls is 375 over the last five years. It is reasonable to assume that the reported deer-car crashes and struck deer

calls can be added to better estimate the total number of deer car collisions in the Hopewell Valley. The combined average is 531 deer-car collisions per year since 2005 (Figure 7).

Figure 7. Sum of Reported Deer-Car Crashes and Struck Deer Calls for Hopewell Township Source: Hopewell Township Police Department



Agricultural Losses

Deer overabundance impacts include direct annual crop losses, land abandonment (permanent loss of productivity), crop switching (reduction in profit by planting less palatable crops that are not as profitable as more palatable crops), sacrificial crops (loss of productivity by planting crops to attract deer without the intention of harvesting to avoid damage on more valuable nearby crops), and fencing costs. The Rutgers University Cooperative Extension conducted a statewide survey in 1998 (http://njaes.rutgers.edu/pubs/deerdamage/), which reported information on the impacts noted above.

Information on impacts collected from Hopewell Valley farmers through the public questionnaire are summarized in Section II.

Landscape Planting Losses

Residential landscapes are also subject to significant damage. Lists of deer resistant plants, deer repellants and fencing requirements are common topics among gardeners. Although deer impacts can be characterized as a quality of life issue, cost estimates for residential landscape damage are not available.

Persistent deer damage has led many gardeners to utilize unpalatable invasive species such as Callery Pear, Japanese Barberry and Chinese Silvergrass. These species, and many others, cause significant damage to natural areas in the Hopewell Valley.

Information on impacts collected from Hopewell Valley residents through the public questionnaire are summarized in Section II.

Ecological Impacts

Stewardship of Natural Lands

The broader view of ecological impacts must consider that direct human uses (e.g., homes, farms) have consumed about 50% of New Jersey's land area. Obviously, these human uses directly destroy natural systems and continued development remains the greatest statewide threat. The other 50% of New Jersey's land exists in a natural state. However, severe impacts on our remaining natural areas are indirect - i.e., they do not involve outright destruction, but are consequences of human activities. Examples include overabundant deer and invasive species. The goal of land stewardship is to restore ecological health by reducing human impacts. The ultimate desired outcome for our remaining natural areas is to maximize ecological health and natural functions to resist continuing human impacts.

Effective stewardship strategies are guided by science and are carefully formulated to maximize ecological health of plant communities that serve both rare and common species. Broad stewardship strategies involve the following prioritized list: 1) Deer herd reduction to facilitate robust native plant communities that exert ecological control over less palatable invasive species, 2) Early Detection & Rapid Response (ED/RR) to prevent establishment of newly emerging invasive species, and 3) Protection of sites with high conservation values by a) eradicating small, outlier populations of all invasive species, and b) intense, long-term control programs to reverse larger infestations. For some rare species, it may be necessary to formulate strategies on a species- and site-specific basis with the goal of promoting long-term, self-perpetuating survival of populations. Direct restoration of degraded lands is an important strategy that is employed on a case-by-case basis and can be considered after (or during) commitment to the stewardship activities outlined above.

Figure 8. Stewardship Philosophy

'Nature manages itself' is commonly heard from those that feel stewardship of natural resources is inappropriate. In some cases, this is based upon a simplistic understanding of natural systems and the forces that create or maintain them. Some proponents of this view fail to acknowledge that there are many indirect impacts of human activities on natural systems (e.g., introductions of non-native species, irreversible fragmentation of natural areas that support deer population growth, profound alteration of soils from past agricultural use, etc.). Other proponents of this view suggest that nature will have to balance itself within the framework established by human activities and that we should not intervene further. Finally, there are well-qualified experts including some experienced natural historians and research professors that understand that our knowledge of natural systems is incomplete and suggest that stewardship should not be practiced until we learn more about natural systems and how they will react to particular management regimes.

In contrast, proponents of stewardship proceed from the viewpoint that human activities directly and indirectly shape the remainder of our natural world and that there is an obligation to intervene to promote ecological health and avoid further losses to biodiversity. In short, stewardship may be defined as 'the mitigation of human impacts on natural systems'. Stewards feel that action is required when human impacts severely threaten ecological health, thereby consciously reducing human impacts through management strategies and actions.

In most cases, stewards strive for short-term interventions that correct natural systems with declining trajectories. Examples of short-term interventions include significant reductions of the white-tailed deer population (i.e., culling) and control of nascent populations of invasive species. In other cases, the continuing needs of the human population require that active management be perpetual (e.g., creation and maintenance of early successional habitats because catastrophic wildfires must be suppressed or a continuing Deer Management Programs to maintain a smaller deer herd).

In general, there are relatively few compromises available to proponents of the extremes of these two opposing viewpoints. However, most individuals realize that a balance is possible, especially when stewardship is coupled with careful monitoring or designed research experiments that provide greater insights to practice adaptive management. Overall, stewardship strategies should seek to utilize minimal human intervention to foster ecological health and stimulate research to provide a better understanding of the natural world.

Forest Health Degradation

Numerous studies and reviews have been conducted on the impacts of white-tailed deer on forest ecosystems. A comprehensive review was conducted in Pennsylvania (Latham et al. 2005, http://pa.audubon.org/deer_report.html); an overview of impacts throughout the Northeast is provided by Rawinski (2008), http://na.fs.fed.us/fhp/special_interests/white_tailed_deer.pdf. Other comprehensive sources include Warren 1997 and McShea et al. 1997.

In general, native species diversity / abundance and overall forest health drop significantly with increasing deer herd size. An often cited research project that provides quantitative guidance on deer population levels associated with ecological damage was performed by David deCalesta, based at the US Forest Service in Pennsylvania (deCalesta 1994, deCalesta 1997). Over the course of a 10-year study using forest enclosures with known densities of deer, deCalesta determined that native forest herbs and tree seedlings became less abundant with deer densities between 10 and 20 per square mile. At densities exceeding 20 per square mile, palatable native plant species disappear and forest shrub-nesting song birds drop in abundance with the loss of the shrub layer. Starvation of deer occurred when densities exceeded 65 per square mile. This study suggests that deer densities exceeding 10 per square mile have negative ecological impacts (Note: Independent historical studies determined that pre-European colonization deer densities were approximately 10 per square mile and breakage – McCabe and McCabe 1984 and breakage of the Lyme disease transmission cycle may occur at 8 deer per square mile – Stafford 2007).

Hopewell Valley forest health data has been collected by the Friends of Hopewell Valley Open Space utilizing the methodology established as part of a statewide 'New Jersey Forest Health Monitoring System' designed by Michael Van Clef (See Figure 11). This system for measuring deer browse on experimentally planted tree seedlings ("Sentinel Seedlings") and current density of woody understory plants ("Forest Secchi") has been utilized by 15 organizations at 38 sites since 2006.

A total of 16 sites in the Hopewell Valley were tested from 2006 - 2009 (data from an additional 13 sites in Northern New Jersey tested within the same time period are provided for comparison) (See Figure 9 and Table 1). The desired threshold value of 10% seedling browse over a 6-month period (December to June) has not been recorded at any site. The average deer browse measurement is 59% over a six month period. Because tree seedlings require at least several years to grow above the typical maximum deer browse height (ca. 4.5 feet), forests at all tested sites are not expected to be able to regenerate following the death of existing canopy trees.

The understory of most mature forests should be filled with tree saplings and shrubs that provide habitat for wildlife (Note: A forest begins to mature at 50-75 years old) (See Figures 12 & 13). This concept is expressed as the desired threshold of 70% native plant cover utilizing the "Forest Secchi" methodology. The average site measured in the Hopewell Valley has 21% native cover, which mimics the statewide average (See Figure 10 and Table 2). The cover of non-native invasive plants is 31% in Hopewell Valley (15% higher than the statewide average). The reason for the low levels of native understory plants (and relatively high levels of invasive plants) may be attributed to deer overabundance over a prolonged period of time.

Figure 9. New Jersey Forest Health Monitoring System - "Sentinel Seedlings"
Source: Michael Van Clef, Ph.D., Friends of Hopewell Valley Open Space

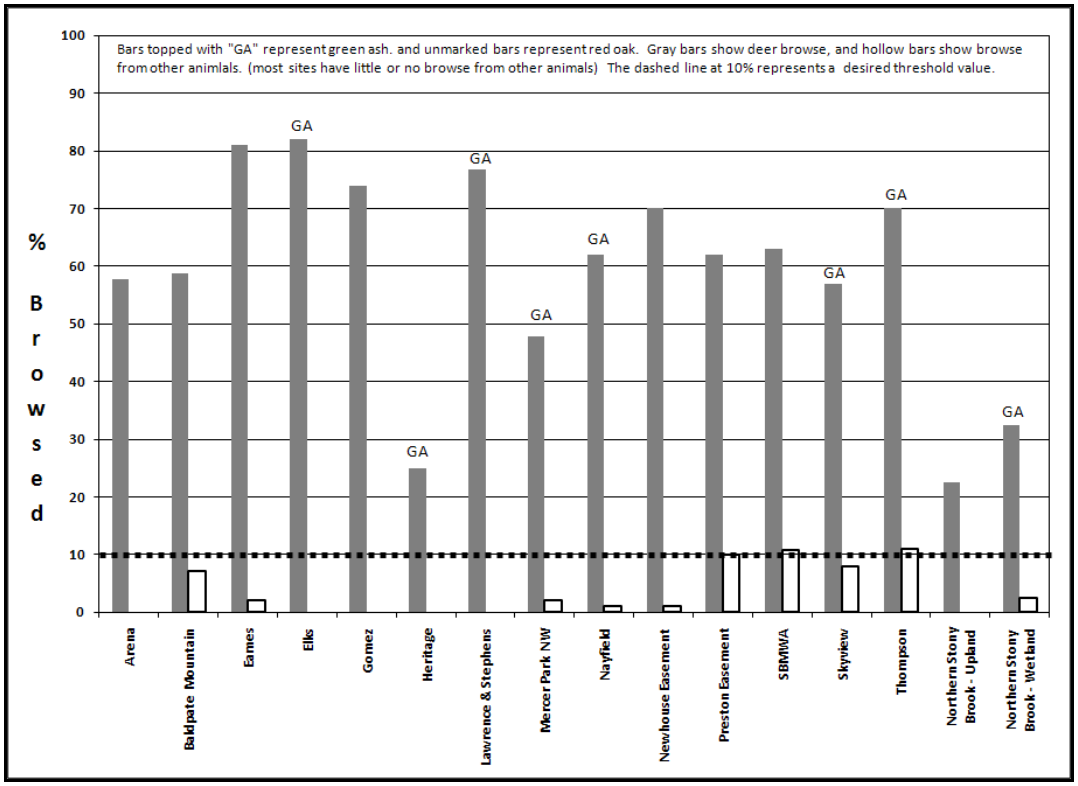


Table 1. Summary of Experimental Seedling Browse Measurements ("Sentinel Seedlings")

Area	Average Deer Seedling Browse (%)	Range of Deer Seedling Browse (%)	Average Other Animal Seedling Browse (%)	Average Other Animal Seedling Browse (%)
Hopewell Valley Sites (16 sites)	59	23-82	3	0-11
Other New Jersey Sites (13 sites)	59	33-82	1	0-6
Combined Statewide Sites (29 sites)	59	23-82	3	0-11

Figure 10. New Jersey Forest Health Monitoring System - "Forest Secchi"
Source: Michael Van Clef, Ph.D., Friends of Hopewell Valley Open Space

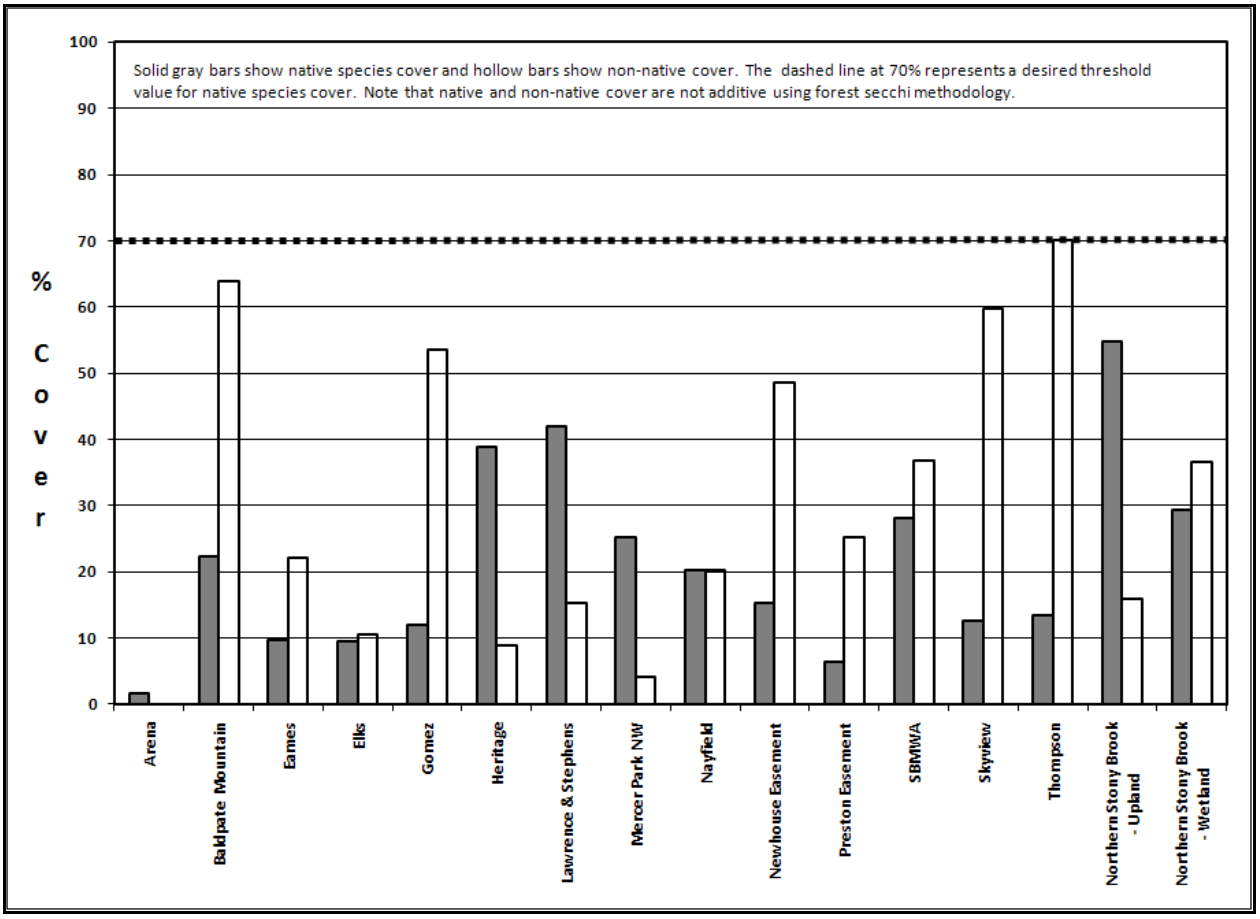


Table 2. Summary of Forest Understory & Canopy Measurements ("Forest Secchi")

Area	Average Native Cover	Range of Native Cover	Average Non-Native Cover	Range of Non-Native Cover	Average Total Cover	Range of Total Cover	Average Canopy Cover	Range of Canopy Cover
Hopewell Valley Sites (16 sites)	21	2-55	31	0-70	47	2-80	93	82-98
Other New Jersey Sites (15 sites)	21	6-52	16	0-46	33	12-61	89	69-98
Combined Statewide Sites (31 sites)	21	2-55	24	0-70	40	2-80	92	69-98

Figure 11. New Jersey Forest Monitoring System Protocol Design

Left: Browse on planted oak seedling, note unbrowsed Japanese Stiltgrass (an invasive species) in background, Center: Sentinel Seedling Plot Design, Top Right: Forest secchi board – the number of grid cells with vegetation are counted to estimate understory cover, Bottom Right: Unbrowsed invasive Japanese Barberry at a site with very high deer density (photo taken adjacent to the browsed oak seedling at left).

Figure 12. Forest Degradation Series Photographs

Top: Healthy forest containing dense understory growth, Middle: Understory browsed away by deer, Bottom: Canopy gaps fill with unpalatable invasive species and native trees cannot grow because of excessive deer browse

Figure 13. Forest Recovery at Ted Stiles Preserve at Baldpate Mountain

Left: Photo of native spicebush thicket within the core of the Preserve – this area harbors forest birds such as Kentucky and Hooded Warblers not found in most places in the Hopewell Valley, Right: Close-up photo of thicket showing spicebush (larger leaves) overtopping the invasive Japanese barberry. This is an example of "ecological control" of invasive species by native species. Although the Deer Management Program at Baldpate has produced significant improvements within the core of the Preserve, additional deer herd reduction is required to restore large portions of the site.

IV. Deer Management Options

Introduction

The decision to reduce impacts of white-tailed deer must be accompanied by review of all available options. The selection of particular methodologies must consider efficacy and cost. The Task Force has reviewed and discussed the management options below. Through consensus, it was determined that an active and coordinated hunting program must be the key management option to meet deer impact reduction goals (See Strategy Sets #1 and #2 in Section V). Non-lethal options are also incorporated into the recommended strategies (See Strategy Set #3 in Section V). It is important to note that a minority of Task Force members and public questionnaire respondents were strongly opposed to lethal control options. Although these opposing viewpoints cannot be reconciled, the Task Force decided that lethal options are required and the explicit incorporation of particular non-lethal options, as appropriate, is also important to meeting stated deer impact reduction goals.

Those interested in comprehensive reviews of deer management options should see DeNicola et al. 2000 (http://ecommons.cornell.edu/handle/1813/65), Drake et al. 2002, and Northeast Deer Technical Committee 2009 (http://www.state.nj.us/dep/fgw/pdf/deer_mgt_options.pdf).

Non-Lethal Options

Birth Control
The use of birth control to limit deer population growth is currently experimental. The NJ Division of Fish & Wildlife provides permits for studies using GonaCon (recently approved for use by U.S. Department of Agriculture and U.S. Environmental Protection Agency). Although efficacy may be possible for captive deer populations, there are currently no commercially available systems to provide population control over wild deer. Costs to administer drugs to wild deer are extremely high (approximately $1,000 per treated deer). A recent summary of the current status of birth control can be found at http://deeralliance.com/index.php?pageID=24&articleID=78.

Deer Exclusion Fencing
Deer exclusion fencing is a relatively expensive technique to protect small areas of high value lands. This can include whole farm fields with high value crops (e.g., sweet corn, vegetables), portions of forests to allow tree regeneration and development of understory vegetation, whole residential properties, or residential gardens. Deer fencing is minimally seven feet tall and may be constructed of various materials including plastic or metal mesh affixed to wood or metal posts (or sometimes existing trees). A review of fencing types can be found at the Internet Center for Wildlife Damage Management (http://icwdm.org/handbook/mammals/Deer.asp).

Repellants
Repellants may be suitable for the protection of residential garden plantings. Efficacy may vary with product utilized and generally needs to be re-applied continuously throughout the year to provide protection. The use of repellants for agricultural crops, forests or large landscapes is cost prohibitive. Information on the efficacy of deer repellants can be found at http://www.walnutcouncil.org/deer_repellent_study.htm and http://yardener.com/YardenersToolshedofProducts/PestAnimalControlProducts/DeerControlProducts/RepellentsForDeer.

Road-related Deer Countermeasures
The Deer Vehicle Crash Information Clearinghouse (www.deercrash.com) published a report that reviewed numerous countermeasures to minimize deer vehicle collisions (Knapp et al. 2004 - http://www.deercrash.com/Toolbox/finalreport.pdf). Evaluated methods included in-vehicle technologies, deer whistles, roadway lighting, speed limit reduction, deicing salt alternatives, deer flagging models, intercept feeding, roadside reflectors and mirrors, repellents, hunting for herd reduction, public information and education, roadside vegetation management, exclusionary fencing, roadside maintenance, design and planning policies, and wildlife crossings. The report suggests that exclusionary fencing and wildlife crossings were the only two sufficiently studied methods that generally produce reductions in deer vehicle collisions – exclusionary fencing and wildlife crossings.

Landscape Use of Unpalatable Plants
Homeowners and grounds managers can consider the use of unpalatable plants to minimize deer damage. Lists of such species often reference the fact that no plant is "deer proof", but many species appear to receive less damage than other favored deer browse. It is important to consider whether unpalatable species are considered "invasive" to natural areas before purchasing. Invasive species are those non-native species that have the ability to dominate natural areas and push out the native flora. Over time, many of the valued landscape plantings have become those that are unpalatable to deer (e.g., Callery Pear, Japanese Barberry, Chinese Silvergrass, etc.), but there are select native species that are not severely browsed (e.g., Indian Grass, Sweet Fern, White Snakeroot). In all cases, purchasers should consider the use of unpalatable native species or non-native species that are not considered invasive.

Lethal Options

Recreational Hunting
Recreational hunting has been a long-standing tradition in the Hopewell Valley and represents the primary source of deer herd management. Hunting regulations are set annually by the Fish & Game Council. These regulations are informed and implemented by the New Jersey Department of Environmental Protection - Division of Fish & Wildlife. The annual Hunting Issue of the Fish and Wildlife Digest is published in August. The Digest defines Regulation Sets that correspond to Deer Management Zones throughout the State. Currently, there are three zones in Hopewell Valley (Zones 12, 14 and 41) that have a single Regulation Set (Set #8). The regulations define harvest limits based upon the particular bow or firearm seasons throughout the overall hunting season (See Table 3 for additional details). Regulations in the Hopewell Valley are considered 'liberal' in that the harvesting of antlerless deer is unlimited in most or all defined hunting seasons.

Figure 14 summarizes the recreational deer harvest across Hopewell Valley (includes Hopewell Township, Pennington Borough and Hopewell Borough). The average total deer harvest over the last eight years was 1,158. Harvest numbers were slightly higher from 2002 - 2004 than in more recent years. The average harvest over the last three seasons was 1,037, with a slight trend to increasing harvest numbers since 2007.

Table 3 summarizes the deer harvest since 2002 based upon hunting season. Overall, bow hunting accounts for approximately 35% of the total harvest, while firearms account for 65% of the harvest. All bow seasons combined account for approximately 5.5 months of the year (ca. early September to mid February). Firearm seasons are conducted over a 2.5 month period (ca. late November to mid February). Overall, firearms produce higher harvest numbers in a shorter period of time, but bow hunting constitutes a significant proportion of the total harvest.

Impacts on the efficacy of recreational hunting toward reducing the deer population include restriction of access (either complete exclusion of hunting or significant time restraints) and lack of coordination

between hunters on neighboring parcels leading to 'pushing' deer from areas of higher to lower hunting activity. In addition, a significant number of hunters prefer to harvest antlered deer relative to antlerless deer, which leads to unbalanced sex ratios in the population (many more females than males). The imbalance of females allows rapid annual population growth as relatively few males impregnate all mature females. An additional limitation on harvesting deer is a lack of options for venison consumption (See Public Questionnaire Results in Section III).

Figure 14. Hopewell Valley Deer Harvest Totals (2002 – 2010)
Source: New Jersey Division of Fish & Wildlife (S. Predl, personal communication)

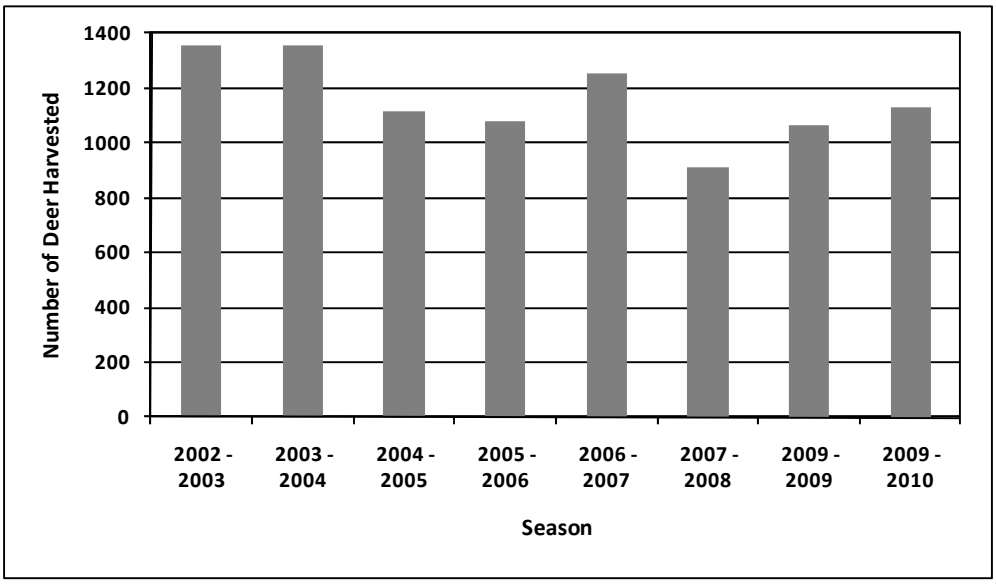


Table 3. Hopewell Valley Deer Harvest by Hunting Seasons (2002 - 2010)
Source: New Jersey Division of Fish & Wildlife (S. Predl, personal communication) and 2009 Hunting Issue of the Fish & Wildlife Digest

Season Name	% of Total Harvest	Approximate Timing	Harvest Notes
Fall Bow	22.8	Duration: 2 months, Early September – Late October	Unlimited antlerless, limit of one antlered. "Earn-a-Buck" required during September only.
Permit Bow	10.9	Duration: 2 months, Late October – Late December	Unlimited antlerless, limit of one antlered with purchase of additional permit
Six Day Firearm	15.2	Duration: 1 week, First full week in December	Two antlered deer limit (antlerless harvest not allowed, but may be harvested under permits within concurrent seasons)
Permit Muzzleloader	10.3	Duration: 2 months, Late November – Mid February (with gaps, various restrictions on timing of antlered deer harvest)	Unlimited antlerless, limit of one antlered with purchase of additional permit.
Permit Shotgun	39.1	Duration: 2 months, Early December – Mid February (with gaps, various restrictions on timing of antlered deer harvest)	Unlimited antlerless, limit of one antlered with purchase of additional permit (no antlered deer may be harvested if two were already taken during Six Day Firearm).
Winter Bow	1.0	Duration: 1.5 months, Early January – Mid February	Unlimited antlerless, limit of one antlered
Youth Day	0.7	Duration: 2 days, End September (bow) & End November (firearm)	One deer of either sex

Agricultural Depredation Permit
Farmers may apply for an agricultural depredation permit through the Division of Fish & Wildlife. The procedure includes a survey of crop damage by a Conservation Officer and the completion of a one-page form. Depredation permits allow the harvesting of deer at any time of day and there are no limits on harvesting deer of either sex. Harvesting may only be conducted by use of a shotgun.

Community Based Deer Management Program (CBDMP)
The NJ Division of Fish & Wildlife offers the CBDMP to municipalities and county government under particular circumstances. The program allows site-specific strategies such as season extensions and use of professional sharpshooters. The program is generally applied to areas where recreational hunting is restricted by dense residential areas and permits have been provided to many government entities. Princeton Township was the first municipality to participate in this program - relatively recent programs have been conducted at Bernards Township, South Mountain Reservation (Essex County) and Millburn Township. Additional information on the CBDMP can be found at http://www.state.nj.us/dep/fgw/cbdmp.htm.

Deer Management Assistance Program (DMAP)
The DMAP allows for improved localized (property specific) deer management in Deer Management Zones that have limits on antlerless deer harvest (Regulation Sets 0 – 3, which includes 17 Zones). This program does not currently apply to the Hopewell Valley because all Zones allow unlimited antlerless harvesting. Additional information on DMAP can be found at http://www.state.nj.us/dep/fgw/pdf/dmap_regs.pdf and http://www.state.nj.us/dep/fgw/dmap.htm.

Deer Management Program (DMP)
Deer Management Programs have been established by multiple non-profit and government entities on their fee-owned properties. The goal of a DMP is to decrease herd size through the selective harvesting of female deer. DMP participants are recreational hunters that are provided access in return for following site-specific rules (e.g., harvesting of one or more antlerless deer before harvesting an antlered deer, harvesting a pre-determined number of antlerless deer). Examples of DMP programs from the Hopewell Valley and nearby areas can be found at http://deerinbalance.org/deer-management-program-resources/.

Quality Deer Management Cooperatives
Quality Deer Management (QDM) is a holistic approach to deer management. The goal of QDM is to manage the deer herd within their habitat constraints and generally leads to smaller, healthier herds. The traditional element of DMP's (i.e., focus on antlerless deer harvest) is coupled with restrictions on harvesting young bucks to allow the growth of larger bucks. The restoration of balance between males to females in the population, along with healthy habitats filled with high-value forage (a.k.a. ecologically healthy forests and fields) is required for successful QDM.

In some areas, QDM cooperatives are formed by neighboring property owners that jointly abide by QDM principles. Generally, a minimum of 1,000 acres is required to create a successful cooperative. Due to the relatively small size of typical parcels in the Hopewell Valley, many hunters interested in QDM fear that hunters on neighboring parcels will not participate and successful QDM is not possible without support from Division of Fish & Wildlife deer regulations. The Fish & Game Council and NJ Division of Fish & Wildlife have the ability to change regulation sets toward favoring QDM. Currently, some Zones in New Jersey (outside of the Hopewell Valley) have restrictions on the harvest of young bucks, but there are no zones with the full complement of regulations and other incentives required for effective QDM.

Professional Services

There are a several local/regional professional service contractors that have the ability to carry out a variety of deer management techniques in places where recreational hunters may not be effective. Professional services may be utilized to control "pocket" or "yard" deer that that cannot be controlled through traditional methods (i.e., deer that occur within 450-foot safety zones of human-occupied structures). Methods utilized by particular municipalities in New Jersey include trap and euthanasia and sharpshooters. Trap and euthanasia involves netting deer and using a specialized tool to deliver a slug that kills the deer. Specially trained sharpshooters can also be utilized with permission of affected landowners. Some contractors utilize typical hunting firearms, but are specifically paid to reduce the deer population. Professional contractors that can conduct these methodologies include White Buffalo, Inc. and Deer Management Systems, Inc. Costs vary based upon methods utilized, but can range from $100 to $1,000 per deer (which usually includes butchering costs to allow donation of venison to local food banks). In most cases, utilization of professional services must be conducted under a Community Based Deer Management Program (CBDMP) permit issued by the Fish and Game Council and administered by the Division of Fish & Wildlife.

The widespread use of professional services throughout the Hopewell Valley (ca. 40,000 acres) would be cost prohibitive. However, localized use of these services may be considered in the future if traditional methods prove to be ineffective for alleviation of deer impacts.

Consideration of Multiple Land Uses

Most publically-owned open space in the Hopewell Valley has multiple land uses that must be considered while conducting deer management. The balance of deer management with passive recreational pursuits such as hiking may be conducted in a variety of ways depending on ownership and the layout of particular properties. For example, some sites allow deer management to occur concurrently with passive recreation, especially when hunting occurs away from well-travelled trails. In some cases, only bow hunting is allowed to occur concurrently with recreational uses. Some land managers decide to close preserves to passive recreation on pre-determined dates to allow deer management. Some lands prohibit hunting because of perceived conflicts with neighbors or passive recreationists. Ideally, a balance should be sought on publically owned lands to allow effective deer management.

Review of Existing Deer Management Programs

Programs Outside of the Hopewell Valley

Statewide deer management is the responsibility of the New Jersey Fish and Game Council and administered by wildlife professionals of the NJDEP - Division of Fish & Wildlife. They break the state up into 49 Deer Management Zones. Each zone is provided 1 of 4 Regulation Sets that dictate harvest bag limits and timing of individual seasons within the overall hunting season. Regulation Sets are related to one of three broad deer population management goals (increase, stabilize or decrease). All zones within the Hopewell Valley have a goal of decreasing the deer population by allowing the unlimited harvesting of antlerless deer (The amount of desired decrease is not quantified by the Division).

In the last several years, the Pennsylvania Game Commission has instituted new regulations that incorporate Quality Deer Management principles. The goal of these changes is to decrease the deer population and improve overall herd and ecological health. Changes include restrictions on harvesting young bucks (less than 6 antler points) and prohibition on harvesting more than one buck throughout the entire hunting season (both of these changes are expected to indirectly increase the doe harvest to bring about population reduction). Application of these changes in the Hopewell Valley could significantly improve the chances of meeting stated goals and should be considered an important strategy for the Task Force.

The majority of counties and municipalities of New Jersey allow access for hunting. Neighboring towns with successful programs that should be explored by the Task Force include Montgomery Township (http://www.montgomery.nj.us/twpcommittee/deerhunting.asp) and Princeton Township. Some other potential models include Union County, Essex County, Hunterdon County (http://www.co.hunterdon.nj.us/hunting/instruct.htm) and Bernards Township (http://www.bernards.org/boards_commissions/deer_management/default.aspx), but many other municipal and county programs could also serve as models. The most comprehensive example of effective deer management within the region is conducted by the Fairfield County Municipal Deer Alliance (www.deeralliance.org), which should be considered a model for the Hopewell Valley. This model could be adopted in the future as a way for the Hopewell Valley to directly link with efforts in neighboring municipalities.

The majority of private land trusts in New Jersey also conduct deer management on their owned properties. Programs run by the Schiff Natural Lands Trust (See http://schiffdeermanagement.org/ for details on an exemplary program), New Jersey Audubon Society, New Jersey Conservation Society could serve as additional models to similar groups within the Hopewell Valley.

Hopewell Valley Programs

Members of the Task Force collected information via interviews with hunters and other local residents regarding the hunting status of parcels throughout the Hopewell Valley. Results of this effort are depicted in Figure 15 and summarized in Table 4. Forty-seven percent of the land area is hunted through agricultural depredation permits, deer management programs or recreational hunting. Hunting access is prohibited on 43% of the land area and unknown hunting status accounts for 10% of the area. The large amount of area without hunting access (including numerous, small residential plots and some large, public and privately owned lands) will challenge efforts to control the deer population and should inform strategies that must be employed to meet stated goals.

There are several active land managers attempting to reduce the deer population. These include Mercer County Parks, Friends of Hopewell Valley Open Space and D&R Greenway Land Trust (See www.deerinbalance.org for program details). There are also several private land programs that are utilizing Quality Deer Management principles. The use of depredation permits is minimal except for a concentration of activity in the north-central portion of the Valley. While most privately owned larger parcels are hunted recreationally, there are several key public- and corporate-owned parcels that are not hunted.

Safety Zones are also a significant issue in the Hopewell Valley (Figure 16). The cumulative area within safety zones accounts for approximately 50% of the Valley. Although some areas within safety zones are hunted with permission of land owners, many hunted parcels are effectively much less hunted because of safety zones that extend from neighboring parcels with land owners do not provide permission to hunt.

Figure 15. Hopewell Valley Parcel-level Deer Management Status

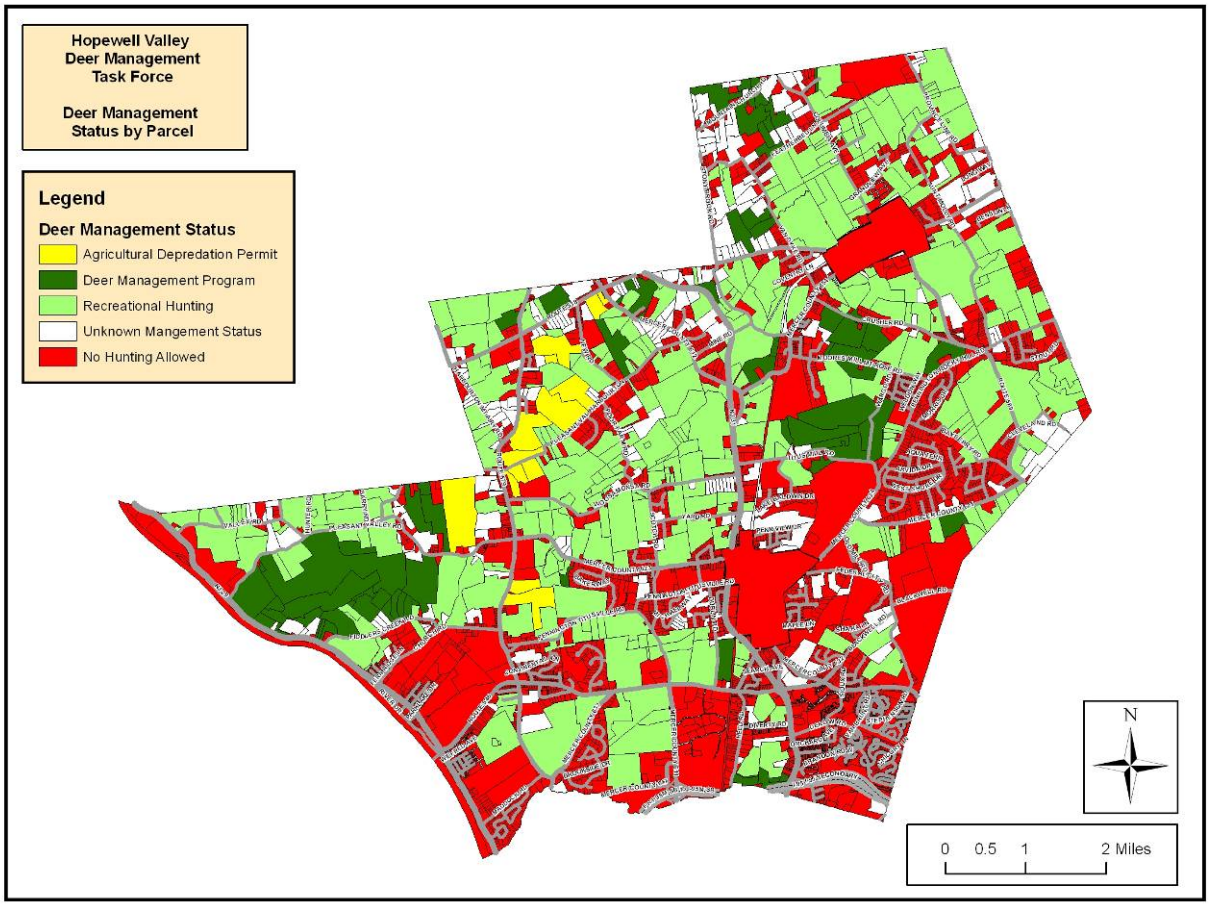
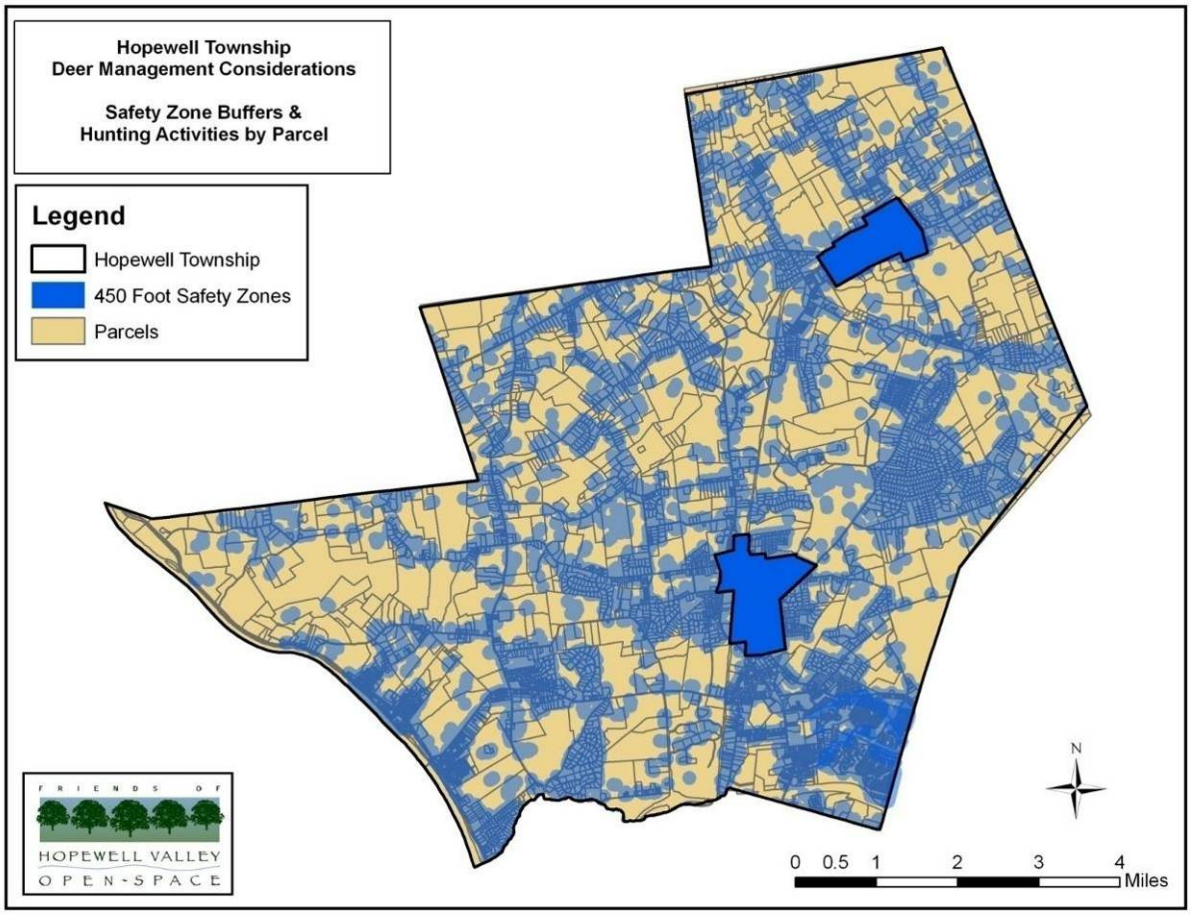


Table 4. Summary of Parcel-level Deer Management Status in the Hopewell Valley

Hunting Status	Number of Parcels	Acres	% of Hopewell Valley*
Agricultural Depredation Permit	14	929	2
Deer Management Program	76	3346	9
Recreational Hunting	335	13578	36
No Hunting Access	6968	14944	43
Unknown Hunting Access	304	3729	10
Totals	**7697**	**37601**	**100**

* Hopewell and Pennington Boroughs were assumed to have no hunting activity, but their acreage totals were considered for calculations.

Figure 16. Hopewell Valley Safety Zone Map



V. Hopewell Valley Deer Management Goals and Strategies

Introduction

The Task Force recommends a set of comprehensive goals along with specific strategies to meet stated goals (recommendations represent a consensus of Task Force members, but opinions of particular members may not be represented). All goals are quantifiable and continual reporting should be based upon three-year cycles to evaluate success. For simplicity, goals suggest a simple 25% reduction for each measurable impact over the next three years and 75% reduction within nine years. Reducing deer impacts will depend upon reducing the size of the deer population - the 2010 survey indicated an early spring population of 37 deer per square mile. An informal deer herd goal that assumes a one-to one relationship between deer numbers and stated goals would suggest a herd reduction of 25% by 2013 (28 per square mile) and a 75% reduction by 2019 (9 per square mile). However, deer impacts may not relate to impacts on a one-to-one basis (e.g., 25% reduction in deer might result in a 10% reduction in Lyme Disease, but a 75% reduction in deer could result in a 90% reduction – in either scenario a very active public education campaign might amplify the success of meeting Lyme Disease reduction goals). Therefore, success should be measured by stated impact reduction goals and not based upon measured deer population size.

The Task Force understands that financial support for this effort is difficult under existing economic conditions. Nearly all recommendations are 'budget neutral', but will require commitment from elected officials and municipal staff toward attainment (e.g., initiating a hunting program on Hopewell Township lands, encouraging hunting access on other public and private lands). The only recommended budget request is for $5,000 from Hopewell Valley municipalities to initiate a venison donation program.

The Task Force strongly recommends that the Township Committee assign a permanent body to facilitate goals and strategies summarized below and detailed within this plan. It is recommended that a permanent Task Force consist of no more than seven members representing various stakeholders (e.g., Township Committee liaison, Chief of Police, agricultural community, conservation community, hunting community, corporate community, and private residents of the Hopewell Valley that have related professional experience). The number of members should be an odd number for voting purposes / decision resolution and should include one non-voting member to act as secretary. The Task Force would meet periodically and have ongoing responsibility to implement strategies that achieve stated goals with assistance from Hopewell Valley municipalities and other stakeholders from public and private sectors.

For all goals and strategies, the Task Force strongly recommends a tracking system that sets an agenda with timelines for completion, quantifies progress and allows effective communication with all stakeholders. Lyme disease and deer vehicle collisions are tracked continuously through existing mechanisms by the Hopewell Township Health and Police Departments, respectively. It is recommended that public questionnaires, as performed in 2010, be repeated every three years to track landscape and agricultural impact reduction goals and overall public opinion. Ecological health is tracked annually on various private and public parcels by the Friends of Hopewell Valley Open Space – summaries of these activities should be provided to the Task Force annually and a report should be provided every three years. The tracking of the deer population should also be repeated every three years using the same seasonal timing and methodology utilized in 2010. Brief but effective tracking / reporting should also be included within each listed strategy to assure effective communication and evaluation of their effectiveness toward meeting stated goals. Specific strategy measures should be developed by Task Force members that are assigned to implementing them.

Recommended Goals

Goal #1: Reduce Lyme Disease Cases
There has been had an average of 170 reportable cases of Lyme disease from 2007-2009. The Task Force recommends a 25% reduction goal by 2013 (128 cases) and a 75% reduction goal by 2019 (43 cases).

Stafford (2007) reviewed studies exploring the link between deer / tick abundance and human cases of Lyme disease. It is suggested that deer densities lower than 8 per square mile could interrupt the life cycle of the Lyme disease organism and nearly eliminate transmission to humans. However, reductions in Lyme disease could be expected at higher deer densities – for example, there was a 90% reduction in Lyme disease at Bluff Point Coastal Preserve in Connecticut when deer densities were reduced from 200 to 30 per square mile (85% reduction).

Goal #2: Reduce Deer Vehicle Collisions
There has been an average of 567 deer-vehicle collisions from 2007-2009. The Task Force recommends a 25% reduction goal by 2013 (425 collisions) and a 75% reduction goal by 2019 (142 collisions).

Data linking deer herd reduction with reduced deer vehicle collisions is sparse. However, Princeton Township experienced a 75% reduction in deer vehicle collisions (from 342 to 85 per year) following a six-year deer management program that resulted in a 72% reduction of the deer population (from 114 to 32 deer per square mile) (DeNicola and Williams 2008).

Goal #3: Reduce Agricultural Losses
The public questionnaire results suggested that 27% of respondents had crop losses exceeding $5,000 per year. The Task Force recommends a 25% reduction goal by 2013 (20% of respondents) and a 75% reduction goal by 2019 (7% of respondents).

Agricultural losses are a significant concern in the Hopewell Valley and complete results of the public questionnaire are provided in Section III and Appendix A. There are no published guidelines linking particular deer densities with agricultural losses, but continual tracking of the above stated goal is expected to act as a proxy for the variety of deer impacts to agricultural viability in the Hopewell Valley.

Goal #4: Reduce Landscape Planting Losses
The public questionnaire results suggested that 55% of respondents had severe or moderate landscape damage. The Task Force recommends a 25% reduction goal by 2013 (41% of respondents) and a 75% reduction goal by 2019 (14% of respondents).

Landscape planting losses are a quality of life issue in the Hopewell Valley. There are no published guidelines linking particular deer densities with landscape planting losses, but continual tracking of the above stated goal is expected to act as a proxy for a range of deer-related impacts within planted landscapes.

Goal #5: Reduce Ecological Damage
Forest health has been monitored through two science-based protocols called the ‘sentinel seedlings’ (measuring deer browse on planted tree seedlings) and ‘forest secchi’ (measuring the density of forest understory vegetation). The average browse on planted tree seedlings has been 59%. The average amount of native understory vegetation was 21%. The Task Force recommends a 25% improvement by 2013 (44% browse on planted seedlings & 26% native understory cover) and a 75% improvement by 2019 (14% browse on planted seedings & 37% native understory cover).

The ultimate forest health goals using the above protocols are subjectively set at 10% seedling browse and 70% native understory cover. Additional work is planned to set forest health goals that are tied to habitat use by sensitive forest birds (i.e., Kentucky Warbler, Hooded Warbler). Reference sites for this work will be located within the Hopewell Valley and measurements will include understory cover and abundance of native herbs. This information can be used to refine forest health guidelines in the future. Literature suggests that pre-European deer densities were approximately 10 per square mile (McCabe and McCabe 1984) and modern studies suggest that densities above 10 deer per square mile are associated with degradation of forest health (deCalesta 1994).

Recommended Strategies for Goal Implementation

The Task Force recommends three sets of proposed strategies to reach stated goals: 1) Improvement of Hunting Access, 2) Improvement of Hunting Efficacy, and 3) Avoidance of Deer Impacts. Brief explanations of control options and avoidance methods are provided in Section IV.

A comprehensive review of many ecological and social issues regarding hunting is provided by McShea et al. 1997, Warren 1997, Drake 2000, and Latham et al. 2005. These documents are especially relevant to meeting ecological goals, which are the most sensitive to deer overabundance (i.e., human health and economic impact reduction goals are likely to be met prior to reaching ecological goals). Quality Deer Management (QDM) is a critical, overarching concept with associated strategies that are necessary to meet all stated goals within the context of recreational hunter satisfaction, which will be required to avoid the need to hire costly professional deer managers. Adherence to QDM principles by Hopewell Valley hunters would result in a smaller, healthier herd featuring large bucks. Multiple documents published by the Quality Deer Management Association (www.qdma.com) explore QDM and should be reviewed by those implementing this plan.

Based upon the 2010 Hopewell Valley deer survey, population growth scenarios were estimated by using a methodology established by Duke Farms in Hillsborough Township (T. Almendinger, personal communication). This method is periodically vetted by wildlife biologists including A. DeNicola of White Buffalo, Inc. and L. Wolgast of the NJ Fish & Game Council. The measured deer density in Hopewell Valley was 37 deer per square mile (total population size approximately 2,300 deer). Based upon population growth calculations, the post-birthing deer density is 54 per square mile (approximately 3,400 deer). A 25% and 75% population reduction goal would result in post-winter deer densities of 28 and 9 deer per square mile, respectively. This is equivalent to deer populations of 1,750 and 560 deer throughout the Hopewell Valley (post-birthing / pre-hunting season deer populations would be approximately 2,600 and 830, respectively). Recent statewide deer population reduction was associated with harvesting greater than 40% of the deer population with greater than 60% of the harvest being antlerless deer (See Figure 2). In order to achieve stated goals within the defined timeframes, Hopewell Valley harvests must exceed these figures. The Task Force should devise annual harvest goals necessary to meet stated goals in consultation with wildlife biologists (e.g., NJ Division of Fish & Wildlife or other wildlife professionals).

Strategy Set #1: Improvement of Hunting Access

1A) Encourage and facilitate hunting access on public and private lands

There are several large public and corporate properties that do not allow hunting access or have limited hunting access. The Task Force, supported by municipal officials and staff, should conduct outreach to support deer management programs on these parcels and any parcels (including private lands) that do not allow hunting access (See Figure 15).

Hopewell Township owns approximately 200 acres of open space that require hunting access to help meet stated goals. Deer Management Programs utilized by other Hopewell Valley land managers, including Mercer County, Friends of Hopewell Valley Open Space, and D&R Greenway Land Trust should be considered models for a program implemented by Hopewell Township (See Section IV). Ideally, Hopewell Township should develop and implement deer management programs on their owned lands as soon as possible to serve as an example for other land owners that do not currently have hunting access.

A possible strategy to pursue is participation from the Hopewell Township Police Department, which could conduct training (e.g., review firearm regulations, test shooting accuracy for bow and firearms) and provide background checks (e.g., verify license, safety record) for interested hunters that could participate in deer management programs on both public and private lands. This effort could ease concerns of neighbors / residents that are hesitant about hunting near or on their properties and provide structure to the program. The cost of such a program would be approximately $500 per training event to pay for police officer overtime (G. Meyer, personal communication) and costs would be assumed by hunters participating in the program (e.g., 25 hunters pay $20 each). A similar program has been utilized in Fairfield County, Connecticut (www.deeralliance.org) to match hunters with prospective property owners and Mendham Township, New Jersey. At a minimum, hunters that may manage deer on Hopewell Township properties could be required to participate in the program.

1B) Develop strategies to access "pocket deer" in residential areas

One of the more challenging aspects of deer management in the Hopewell Valley will be obtaining access to "pocket" or "yard" deer. Some municipalities have utilized contracted professionals under special state permits to reduce deer populations where typical recreational hunting is not feasible (e.g., Princeton Township, Millburn Township). These methods can be expensive and should not be considered the first option in Hopewell Valley. The expected passage of legislation that will increase hunting land near structures may ease this problem (bow hunting will be allowed within 150 feet as opposed to the previous 450 feet safety zone that will continue to apply to firearm hunting). Additionally, lands accessible to hunters that are adjacent to residential developments may consider cooperative efforts to either 'push' (i.e., coordinated deer drives) or 'pull' (i.e., baiting strategies) deer from areas inaccessible to hunting (Strategy Set #2). If these efforts appear inadequate, then municipalities of the Hopewell Valley should consider hiring professional contractors to reduce the deer herd in order to meet stated goals.

Strategy Set #2: Improvement of Hunting Efficacy

2A) Encourage and facilitate coordinated hunting activities among neighboring landowners

The 'pushing' of deer from one parcel to another is a perennial problem in Hopewell Valley. This occurs when one parcel is hunted, but a neighboring parcel does not allow hunting access. It also occurs when hunting occurs at different times on two adjacent parcels that are both hunted. Coordination is critical to meeting stated goals. Land owners that do not allow hunting should be approached by the Task Force and asked to consider hunting access that is coordinated with neighboring parcels. If hunting access is still not acceptable, then the land owners could be asked whether they would allow hunters without weapons to drive deer onto neighboring parcels that allow hunting access. When adjacent parcels both have hunting access, the respective hunters could consider hunting simultaneously – this would increase deer movements and potentially increase harvest numbers for all hunters.

The use of coordinated drives toward strategic culling locations should be developed at multiple locations throughout the Hopewell Valley. Drives could be conducted by individuals passing Hopewell Township Police Department safety training (see above) and be registered for each particular drive before it is initiated. Drive 'teams' should provide a written plan including a map and date/time that drives will

occur. The map should include an indication of safety zones (or have written permission from appropriate landowners if conducted within safety zones).

The strategic use of baiting and deer food plots could also be considered as a means of pulling deer off of lands that are not hunted and/or concentrating deer in areas where they can be hunted. As with coordinated deer drives, spatially explicit planning among local hunters will be critical to success of this effort. The Task Force should facilitate both coordination and baiting/food plot among local hunters. As necessary, consultations with wildlife biologists should also be considered.

2B) Encourage and facilitate use of Agricultural Depredation Permits by farmers

The use of agricultural depredation permits should be increased in Hopewell Valley (See Appendix A – Public Questionnaire questions 10F, 10G & 10H). Although it is unclear why use of depredation permits is not more extensive, reasons may include lack of permission on leased farmlands and issues with nuisance complaints from neighbors because of off-season gunfire. Other factors such as use of deer exclosure fencing or crop type (e.g., hay isn't generally over browsed by deer) may also have a bearing the use of depredation permits. A more extensive utilization of this permit can be beneficial toward reducing the deer population in the Hopewell Valley. The Task Force, supported by municipal officials and staff, should work with the agricultural community to increase the use of Agricultural Depredation Permits.

2C) Encourage and facilitate Deer Management Programs that focus harvests on female deer

Deer Management Programs (DMP) are utilized locally by Mercer County Parks, D&R Greenway Land Trust and Friends of Hopewell Valley Open Space (See http://deerinbalance.org/deer-management-program-resources/). The implementation of DMP's by all land managers / property owners that provide access to hunters would significantly reduce the Hopewell Valley deer population. The incorporation of Quality Deer Management (QDM) principles into DMP's should be encouraged to produce a healthier herd structure in addition to reducing the overall herd size. The Task Force should provide outreach to public and private land owners that allow hunting access to increase the use of DMP's containing QDM principles.

2D) Encourage and facilitate program for venison donation to local food banks

The Task Force should assist with a creation of a Hopewell Valley venison donation program. This would include transportation, processing and distribution with a network of hunters, butchers, and food banks. Hopewell Valley hunters that responded to the public questionnaire cited a lack of outlets for venison restricted their harvesting of deer (See Appendix A – Question 9b). The Task Force recommends that Hopewell Valley municipalities contribute $5,000 annually to the program. This amount would accommodate the donation of approximately 50 deer, which translates to 5,000 pounds of venison or 20,000 meals. The Task Force should seek additional contributions from the public and private sector to enhance the program once the program is established with a recurring annual contribution from the municipalities.

A partnership could be formed with Hunters Helping the Hungry (HHH) - www.huntershelpingthehungry.org. HHH is a non-profit organization that facilitates venison donations. In 2009, HHH was able to process 15,000 pounds of venison (ca. 60,000 meals) utilizing $15,000 of funding (ca. $1 per pound of venison). Jack Chellew and John Person are HHH contacts.

The Task Force (via Morton Rosenthal) has conducted research toward establishing a relationship with local food banks, butchers and HHH. The closest food bank to the Hopewell Valley is the Trenton Soup

Kitchen (Denis Micai, CEO). The butcher that that provides meat to the Trenton Soup Kitchen is City Beef. Unfortunately, USDA regulations do not allow City Beef to process game in the same building as agriculturally-produced meats and they would be unable to participate in any future program. [Note: Butchers of venison must meet the following standards: 1) Walk-in cooler with temperatures of 38 degrees or lower, 2) Two tracks or other ways to segregate venison from other meats, 3) Freezer that is at zero degrees, and 4) Pass sanitary inspections by State Board of Health.] HHH lists eight participating butchers in New Jersey. The closest participating butcher is John Person, located on State Highway 31 South in Lebanon, NJ (ca. 30 minutes north of Hopewell Valley). Mr. Person is capable of processing venison that could be supplied to the Trenton Soup Kitchen.

An additional avenue to explore might involve coordination of private landowners and hunters. Research should be conducted to determine the feasibility of allowing private residents that would like to consume venison and hunters that might otherwise limit their hunting activity because they do not have an outlet for harvested deer. As an example, private residents might pay for butchering costs and keep processed venison that a hunter drops off with a participating butcher. The Task Force should work with the Fish & Game Council and Division of Fish & Wildlife to determine whether this strategy is acceptable under current game code and explore options toward modifying the code to allow this strategy in the future.

2E) Consult with the NJ Division of Fish & Wildlife to conduct strategies listed above

The Fish and Game Council and NJ Division of Fish & Wildlife are critical partners in all efforts regarding deer management. Their Community Based Deer Management Program (CBDMP) can allow strategies such as season extensions in particular high deer density areas to increase harvests and special rules to access pocket deer.

A request for changes to the game code for Deer Management Zones in the Hopewell Valley that facilitate Quality Deer Management is seen as critical toward attainment of all stated goals. The Task Force, along with interested Hopewell Valley hunters, has begun to discuss QDM concepts and plan to approach the Division of Fish & Wildlife in fall 2010. Potential changes could include requirements for antlerless deer harvest through licensing incentives and restrictions on buck harvests (e.g., allowance of only one buck per hunter per year, prohibiting the harvest of bucks with less than 6 antler points).

Strategy Set #3: Avoidance of Deer Impacts

3A) Improve awareness of methods that reduce Deer Vehicle Collisions

Research on road-related countermeasures does not suggest any effective methods that could be utilized in the Hopewell Valley. However, increased outreach via public service announcements or other methods should be conducted during the fall to coincide with the deer breeding season when animal movement is generally at its peak and deer vehicle collisions are most likely to occur. For example, electronic traffic message boards can be placed along roadways with the highest risk for collisions during the fall deer mating season. The Task Force should work with Hopewell Valley municipalities to increase outreach and education about deer vehicle collisions.

3B) Improve awareness of methods that reduce Lyme disease

There are multiple strategies that can be carried out by individuals to reduce their risk of contracting the disease. Awareness of ticks and the need to search for ticks following likely exposure activities is critical. The use of repellents, wearing socks over the bottom of pants, wearing of light clothing to detect ticks, etc. are all useful prevention strategies. The Task Force should work with Hopewell Valley municipalities to increase outreach and education about Lyme disease prevention.

3C) Improve awareness of methods that reduce landscape damage

There are a variety of techniques that can be attempted to reduce landscape damage. Options include the use of fencing, repellents and deer resistant plants. In general, fencing can be expensive for significant areas, but low-cost options could be utilized by most residents in defined areas such as vegetable gardens (residents of the Hopewell Valley should consult with their local zoning officer regarding restrictions on fencing height and placement). Repellents were utilized by 60% of public questionnaire respondents, but evaluation of their effectiveness was not explored. There are a wide variety of repellants and cost and effectiveness can vary widely. Deer resistant plants can significantly reduce browse damage, but deer often browse reportedly resistant plants. Lists of deer resistant plants can be found in various websites; however, the use of invasive species that damage natural areas should not be considered viable alternatives to more palatable species. The Task Force should work with the Mercer County Master Gardeners and local garden clubs to provide outreach and education to reduce landscape damage.

3D) Discourage the intentional feeding of deer in non-hunting situations

In addition to the unintentional feeding of deer through landscape plantings and agricultural crops, approximately 4% of questionnaire respondents actively feed deer at their homes. The public questionnaire reported that 65% of respondents would favor a law banning the intentional feeding of deer. However, the Task Force considers enforcement of such a ban to be impractical and instead favors outreach to discourage the intentional feeding of deer in non-hunting situations.

Literature Cited

Burt, W.H. 1976. Peterson Field Guides – Mammals. Houghton Mifflin Company. New York. 289 pages.

Centers for Disease Control. 2010. Surveillance for Lyme Disease – United States. http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5710a1.htm. Accessed: August 2010. College of Environmental Science and Forestry, Syracuse. 171 pp.

deCalesta, D. S. 1994. Effects of white-tailed deer on songbirds within managed forests in Pennsylvania. Journal of Wildlife Management 58:711-717.

deCalesta, D. S. 1997. Deer and ecosystem management. Pages 267-279 *in* W. J. McShea, H. B. Underwood, and J. H. Rap-pole, eds. The science of overabundance: deer ecology and population management. Smithsonian Inst. Press, Washing-ton, D.C.

DeNicola, A.J., K.C. VerCauteren, P.D. Curtis, and S.E. Hygnstrom. 2000. Managing white-tailed deer in suburban environments: a technical guide. Cornell University Cooperative Extension, Wildlife Society – Wildlife Damage Management Working Group, and the Northeast Wildlife Damage Research and Outreach Cooperative. Ithaca, NY.52 pages. http://ecommons.cornell.edu/handle/1813/65

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

Drake, D. 2000. A private lands approach to controlling New Jersey's deer population. Wildlife Damage Management – Internet Center for Wildlife Damage Management Conference Proceedings. Lincoln, NE. http://digitalcommons.unl.edu/icedm_wdmconfproc/28.

Drake, D., M. Lock, and J. Kelly. 2002. Managing New Jersey's Deer Population. Rutgers Cooperative Extension, New Brunswick. 44 pp.

Jones, M. L., Methews, N. E. and Porter, W. F. 1997. Influence of social organization on dispersal and survival of translocated female white-tailed deer. Wildlife Society Bulletin 25: 272-278.

Knapp, K.K., X. Yi, T. Oakasa, W. Thimm, E. Hudson, and C. Rathmann. 2004. Deer-Vehicle Crash Countermeasure Toolbox: A decision and choice resource. Wisconsin Department of Transportation, Madison, WI. 220 pages. http://www.deercrash.com/Toolbox/finalreport.pdf

Latham, R.E., J. Beyea, M. Benner, C. Adams Dunn, M.A. Fajvan, R.R. Freed, M. Grund, S.B. Horsley, A.F. Rhoades, and B.P. Shissler. 2005. Managing white-tailed deer in forest habitat from an ecosystem perspective: Pennsylvania Case Study. Audubon Pennsylvania and Pennsylvania Habitat Alliance. Harrisburg, PA. 340 pages.

Matthews, N. E. 1989. Social structure, genetic structure, and anti-predator behavior of white-tailed deer in the central Adirondacks. Ph.D. thesis, State University of New York College of Environmental Science and Forestry, Syracuse. 171 pp.

McCabe, T.R. and R.E. McCabe. 1984. Of slings and arrows: A historical retrospection. Pages 19-73. *In* Halls, L.K. (ed.). *White-tailed deer: ecology and management.* Stackpole Books, Harrisburg, PA.

McNulty, S. A., Porter, W. F., Mathews, N. E., and Hill, J. A. 1997. Localized management for reducing white-tailed deer population. Wildlife Society Bulletin 25: 265-271.

McShea, W. J., Underwood, H. B., and Rappole, J. H. (eds.). 1997. The Science of Overabundance: Deer Ecology and Population Management. Smithsonian Institution Press, Washington, DC.

Miller, K. V. and Ozoga, J. J. 1997. Density effects on deer sociobiology, pp. 136-150. *In*

NatureServe Explorer. 2001. An Online Encyclopedia of life, Version 1.6. Arlington, VA, USA: NatureServe. http://www.natureserve.org/explorer.

New Jersey Division of Fish and Wildlife. 2002. Deer Biology. Trenton, NJ. http://www.njfishandwildlife.com/deer.htm.

Northeast Deer Technical Committee. 2009. An evaluation of deer management options. New England Chapter of the Wildlife Society and The Northeast Deer Technical Committee. 27 pages. http://www.state.nj.us/dep/fgw/pdf/deer_mgt_options.pdf

Rawinski, T.J. 2008. Impacts of white-tailed deer overabundance in forest ecosystems: an overview. United States Forest Service, Newtown Square, PA. http://na.fs.fed.us/fhp/special_interests/white_tailed_deer.pdf

Stafford, K.C. III. 2007. Tick Management Handbook. Connecticut Agricultural Extension Service, New Haven, CT. Bulletin No. 1010. 78 pages.

State Farm Life Insurance Company. 2009. Press Release (9/28/09) – Deer Vehicle Collision Frequency Jumps 18 Percent in Five Years. http://www.statefarm.com/about/media/media_releases/20090928.asp

Warren, R.J. 1997. Special Issue - Deer Overabundance. Wildlife Society Bulletin 25: 213-596.

Webster, W.D., J.F. Parnell, and W.C. Biggs. 1985. Mammals of the Carolinas, Virginia, and Maryland. The University of North Carolina Press. Chapel Hill, NC and London. 255 pp.

White, G. C. and Bartmann, R. M. 1997. Density Dependence in Deer Populations, pp. 120-135. *In* W. J. McShea, H. B. Underwood and J. H. Rappole (eds.). The Science of Overabundance: Deer ecology and population management. Smithsonian Institution Press, Washington, D. C.

Appendix A. Public Questionnaire Results – Tabular

Total Number of Respondents: 575

Tracking Number	Main Question and Follow-Up Questions	Response Percentage	Response Number
1	**1. Where do you live?**	**99.0**	**569**
1a	Hopewell Township	74.3	423
1b	Hopewell Borough	6.7	38
1c	Pennington Borough	19.0	108
1-open	Name the closest road intersection	N/A	N/A
2	**2. Has a physician diagnosed you or anyone in your household with Lyme Disease within past three years?**	**100.0**	**575**
2a	No	73.6	423
2b	Yes	26.4	152
3	**3. Have you or someone in household been involved in deer/car collision within past 3 yrs in Hopewell Valley?**	**94.3**	**542**
3a	No	72.0	390
3b	Yes	28.0	152
4	**3. Follow-Up A: Was the collision serious enough that it was reported to the police?**	**30.4**	**175**
4a	No	57.7	101
4b	Yes	42.3	74
5	**3. Follow-Up B: Was any collision serious enought to require hospitalization or visit to a doctor's office?**	**29.7**	**171**
5a	No	94.2	161
5b	Yes	5.8	10
6	**4. Do you experience damage to your landscaping?**	**99.3**	**571**
6a	No Damage	15.4	88
6b	Minor Damage	29.4	168
6c	Moderate Damage	30.8	176
6d	Severe Damage	24.3	139
7	**4. Follow-Up A: Do you use fencing or other repellents to protect your landscaping?**	**99.3**	**571**
7a	No	40.1	229
7b	Yes	59.9	342
8	**5. Have deer created a problem with your bird feeder?**	**99.0**	**569**
8a	No	53.4	304
8b	Yes	16.7	95
8c	Don't have feeders	29.9	170
9	**6. Do you feed the deer with corn or any other supplements?**	**99.5**	**572**
9a	No	95.8	548
9b	Yes	4.2	24

Appendix A. Public Questionnaire Results – Tabular

Total Number of Respondents: 575

Tracking Number	Main Question and Follow-Up Questions	Response Percentage	Response Number
10	**7. Would you support a new law banning residents from feeding deer in Hopewell Valley?**	**99.3**	**571**
10a	No	14.7	84
10b	Yes	64.8	370
10c	Not Sure	20.5	117
11	**8. Which statement best fits your attitude towards our local white-tailed deer population?**	**98.3**	**565**
11a	Deer do not cause any problems in Hopewell Valley	4.8	27
11b	Deer cause some problems, but not enough to worry about	24.6	139
11c	Deer cause many problems and solutions are needed	70.6	399
	HUNTER-RELATED QUESTIONS		
12	**9. Does anyone in your household hunt deer?**	**94.8**	**545**
12a	No --> SKIP TO Q. 10	89.5	488
12b	Yes	10.5	57
13	**9. Follow-Up A: How many *Hopewell Valley* deer are usually taken by hunters in your household each year? (Open Question)**	**9.7**	**56**
13a	0	26.8	15
13b	1	16.1	9
13c	2	16.1	9
13d	3	16.1	9
13e	4	5.4	3
13d	>4	19.6	11
14	**9. Follow-Up B: What factors might lead hunters in your household to take more deer in HV (Check all that apply)? (Three response choices in bold were provided, but results of all combinations are reported below.)**	**12.5**	**72**
14a	**Butcher available who would donate the venison to local food banks**	18.1	13
14b	**More time available for hunting in Hopewell Valley**	9.7	7
14c	**More places to hunt in Hopewell Valley, including public land**	22.2	16
14d	Two choices selected - more places and more time to hunt	5.6	4
14e	Two choices selected - donation availability and more places to hunt	12.5	9
14f	Two choices selected - donation availability and more time to hunt	1.4	1
14g	Three choices selected - donation availability and more time to hunt and more places to hunt	30.6	22

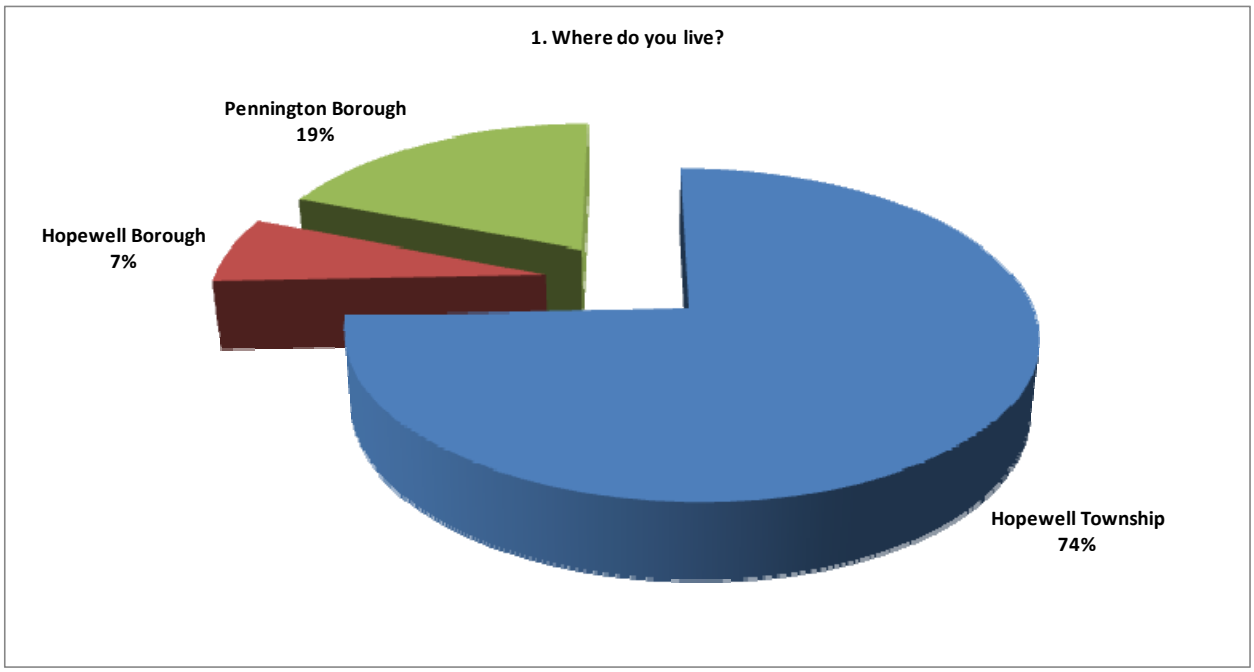
Appendix A. Public Questionnaire Results – Tabular

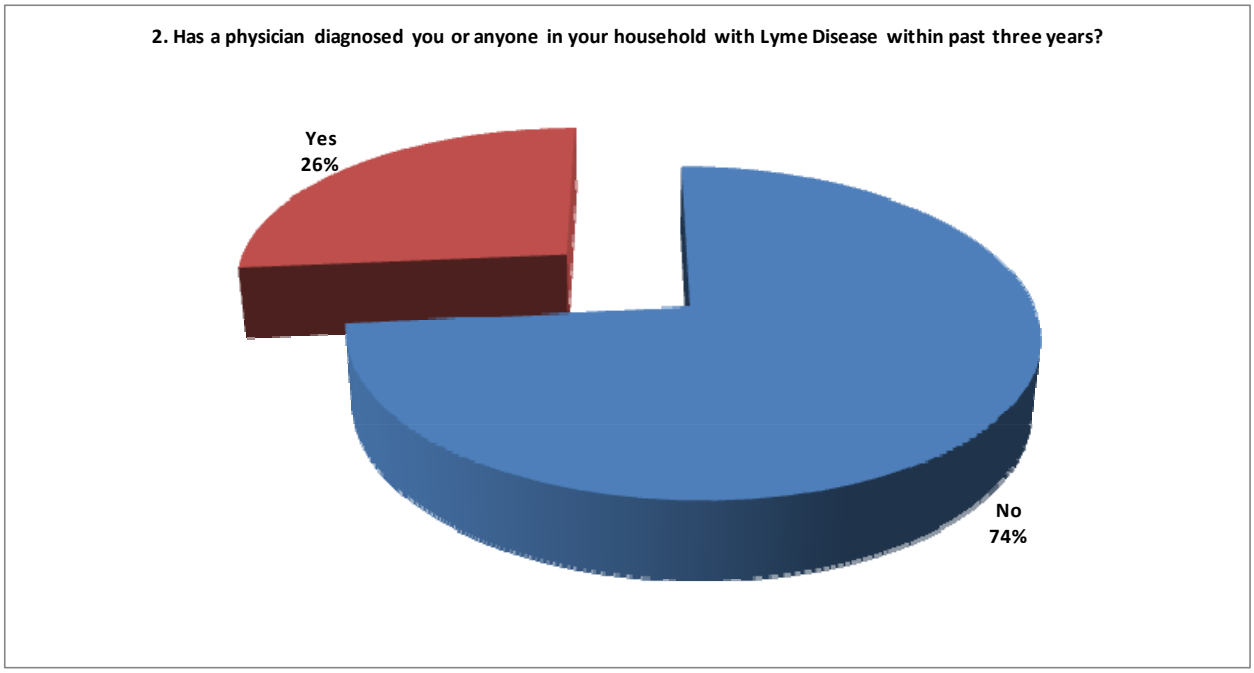
Total Number of Respondents: 575

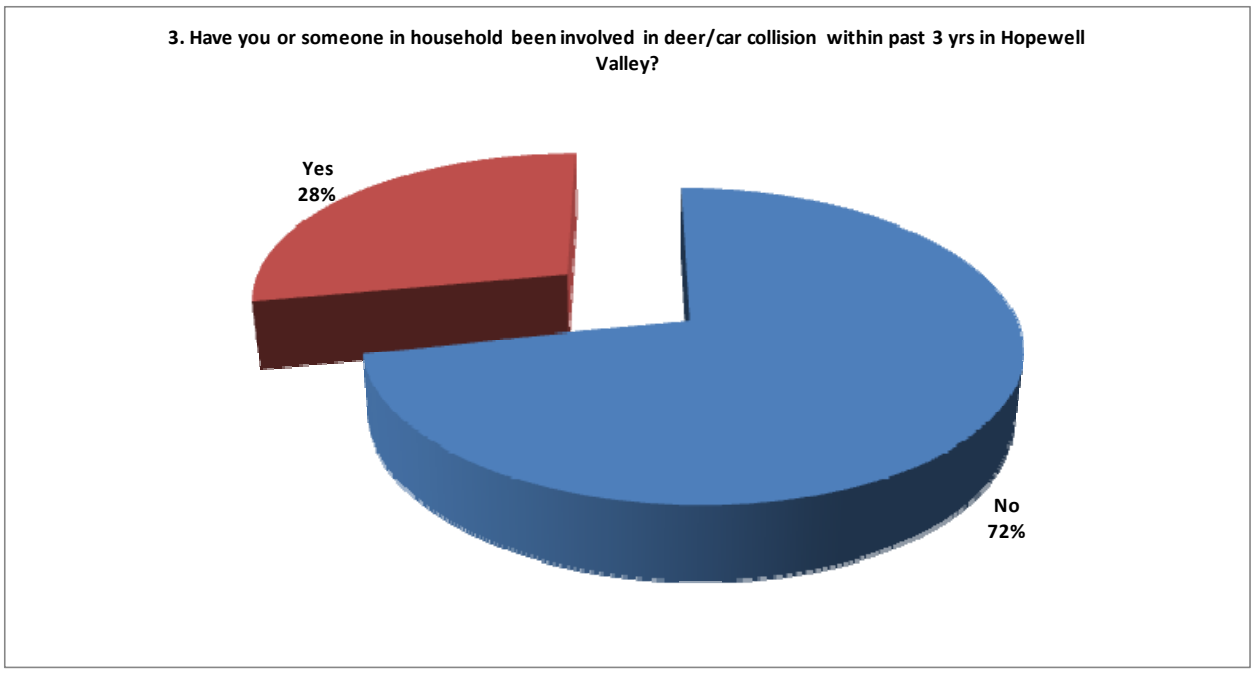
Tracking Number	Main Question and Follow-Up Questions	Response Percentage	Response Number
	FARMER-RELATED QUESTIONS		
15	**10. Has anyone in your household ever been a full or part-time farmer in Hopewell Valley?**	**89.9**	**517**
15a	No, STOP HERE	88.4	457
15b	Yes, still farming	7.5	39
15c	Yes, but stopped because of deer predation	1.2	6
15d	Yes, but stopped for other reasons	2.9	15
16	**10. Follow-Up A: Has anyone in your household experienced crop losses due to deer predation in last the last three years?**	**9.7**	**56**
16a	No	48.2	27
16b	Yes	51.8	29
17	**10. Follow-Up B: Please estimate your <u>average yearly</u> crop losses over the past three years due to deer damage:**	**4.5**	**26**
17a	Less than $5,000	73.1	19
17b	$5,000 - $25,000	19.2	5
17c	$25,000 - $50,000	3.8	1
17d	Over $50,000	3.8	1
18	**10. Follow-Up C: Are there any crops that you stopped planting due to actual or feared deer damage?**	**4.7**	**27**
18a	No	63.0	17
18b	Yes --> Please specify (See below)	25.9	7
18c	Yes, Corn	3.7	1
18d	Yes, Perenials and annuals	3.7	1
18e	Yes, Oak trees	3.7	1
19	**10. Follow-Up D: Have you planted sacrifical crops for deer to protect your cash crops?**	**7.0**	**40**
19a	No	92.5	37
19b	Yes	7.5	3
20	**10. Follow-Up to 10D: How many acres?**	**0.3**	**2**
20-open-a	Three	50.0	1
20-open-b	Eight	50.0	1
21	**10. Follow-Up E: Have you incurred other deer-related expenses, such as increased fencing costs?**	**7.1**	**41**
21a	No	48.8	20
21b	Yes --> Approximate cost over 3 years (See below)	51.2	21

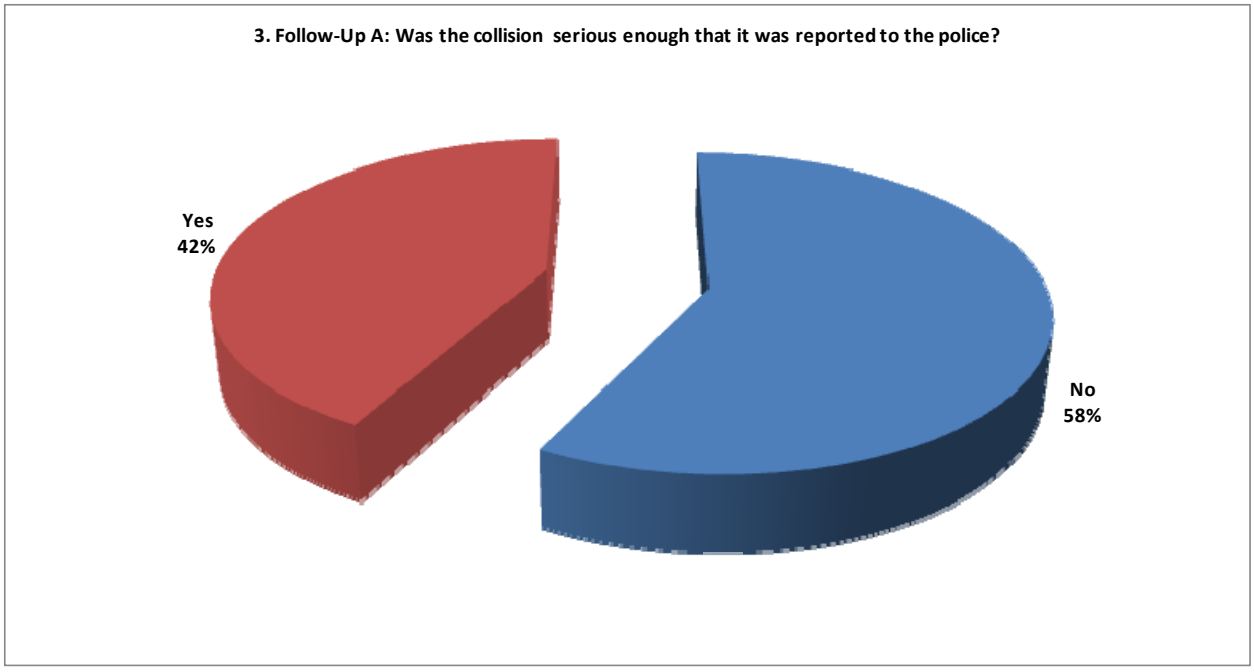
Total Number of Respondents: 575

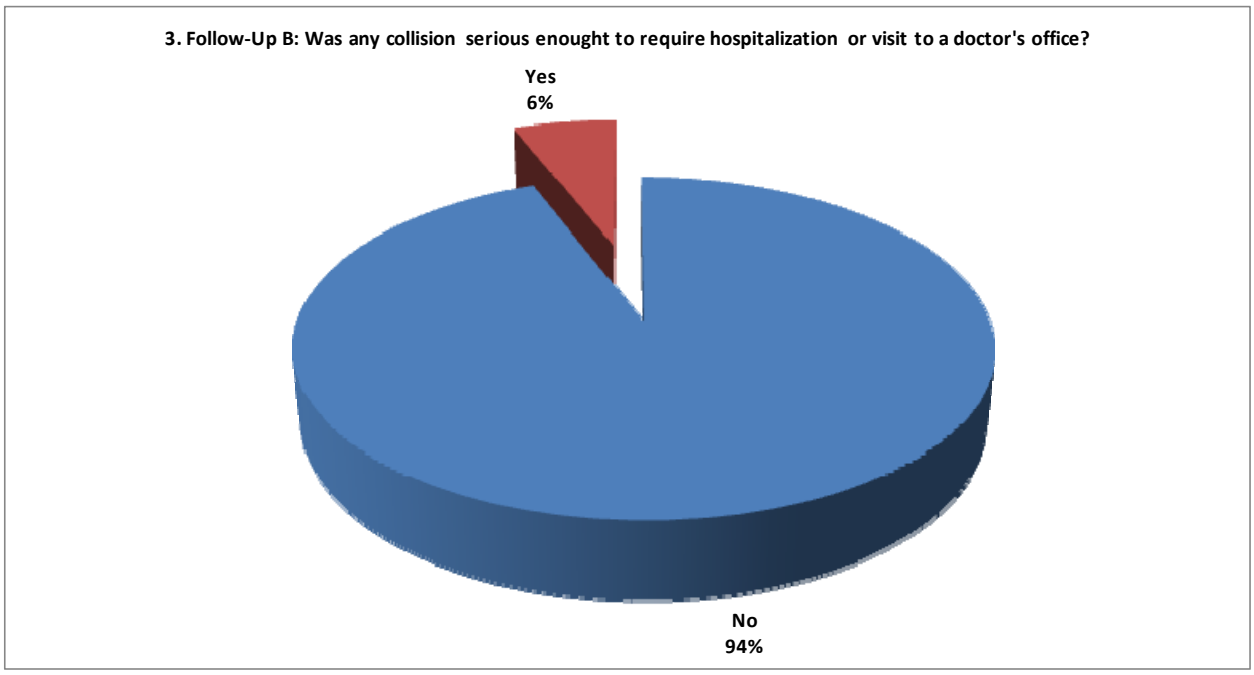
Tracking Number	Main Question and Follow-Up Questions	Response Percentage	Response Number
22	**10. Follow-Up to 10E: Approximate costs over 3 years**	**1.0**	**6**
22a	Less than $1000	100.0	6
22b	Between $1000 and $5000	0.0	0
23	**10. Follow-Up F: Do you allow hunting on your owned farmland?**	**9.4**	**54**
23a	No	37.0	20
23b	Yes	51.9	28
23c	Do not own any land	11.1	6
24	**10. Follow-Up G: Is hunting allowed by the owners of any land you lease for farming?**	**8.3**	**48**
24a	I don't lease any land	70.8	34
24b	No, hunting is not allowed on any of the land I lease	18.8	9
24c	Yes, hunting is allowed on some of the land I lease	4.2	2
24d	Yes, hunting is allowed on all of the land I lease	6.3	3
25	**10. Follow-Up H: Do you use an agricultural depredation permit?**	**8.2**	**47**
25a	No	83.0	39
25b	Yes (owned farmland)	14.9	7
25c	Yes (all leased farmland)	0.0	0
25d	Yes (some leased farmland)	2.1	1

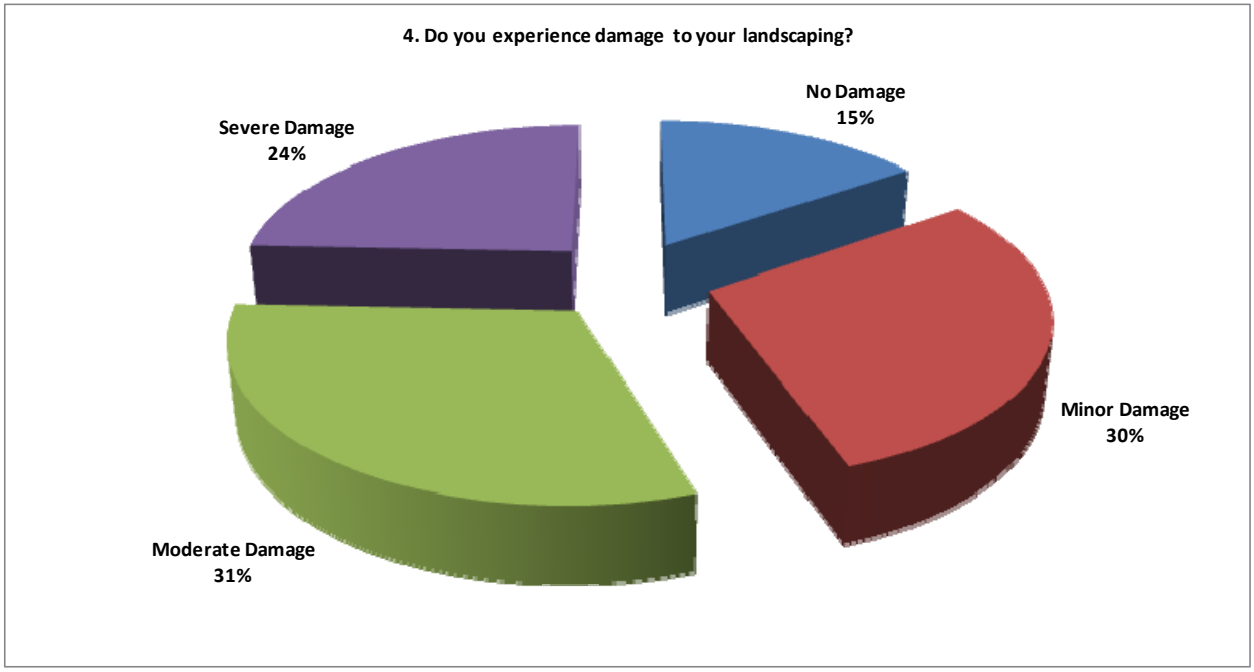

1. Where do you live?
Pennington Borough
19%
Hopewell Borough
7%
Hopewell Township
74%

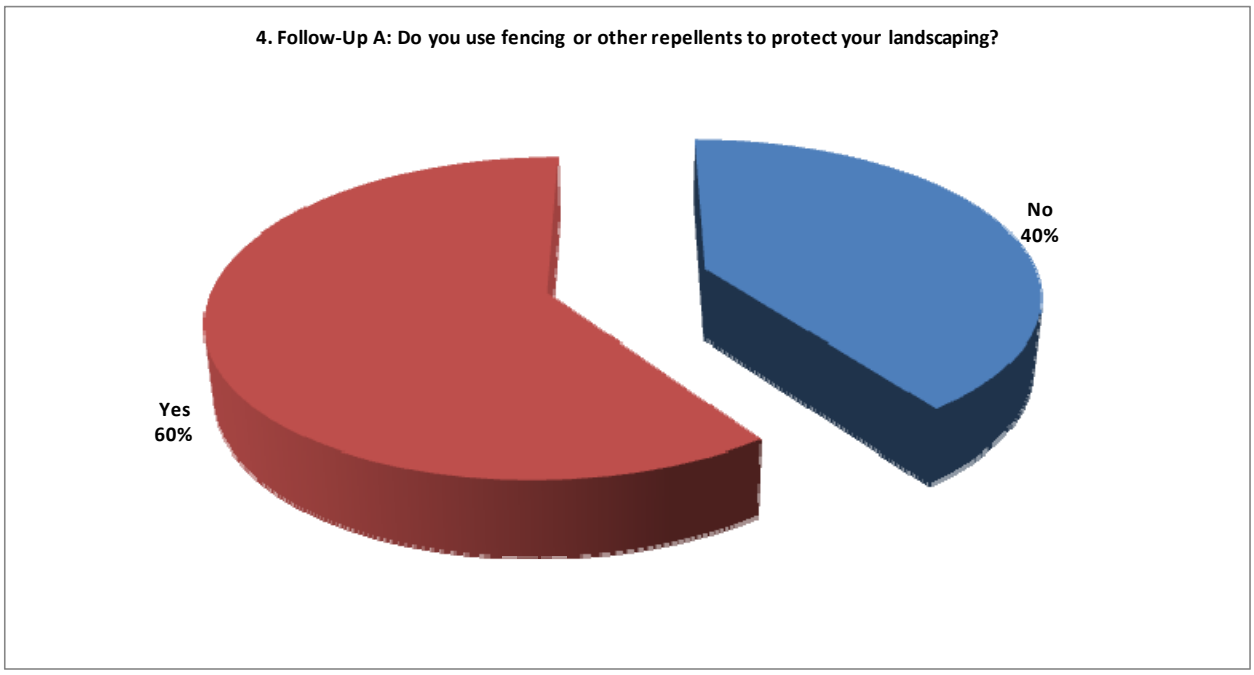

2. Has a physician diagnosed you or anyone in your household with Lyme Disease within past three years?
Yes
26%
No
74%

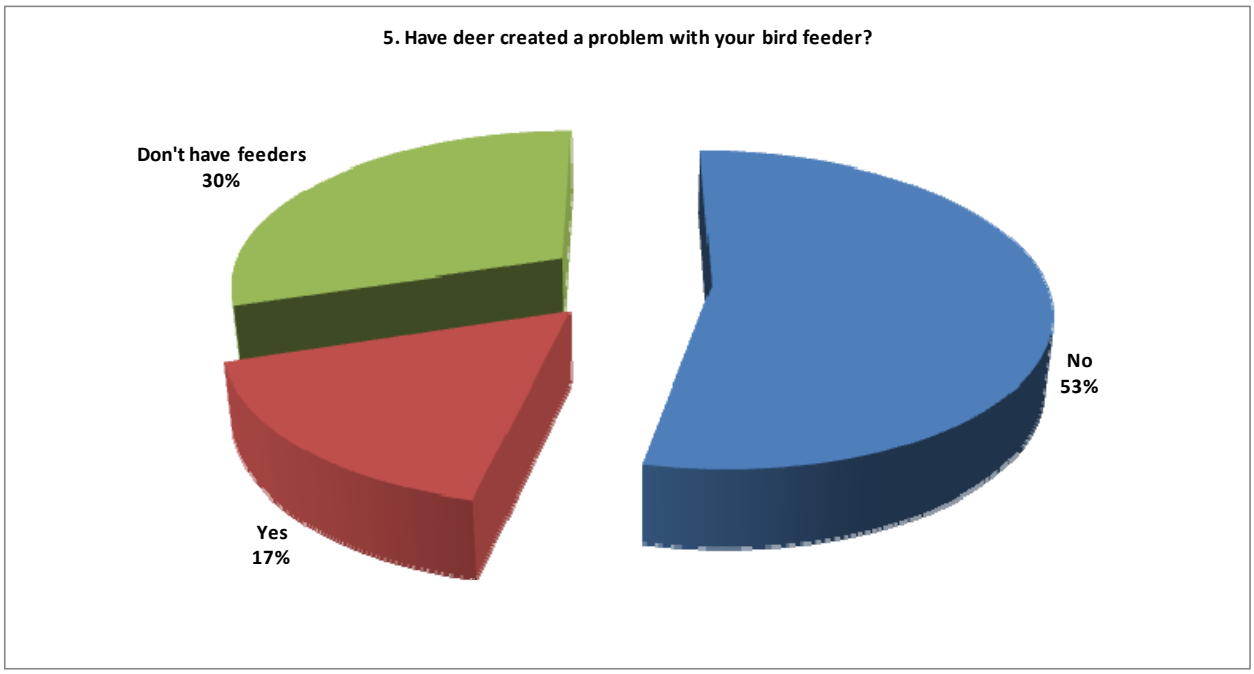

3. Have you or someone in household been involved in deer/car collision within past 3 yrs in Hopewell Valley?
Yes
28%
No
72%

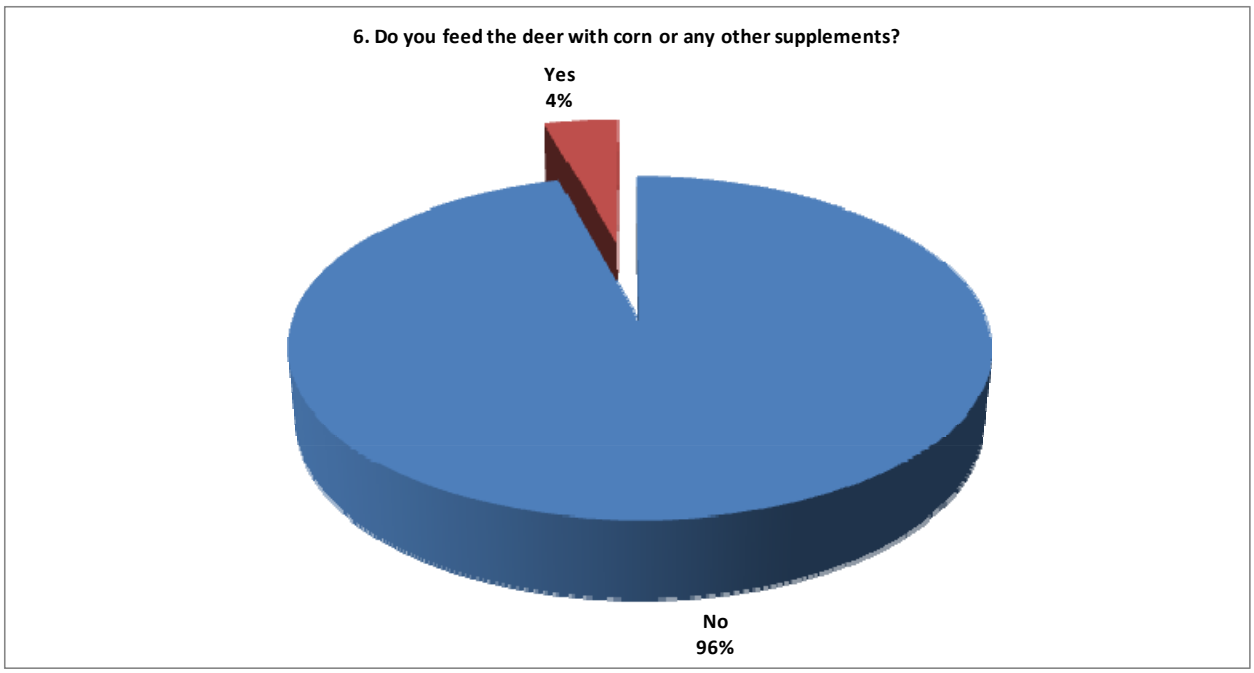

3. Follow-Up A: Was the collision serious enough that it was reported to the police?
Yes
42%
No
58%

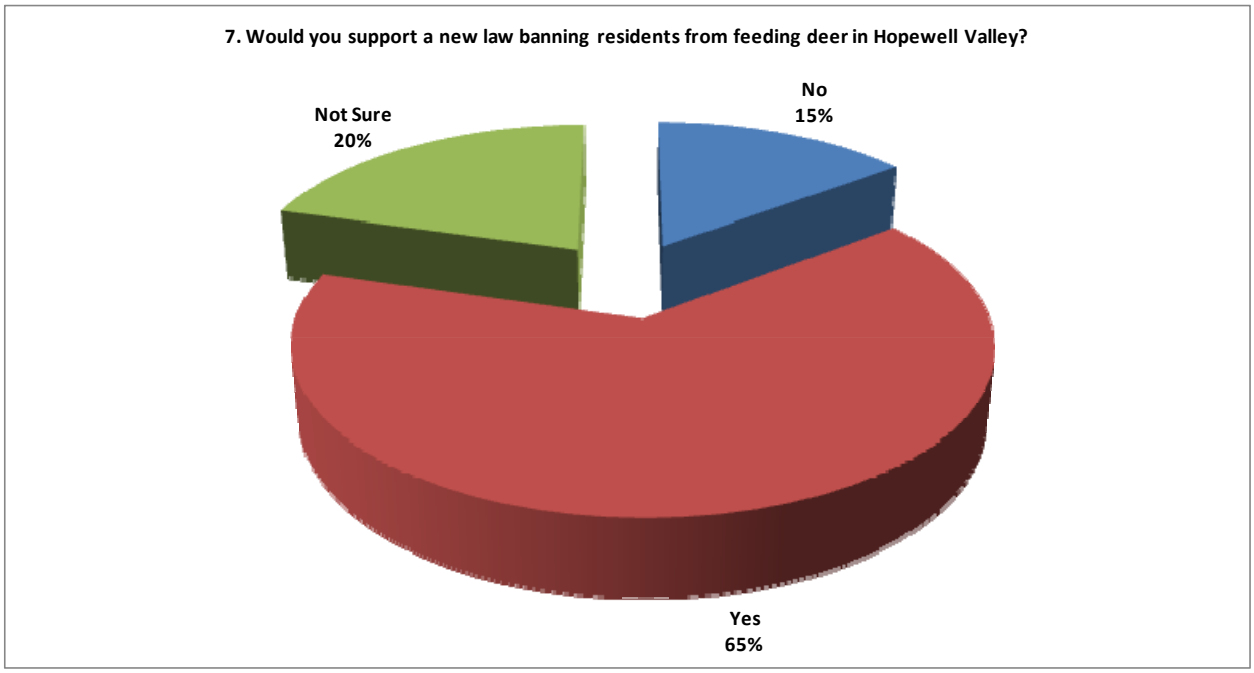

3. Follow-Up B: Was any collision serious enought to require hospitalization or visit to a doctor's office?
Yes
6%
No
94%

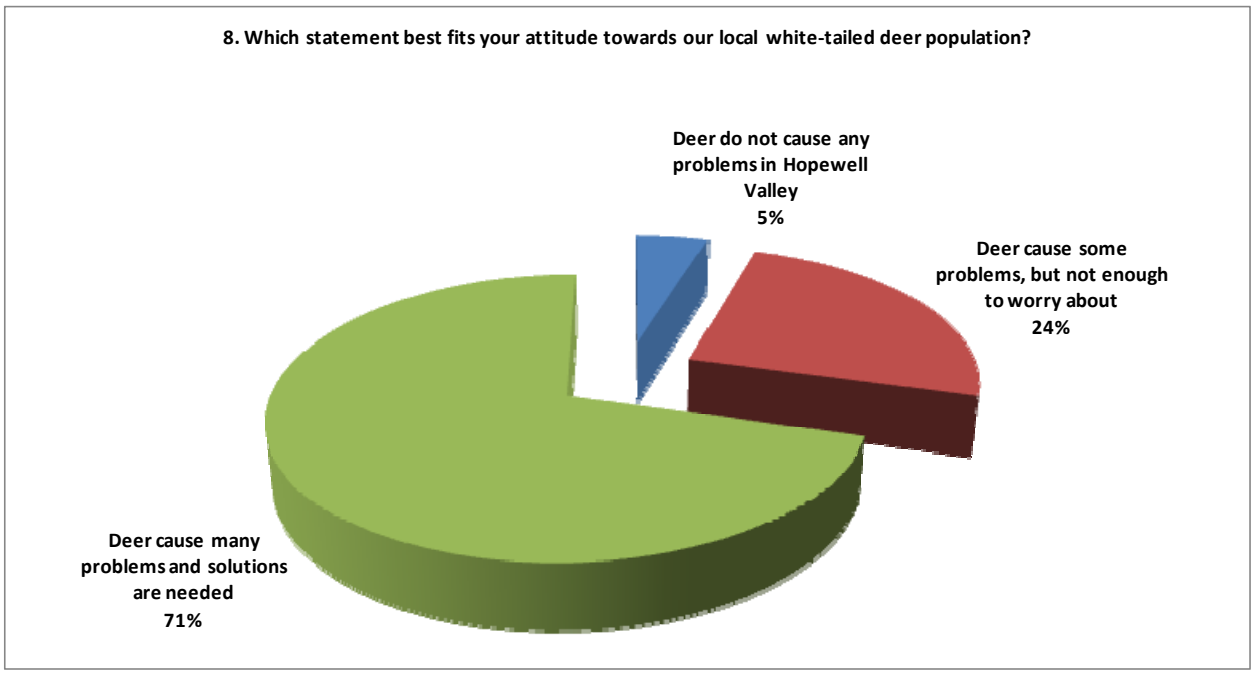

4. Do you experience damage to your landscaping?
No Damage
15%
Minor Damage
30%
Moderate Damage
31%
Severe Damage
24%

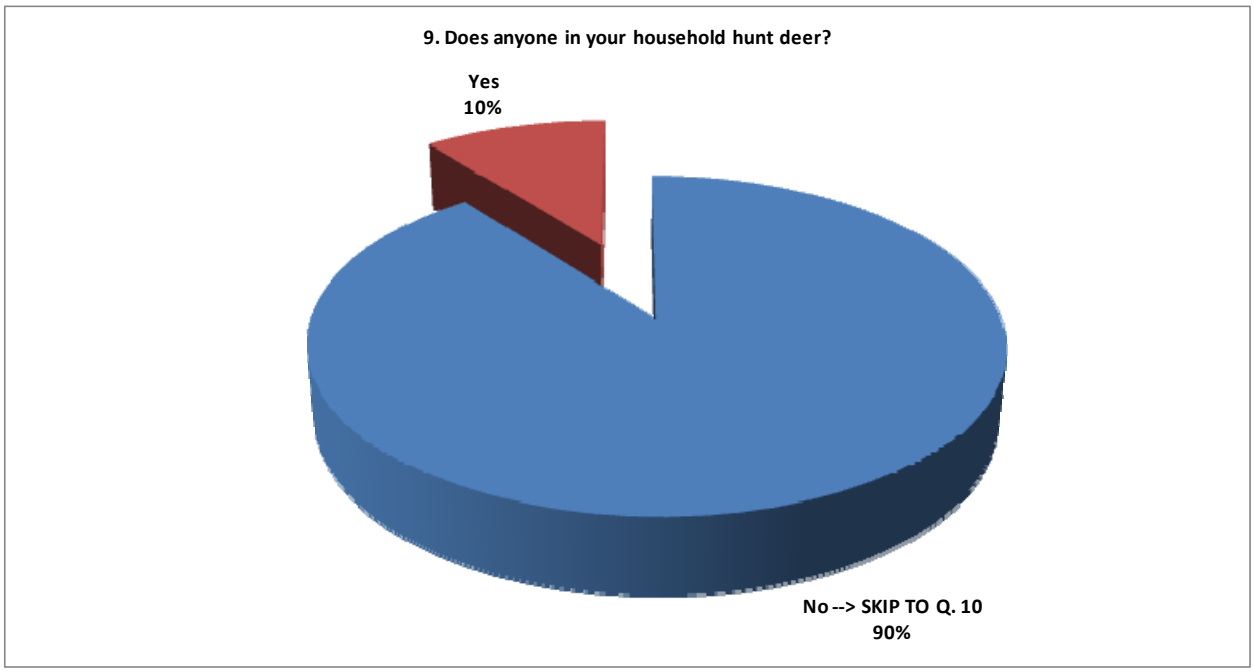

4. Follow-Up A: Do you use fencing or other repellents to protect your landscaping?
No
40%
Yes
60%


5. Have deer created a problem with your bird feeder?
Don't have feeders
30%
No
53%
Yes
17%

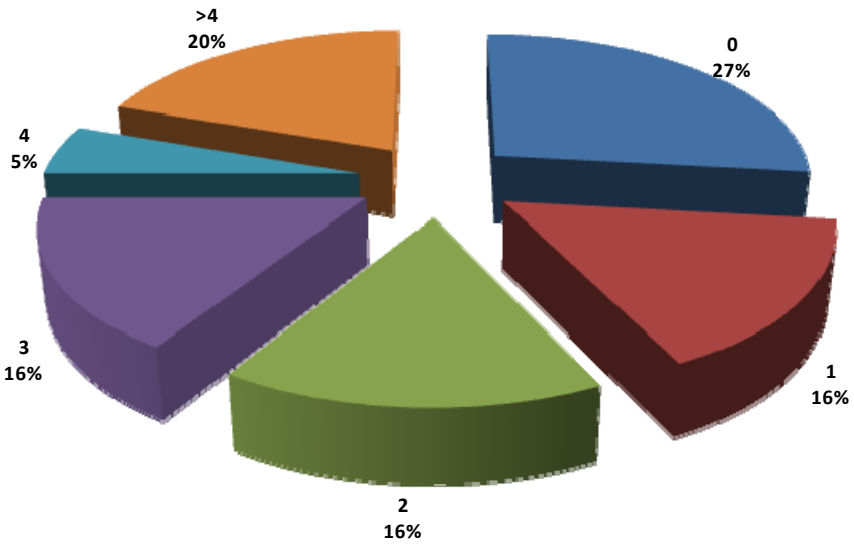

6. Do you feed the deer with corn or any other supplements?
Yes
4%
No
96%


7. Would you support a new law banning residents from feeding deer in Hopewell Valley?
No
15%
Not Sure
20%
Yes
65%

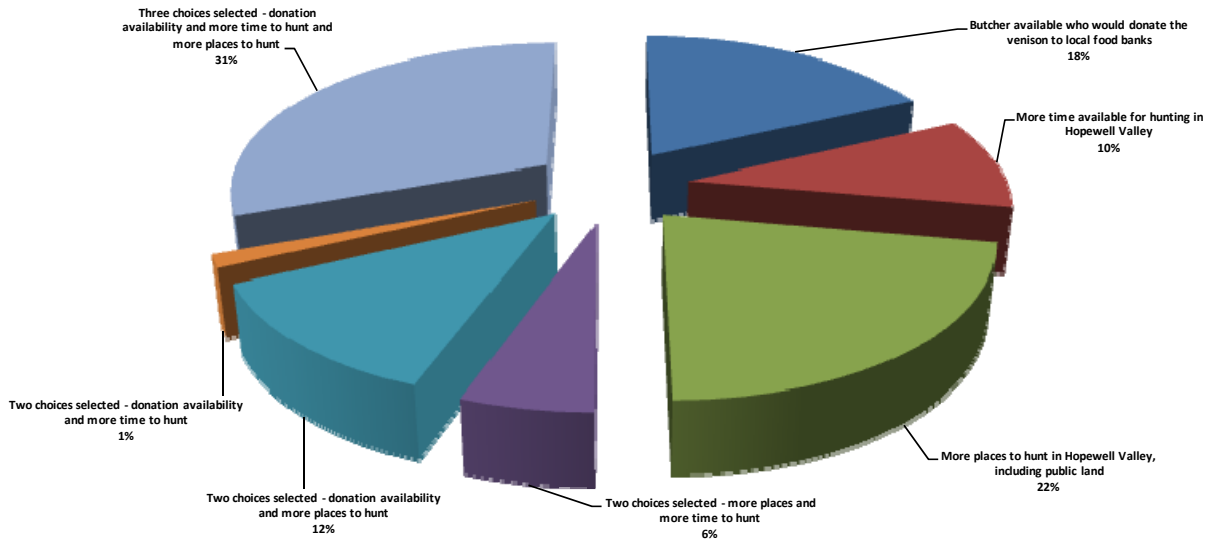

8. Which statement best fits your attitude towards our local white-tailed deer population?
Deer do not cause any problems in Hopewell Valley 5%
Deer cause some problems, but not enough to worry about 24%
Deer cause many problems and solutions are needed 71%

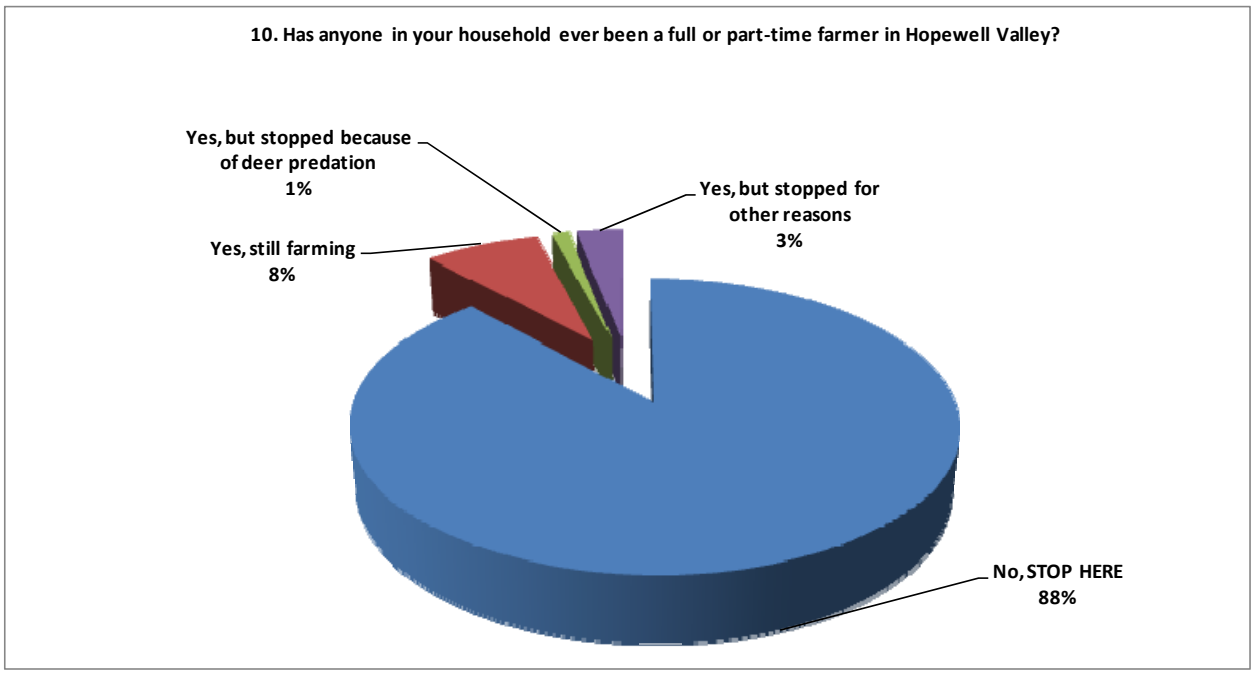

9. Does anyone in your household hunt deer?
Yes 10%
No --> SKIP TO Q. 10 90%

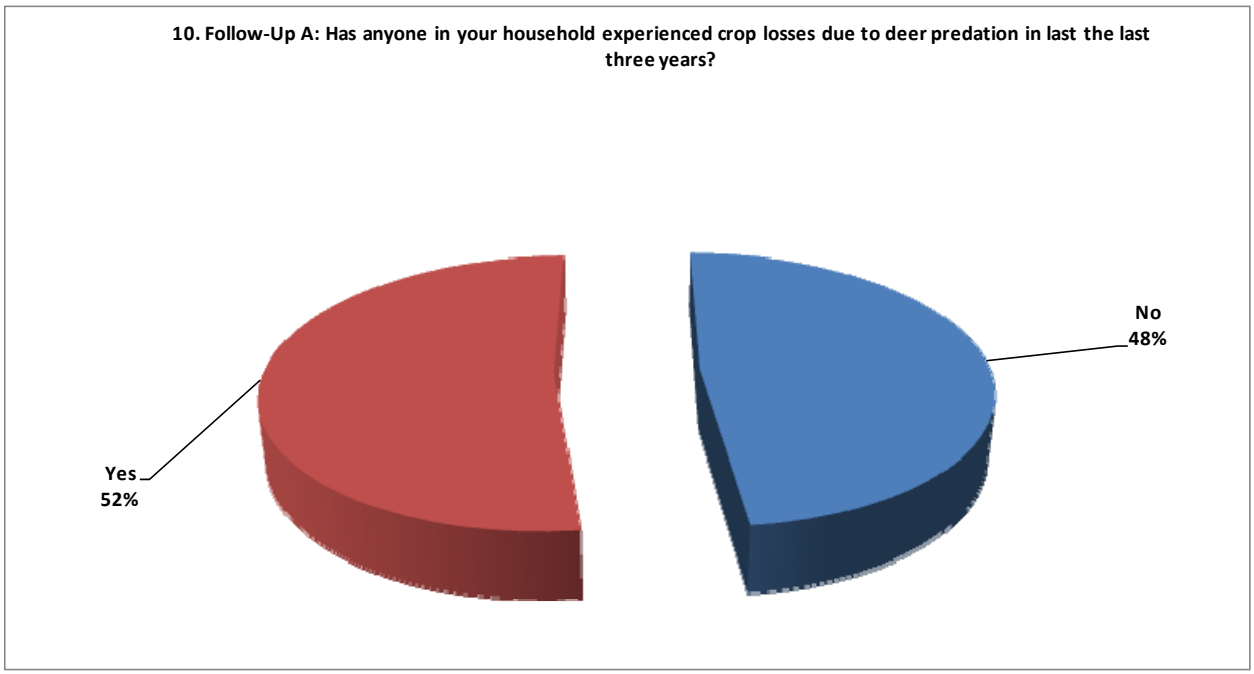
9. Follow-Up A: How many Hopewell Valley deer are usually taken by hunters in your household each year? (Open Question)

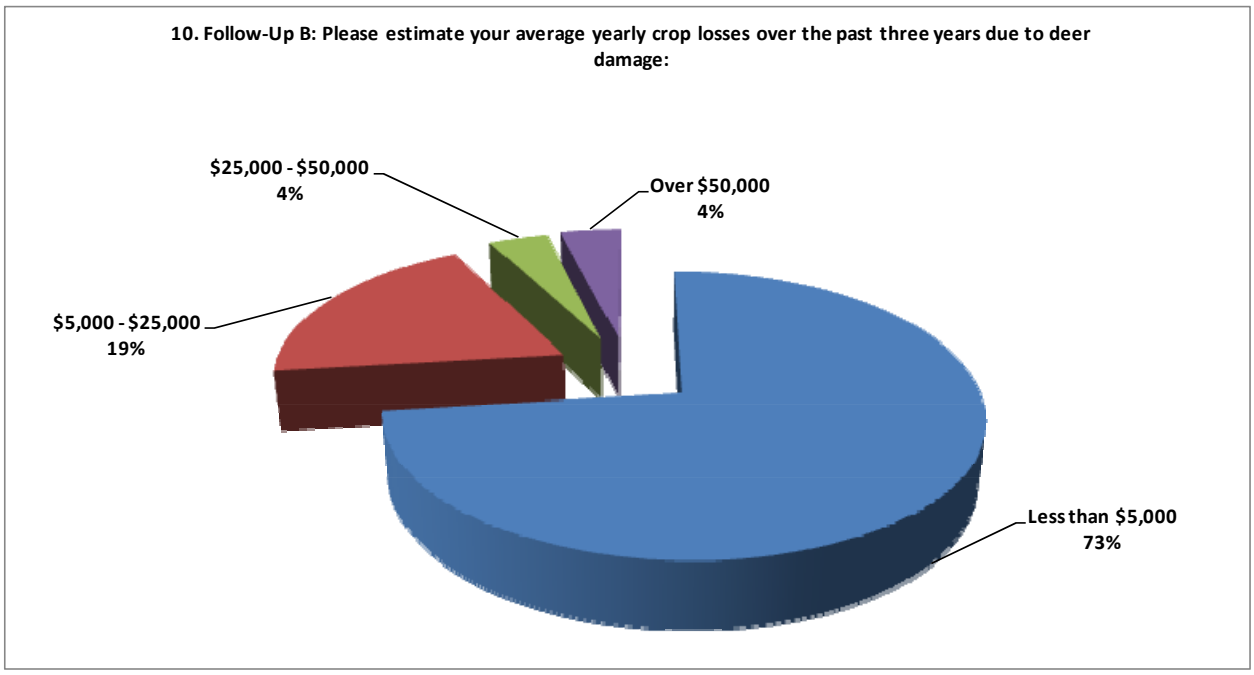


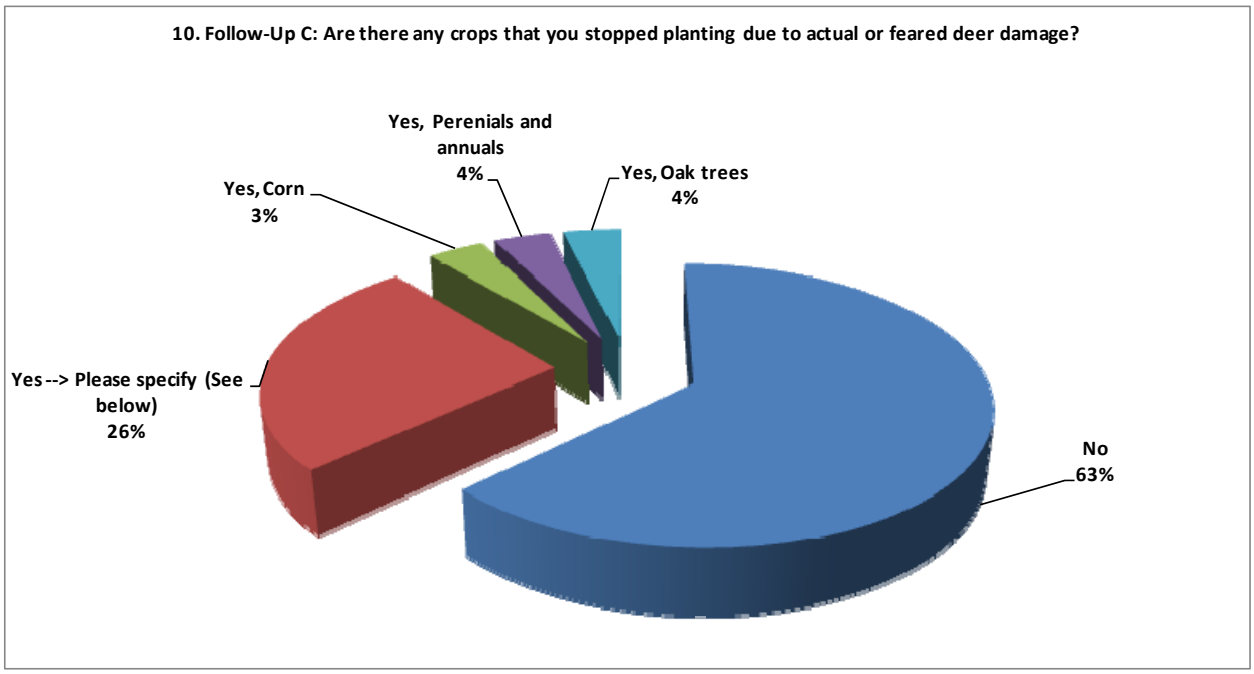
9. Follow-Up B: What factors might lead hunters in your household to take more deer in HV (Check all that apply)? (Three response choices in bold were provided, but results of all combinations are reported below.)

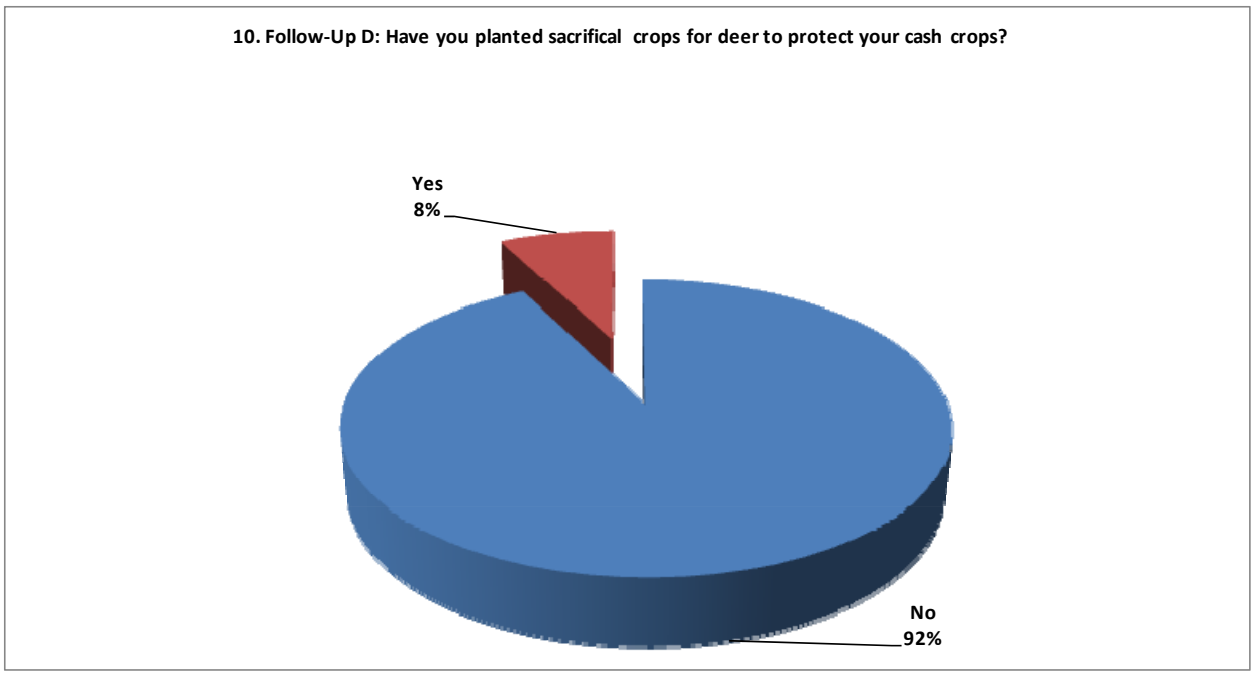


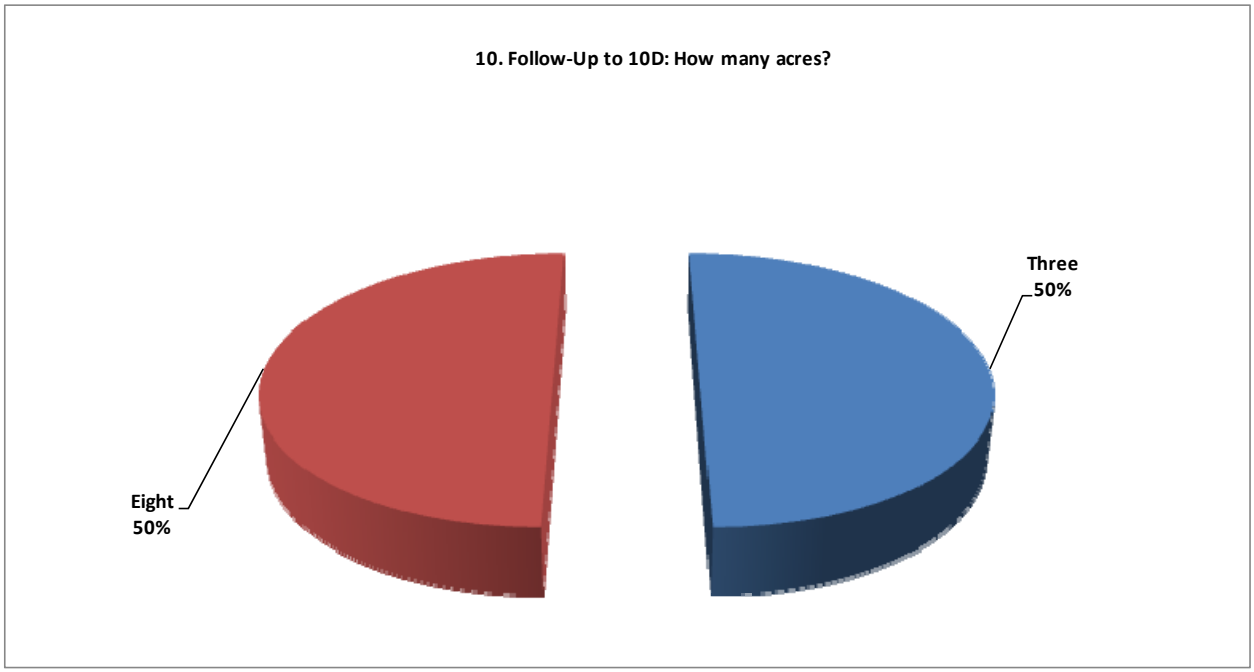

10. Has anyone in your household ever been a full or part-time farmer in Hopewell Valley?
Yes, but stopped because of deer predation 1%
Yes, but stopped for other reasons 3%
Yes, still farming 8%
No, STOP HERE 88%

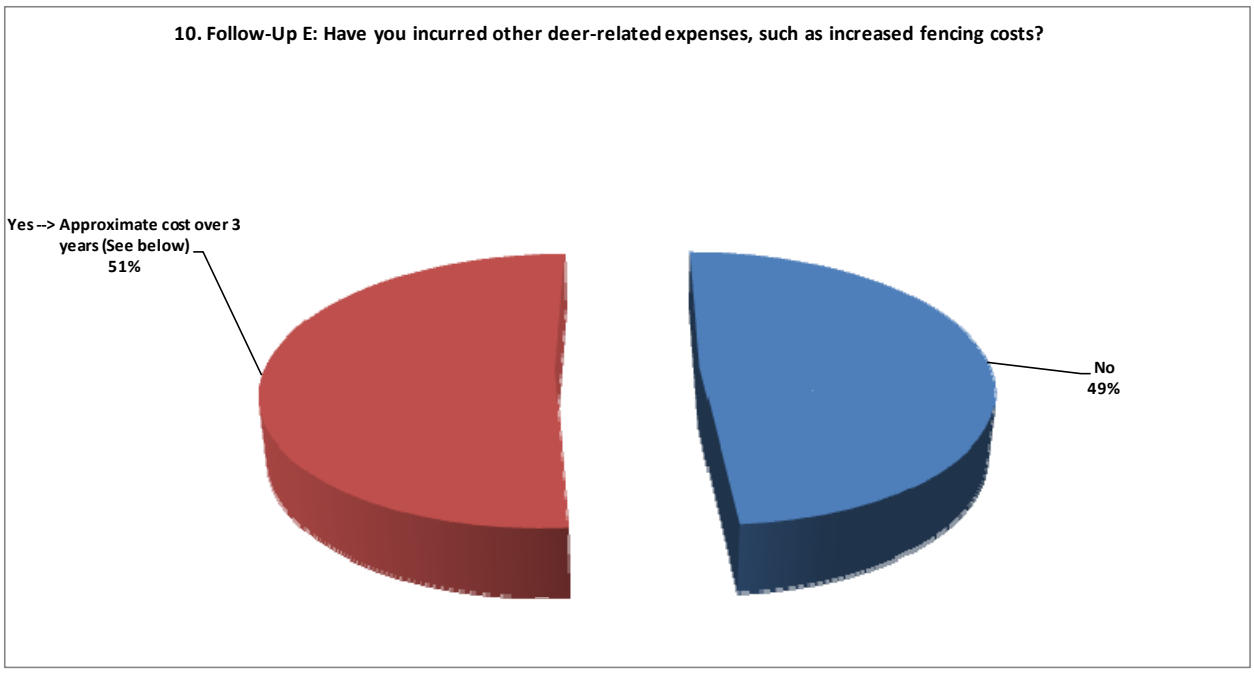

10. Follow-Up A: Has anyone in your household experienced crop losses due to deer predation in last the last three years?
No 48%
Yes 52%

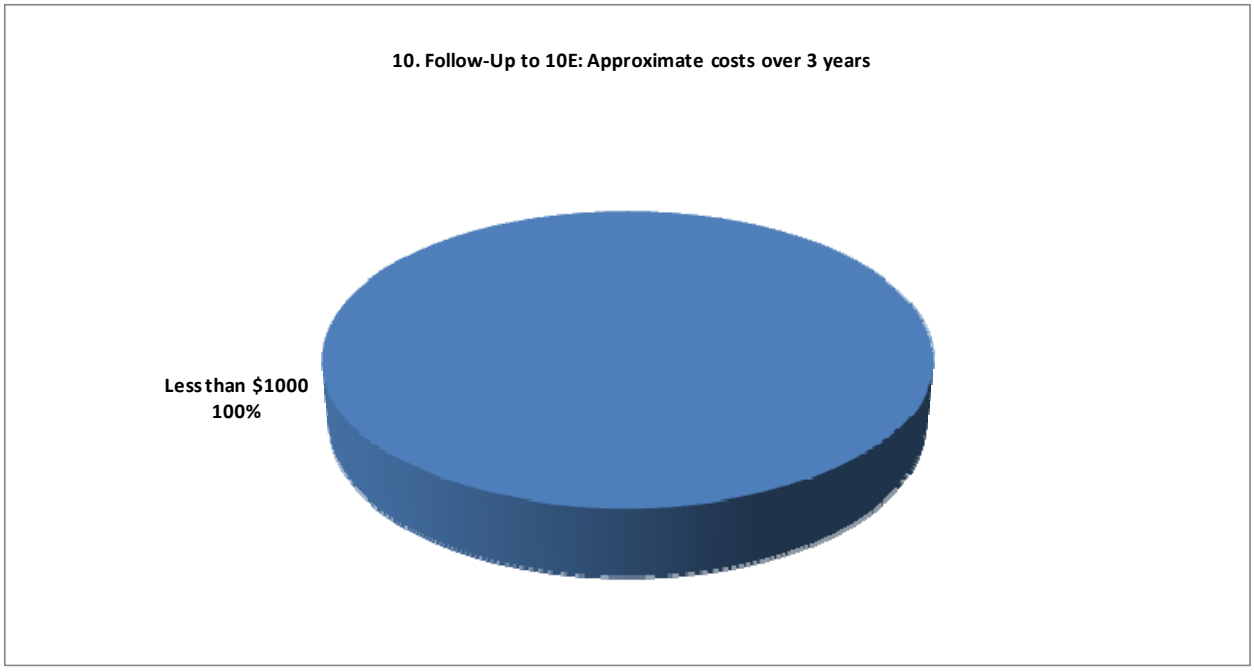

10. Follow-Up B: Please estimate your average yearly crop losses over the past three years due to deer damage:
$25,000 - $50,000
4%
Over $50,000
4%
$5,000 - $25,000
19%
Less than $5,000
73%

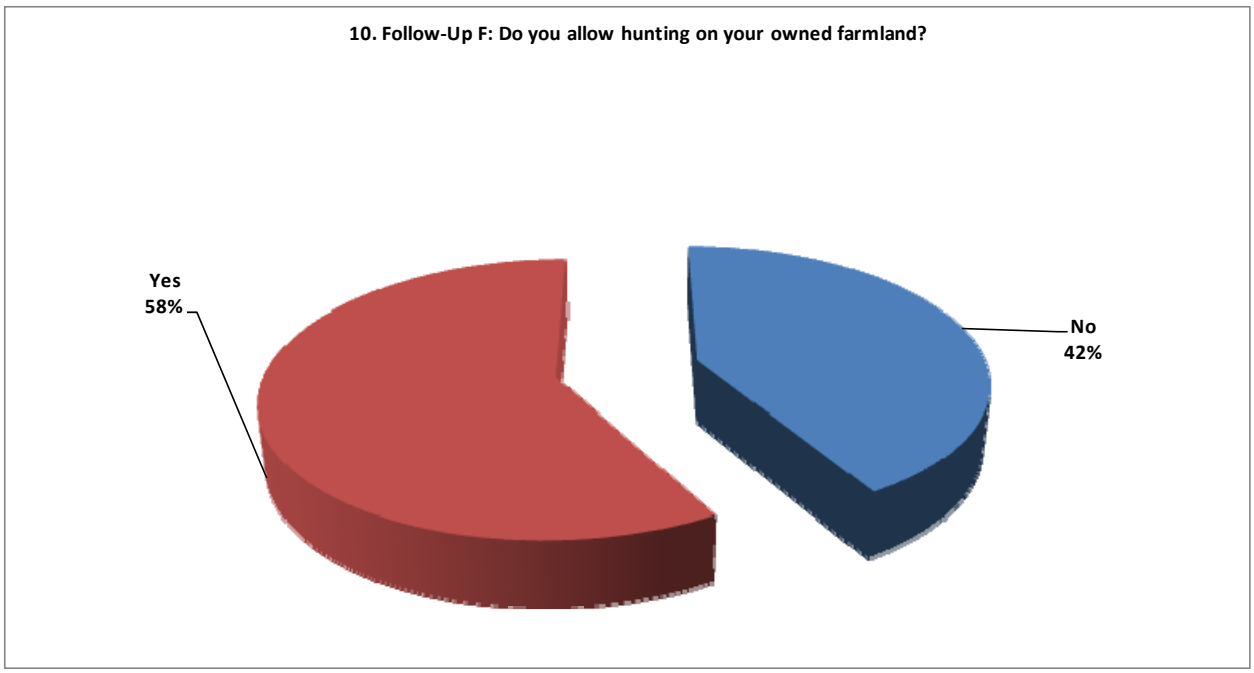

10. Follow-Up C: Are there any crops that you stopped planting due to actual or feared deer damage?
Yes, Perenials and annuals
4%
Yes, Oak trees
4%
Yes, Corn
3%
Yes --> Please specify (See below)
26%
No
63%

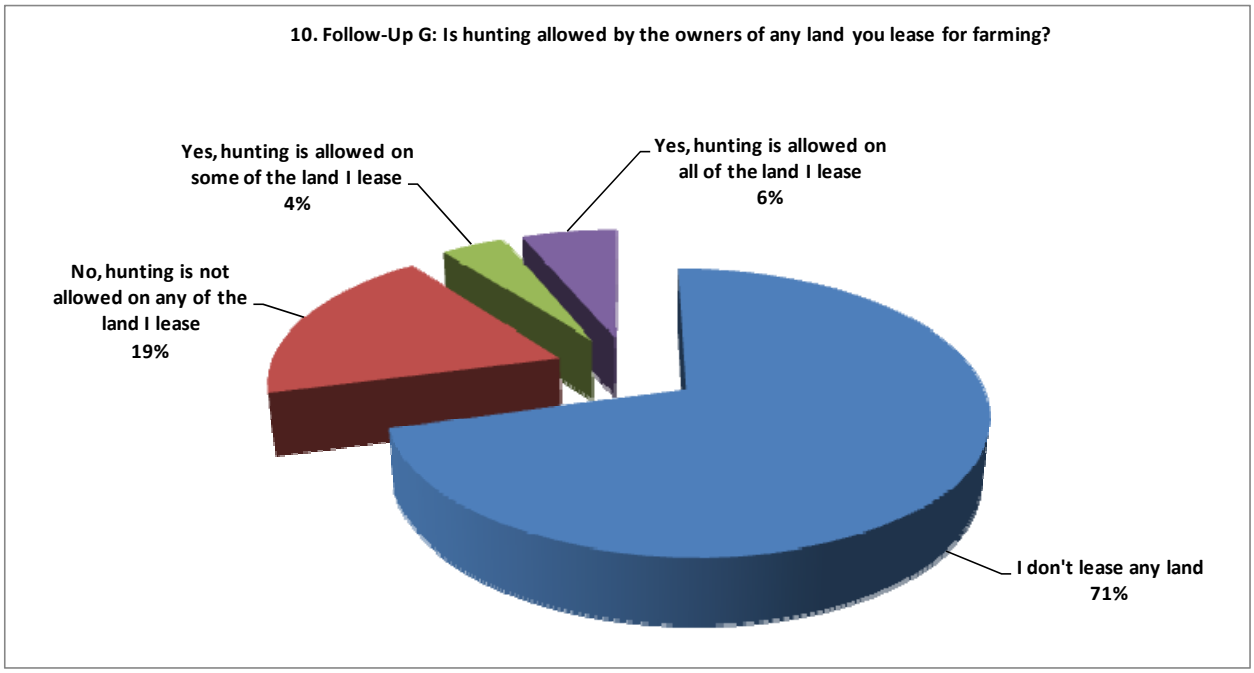

10. Follow-Up D: Have you planted sacrifical crops for deer to protect your cash crops?
Yes
8%
No
92%

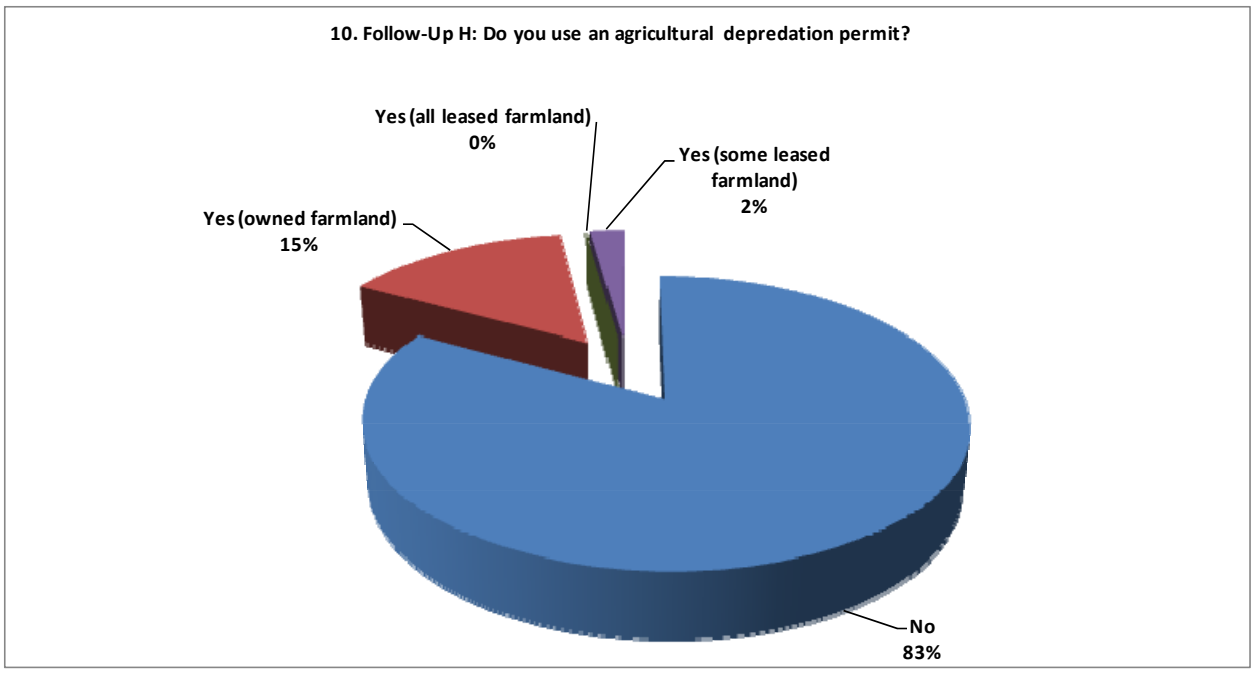

10. Follow-Up to 10D: How many acres?
Three
50%
Eight
50%


10. Follow-Up E: Have you incurred other deer-related expenses, such as increased fencing costs?
Yes --> Approximate cost over 3 years (See below)
51%
No
49%


10. Follow-Up to 10E: Approximate costs over 3 years
Less than $1000
100%


10. Follow-Up F: Do you allow hunting on your owned farmland?
Yes
58%
No
42%


10. Follow-Up G: Is hunting allowed by the owners of any land you lease for farming?
Yes, hunting is allowed on some of the land I lease
4%
Yes, hunting is allowed on all of the land I lease
6%
No, hunting is not allowed on any of the land I lease
19%
I don't lease any land
71%


10. Follow-Up H: Do you use an agricultural depredation permit?
Yes (all leased farmland)
0%
Yes (some leased farmland)
2%
Yes (owned farmland)
15%
No
83%