Westchester Citizens' Task Force on White-tailed Deer & Forest Regeneration

October 28, 2008

Hon. Andrew J. Spano, County Executive
County Office Building
148 Martine Avenue
White Plains, New York 10601

Re: Final Report of Citizens' Task Force on White-tailed Deer and Forest Regeneration

Dear County Executive Spano:

I am pleased to enclose the Final Report of the Westchester Citizens' Task Force on White-tailed Deer and Forest Regeneration. In February 2006 you appointed the Task Force to study the impact of deer on Westchester's environment, and to make appropriate recommendations. I was appointed to chair this Task Force of distinguished members, including governmental representatives from New York State, New York City, Westchester County, and various Westchester towns, and from environmental and other private organizations, and private citizens.

The Task Force has worked long, diligently and well. The expertise, professionalism and devotion of Task Force members has been extraordinary, and staff support has been excellent. The Task Force has met virtually monthly and sometimes more often to assess the incidence of White-tailed deer in Westchester, and to analyze their impact on Westchester's forests, green areas, and gardens, and on related environmental areas.

We have had presentations from experts in deer management from other areas, including Connecticut and New Jersey, and the United States Forest Service. We have combed the scientific literature on the subject, including over 30 applicable case studies, and have included in an appendix six case studies from programs in Maryland, Minnesota, Wisconsin, and New Jersey, and from our own Mianus River Gorge Preserve and the Town of Pound Ridge. The Report's Bibliography includes over 45 articles and websites.

We surveyed and set forth applicable New York State and County laws and regulations on deer. We made field visits to sites in the County with deer enclosures, to compare the trees and vegetation in areas where deer roam free to those where they cannot. We also reviewed the 1991 Westchester County White-tailed Deer Study Committee Report.

Using democratic, open procedures, I have encouraged, and received, full and free expression of Task Force members on each aspect of the subject. Drafts of the report or parts

thereof have been subjected to careful scrutiny, discussion and amendment. I believe the resulting Final Report is a thorough and excellent document which supports action now.

Our conclusion, found on page 6 of the Report, is:

> **[In Westchester] the lack of forest regeneration, the severe impact on biodiversity, the threat to water quality, and other detrimental ecological impacts, call for immediate action. The Task Force sets forth urgent recommendations in four areas: Deer management and monitoring, public education, legislation and funding, and the establishment of a public-private partnership for an adaptive deer management program.**

An infrared aerial survey of White-tailed deer in the Kensico Reservoir watershed basin, which is at least 90% accurate, showed an average density of 25 deer per square mile, far too high. A Spring 2008 deer pellet and browse impact survey, with comparable accuracy, led by Pennsylvania wildlife analysts and using 36 state and local foresters in Ward Pound Ridge Reservation, Westchester's largest park (4315 acres), indicated an average density of 63.7 deer per square mile, and no forest regeneration in 91.5% of the plots studied. The report concluded that "The deer density was the highest observed by either presenter, anywhere, on continuously forested areas throughout New York, Pennsylvania, Maryland and Vermont, in over 10 years of such work." It put the "ecologically viable levels" for the reservation at 5-10 deer per square mile, and said the deer population must be reduced accordingly (The Ward Pound Ridge Survey is Appendix 2 to the report).

Deer hunting and culling has successfully managed deer density on private Rockefeller lands for years, in 2007 on Rockefeller State Park Preserve areas, and in 2008 on town lands in Pound Ridge, by Town permit. Hunting and culling has been through archery.

The Task Force has concluded that other deer management techniques--trap and transfer, encouragement of deer predators, immunocontraception and sterilization--fall far short for many reasons, including impracticality, illegality, impermanence, high expense, and unsuitability for large scale use.

An important difference in this Report from the 1991 Report is our recommendation to expand recreational hunting and planned culling of White-tailed deer in Westchester County, through opening to hunting and/or culling additional forests and large green areas in Westchester that are owned by the State or by New York City, and to change Westchester's laws and ordinances to allow hunting in appropriate County tracts. We recommend specifically that the County law be amended to allow hunting in a minimum of three County Parks, including Ward Pound Ridge Reservation, Muscoot Farm/Lasdon Arboretum, Mountain Lakes Park, and Blue Mountain Park. Recreational hunting and culling has been, and is recommended to be, by bow hunting only, except under "nuisance" damage permits.

We also stress the need for an ongoing adaptive deer management program, a public-private partnership of a broad and diverse group of participants like this Task Force, guided

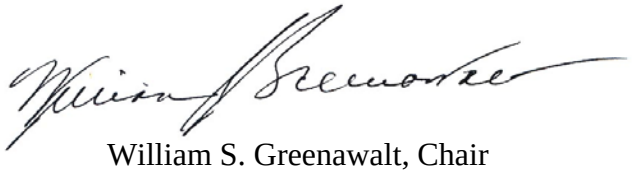
by the County, with members from the State DEC, New York City's DEP, local governments, and private groups and individuals. This program would collect data and written and personal inputs from here and elsewhere, evaluate the success of measures in place and the likely success of other measures, encourage collection of deer population figures through air and land surveys, broaden outreach on deer through public education and conferences, and seek public and private monies to strengthen deer management in Westchester County.

Public education about the impact of deer on Westchester is important. Direct deer-human conflicts are increasing, and deer threaten many gardens, but our attitudes toward deer should also be shaped by concern for our forests, ecosystem, and regeneration. Legislation and public funding of an adaptive management program are vital to bring about the changes called for in the Report. This is a serious challenge to Westchester's ecological vitality and it must be met.

I am prepared to appear and present this Report, and to discuss our work and the issues, with the County government and with public and private audiences with an interest in this problem. I know Task Force members are also eager to carry this effort forward.

It has been a privilege to serve as Chair of the Citizens' Task Force. The health and regeneration of our forests are a vital important aspect of our beautiful county. We hope the measures recommended will be implemented, to provide protection for our environment and health, and a gift to future generations.

Sincerely yours,



William S. Greenawalt, Chair
Citizens' Task Force
on White-tailed Deer and
Regeneration

Enclosure

Citizens' Task Force on White-tailed Deer and Forest Regeneration

Final Report

November 1, 2008

William S. Greenawalt, Esq., Task Force Chairman
Chair, Westchester County Parks, Recreation, and Conservation Board

Jan Blaire, Irvington Environmental Conservation Board

Roderick G. Christie, Executive Director, Mianus River Gorge Preserve

Kevin Clarke, Wildlife Biologist, New York State Department of Environmental Conservation,(NYSDEC)

Steve Cook, Retired, NYSDEC

Carolyn Cunningham, Co-Treasurer, Federated Conservationists of Westchester County

Gina D'Agrosa, Water Master, Westchester County Department of Planning

Doug Erickson, President, Westchester Bow Hunter's Association

Nathan Ermer, Wildlife Biologist, NYSDEC

Fred Gliesing, Forest Coordinator, New York City Department of Environmental Protection

William C. Harding, Executive Director, Watershed Protection and Partnership Council, New York State Department of State

Beth Herr, Program Administrator, Conservation, Westchester County Department of Parks, Recreation and Conservation (WCPRC)

Fred Koontz, Executive Director, Teatown Lake Reservation

Diane Lowry, Greenburgh Deer Committee

Jeff Main, Senior Curator, WCPRC

George Morrison, Representing Assemblywoman Sandy Galef, 90th Assembly District, Westchester Homeowner

Constance Porter, Greenburgh Deer Committee

Jon G. Powers, Deputy Supervisor, Town of Pound Ridge

Laura Simon, Field Director, Urban Wildlife Program, Humane Society of the United States
(She disagrees with the deer hunting recommendations in this report; the HSUS believes that the lethal management strategies described do not provide a humane, justifiable, or efficient way to achieve biodiversity goals)

Angelo Spillo, Adjunct Lecturer and Director, Pace University Environmental Center

The following also contributed to the discussion but did not participate in the final writing of the report:

Peter Harckham, Westchester County Legislator

Ursula LaMotte, Former Westchester County Legislator

Jack Robbins, Retired Deputy Commissioner, Conservation, WCPRC

Staff Support

Patricia Infante, WCPRC

Presenters to the Task Force

Tim Gordon, Business Administrator, Millburn Township, New Jersey

John Hannon, former President, Bedford Audubon Society

Ted Kozlowski, Coordinator of Natural Resources, County Forester, WCPRC

Dr. Oswald Schmitz, Oastler Professor of Population and Community Ecology, Yale School of Forestry and Environmental Studies

Susan Stout, Research Project Leader USDA Forest Service, Northeastern Research Station

Deer Task Force Report Outline

Appendices

FINAL REPORT

CITIZENS' TASK FORCE ON WHITE-TAILED DEER AND FOREST REGENERATION

I. EXECUTIVE SUMMARY

The Citizens' Task Force assessed the impacts of white-tailed deer (*Odocoileus virginanus)* on the local environment for the purpose of making recommendations to reduce conflict between people and deer and to protect Westchester's biodiversity. A special focus was placed on examining the role of deer on the ecological health of Westchester's forests, which appear to be at risk because few native tree saplings are surviving. The Task Force was appointed by County Executive Andrew J. Spano in February 2006, and included members that collectively brought significant expertise and a wide variety of perspectives to the team.

The Task Force reviewed information from a diversity of sources, including: scientific literature; New York State hunting data; scientist and expert interviews; laws and regulations; an opinion survey of town supervisors; over 30 applicable case studies, and field visits to compare unfenced habitat and areas excluded of deer by fencing. In addition, the Task Force built on the solid foundation provided in the 1991 Westchester County White-tailed Deer Study Committee Final Report.

After two years of review, this Task Force points out the complexity of precisely quantifying deer impacts on our local environment, specifically forest regeneration. This is counter to our more certain understanding of deer impacts on humans. For example, we can chart the reported economic costs of automobile-deer collisions and the value of damaged ornamental plants gardened in our yards. The causal relationships between deer densities and forest regeneration are much less understood. This is due to the fact that deer are one component of a natural system, a web of abiotic and biotic factors (e.g. acid rain effects, destructive invasive, non-native plants and animals, and other factors) that together interact to create the environment that emerges around us.

Despite this complexity, the Task Force concludes that there is clear evidence that Westchester's forests are threatened by the overabundance of white-tailed deer.

Consequently, the lack of forest regeneration, the severe impact on biodiversity, the threat to water quality, and other detrimental ecological impacts, call for immediate action. The Task Force sets forth urgent recommendations in four areas: Deer management and monitoring, public education, legislation and funding, and the establishment of a public-private partnership for an adaptive deer management program.

II. INTRODUCTION

Westchester County Executive Andrew J. Spano announced in February 2006 the formation of a "Citizen Task Force…to examine the problem of deer overpopulation…to include the New York City Department of Environmental Protection…and New York State Department of Environmental Conservation …and representatives from some of those communities most affected by deer depredation."

Additionally the Citizens' Task Force was in part a response to a letter written by the conference organizers of "Conversations on Conservation: White-tails in Westchester County" held at Pace University on November 18, 2005. At that conference, the participants urged that a comprehensive review of deer impacts on Westchester's forests and biodiversity was needed.

A similar effort was concluded in 1991. In response to the concerns of county residents and at the request of the Westchester County Board of Legislators, County Executive Andrew O'Rourke created a committee to study deer impacts in Westchester and summarize its findings in a report. Since that report was written, more research has been done in the Northeast, prompted by concern over lack of forest regeneration. This reexamination of the complex issues regarding deer is timely and can now be supported by the latest scientific research and deer management experiences of other communities across the nation over the past fifteen years.

The primary mission of this Task Force was to examine the impacts of white-tailed deer on forests, and to make recommendations for improved deer management for forest

regeneration and native biodiversity. The report also contains information on other important human/deer issues and appropriate mitigation measures. This report builds on the 1991 study, and additionally recommends action at all levels of government.

III. BACKGROUND: LIVING WITH DEER; STRATEGIES AND LESSONS LEARNED

A. Introduction

Westchester County's population growth over the last four decades has fueled sprawling suburban development with much conversion of natural lands and an increased number of automobiles and roads. At the same time, white-tailed deer numbers have increased to the point where there is concern that they are negatively impacting local biodiversity, causing significant economic losses to landowners, and presenting safety hazards to motorists.

The most serious impacts of deer on Westchester County's flora, fauna, and ecosystems result from browsing of plants for food. Deer consume an average of 4 to 8 pounds of forage per day; one deer can eat one ton of vegetation annually. A growing number of Westchester and New York State biologists believe that heavy deer browsing exacerbates the effects of other human-created impacts on the environment such as habitat loss, invasive species proliferation, soil degradation and erosion, acid rain, and pesticides – which together jeopardize the survival of many wildflowers, hinder regeneration of trees and other plants, and potentially threaten important ecological services (e.g. quality of drinking water supplies) provided by healthy forests.

The ability of deer to adapt to suburbanized landscapes and co-exist with people has created new challenges for environmental managers and Westchester County residents. Some experts posit that no other aspect of wildlife management is as visible to the public as the deer-human conflicts that currently are occurring in North American cites and suburbs (Cornicelli et al. 1993). Deer populations and deer-human conflicts are increasing due to a combination of factors, including: 1) more development of wildlife habitat into suburban landscapes; 2) the "edge" intermix of yard and forest plus the high forage value of

ornamental plant laden suburban landscapes, which translate into prime deer habitat; 3) the high reproductive potential of well-nourished deer, and their ability to exist at high densities where impacts are noticed; and 4) the bisecting of wildlife habitat with more roadways.

More about white-tailed deer biology and how it relates to the suburban ecology of Westchester County can be found in Appendix 1: White-tailed Deer Ecology.

B. Deer in Westchester County

The first question asked when deer overabundance issues are examined is how many are there. Deer density in Westchester County's forest/suburb ecological matrix is surprisingly difficult to measure accurately. The deer's secretive habits, forest canopy cover, and rugged terrain of our region preclude exact counts.

In the absence of exact population counts, analyzing deer harvest data is used by the New York State Department of Environmental Conservation (NYSDEC) as an index to characterize population trends. Table 1 shows the number of deer taken by hunters as tracked by the NYSDEC. The increase in the number of deer management permits is indicative of NYSDEC's efforts to increase deer harvest. NYSDEC recognizes the impact of deer in Westchester County.

Table 1: Deer Harvest and Hunting Data through 2006

Year	Antlered Harvest	Total Harvest	**Deer Management Permits Issued**	# of Licensed, Westchester Resident Archery Hunters	# of Deer Damage Permit Applicants	Deer Taken with Deer Damage Permits
1990	753	1133	1870	n/a	n/a	n/a
1991	423	1079	3000	n/a	n/a	n/a
1992	550	2070	4385	n/a	n/a	n/a
1993	476	1522	4695	n/a	n/a	n/a
1994	494	1543	4989	n/a	n/a	n/a
1995	498	1558	4342	n/a	n/a	n/a

1996	603	1713	4059	n/a	n/a	n/a
1997	548	1508	4023	n/a	n/a	n/a
1998	556	1448	3739	n/a	n/a	n/a
1999	665	1594	3532	n/a	n/a	n/a
2000	594	1560	3361	n/a	n/a	n/a
2001	682	1571	3551	n/a	n/a	n/a
2002	559	1658	4505	4988	n/a	n/a
2003	557	1633	6645	4708	n/a	n/a
2004	638	1687	7091	4513	27	192
2005	587	1694	8608	4153	30	134
2006	596	1724	9050	3834	37	127

New technology has enabled the collection of more accurate population data. The New York City Department of Environmental Protection (NYCDEP) performed an aerial infrared survey of white-tailed deer in February and March of 2006 to assess deer densities. The survey used forward- looking infrared affixed on wing aircraft and covered 25.2 square miles of the Kensico Reservoir watershed basin. The area included deciduous and conifer forest cover, open fields and meadows, and developed areas (residential and commercial). The study area included the county airport, which actively controls deer numbers by special federal and state nuisance permits, and is bisected by several roadways. The survey showed a total of 547 deer with an average density of 25 deer per square mile, ranging from 5 to 69 deer per square mile. Even with the infrared technology, however, the industry can only guarantee 90% accuracy in deciduous forests and considerably less in coniferous cover.

Estimating deer density and browse impacts on forests can be accomplished at ground level to within one percent accuracy of aerial infrared survey data. The protocol for ground surveys includes deer pellet and browse impact counts from 4' radius plots at 100 ft. intervals on one mile transects (deCalesta 2006).

On April 8, 2008 a deer pellet and browse impact survey was conducted by 36 state and local foresters led by Pennsylvania wildlife analysts in Ward Pound Ridge Reservation

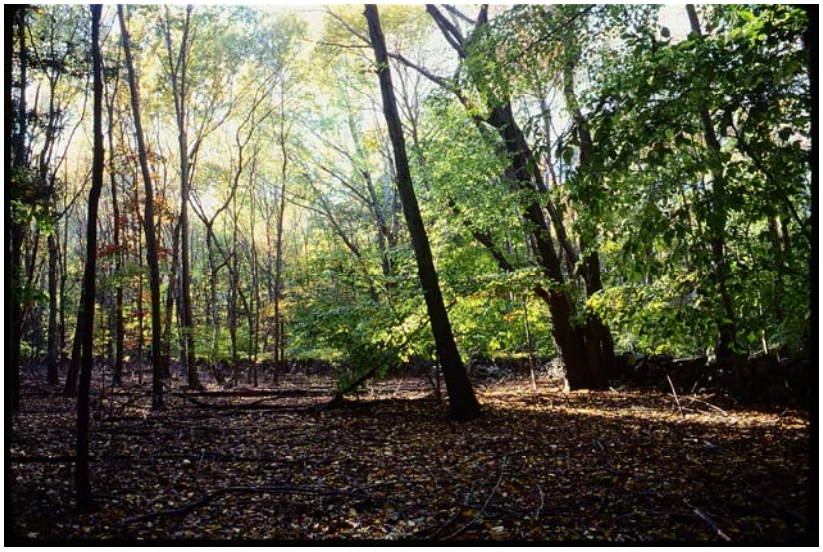
(WPRR) Westchester County's largest park at 4,315 acres. The data collected indicated a deer density of 63.7 deer per square mile. The deer browse survey suggested severe impacts, with 91.5% of plots showing no regeneration. The report in part concluded: "The deer herd within WPRR must be brought down to ecologically viable levels; on the WPRR this density is in the 5-10 deer per square mile range…The ecological cost of not achieving deer herd reduction is collapse of the ecosystem. This deer density was the highest observed by either presenter, anywhere, on continuously forested areas throughout New York, Pennsylvania, Maryland and Vermont, in over 10 years of such work" (Appendix 2).

Any single deer count or assessment is simply a snapshot of a particular time. The best approach to quantify deer impacts is to establish long term monitoring programs with repeated surveys of browse levels, target seedlings, understory, and biodiversity. These tools can also serve as criteria to evaluate any deer management or habitat recovery program.

C. Deer Impacts on Our Forests and Ecological Health

Living with deer in Westchester County has expanded beyond simply a desire for co-existence between deer and people, but now extends to finding balance among deer, people, and <u>all</u> species of life. This concern has arisen out of many shared observations that point toward deer overabundance being largely (but not solely) responsible for decreases in the abundance of native plants and tree seedlings in forests, both on public and private lands.

Burgeoning deer populations cause significant impacts to forest systems by severe overbrowsing of the understory vegetation. Overbrowsing leads to reduced plant species diversity, restricted height development, a shift in the plant community to species tolerant of repeated browsing, and a change in the physical structure of forest habitat (Horsley et al. 2003). All this in turn negatively impacts wildlife diversity.



Distinct browse lines and lack of understory plants show deer browse impact (Mianus River Gorge).

White-tailed deer not only damage vegetation structure through direct browsing of established plants, they also indirectly affect vegetation by lowering the reproductive output of native plants and simultaneously distributing seeds of non-native species. Deer consume seeds of non-native invasive plants in disturbed or edge habitats, which are often adjacent to residential housing, and transport them into forested areas where these plants are not as prevalent (Williams et al. 2007). Once browse-resistant species become established, they can minimize the reestablishment of less browse-resilient species through physical competition and/or chemical interference (allelopathy). For example, an increase in hay-scented fern abundance, a browse-resistant species, has caused particularly strong interference with regeneration of hardwood trees (Horsley and Marquis 1993).

Lack of seedlings and shrubs caused by deer browsing creates deer savannahs (WPRR).

The legacy effect of long term over-browsing can be "deer savannahs" or "deer parks." These aesthetically pleasing but biologically destitute areas are characterized by higher densities of ferns and grasses (species not preferred by deer) or park-like habitats of large trees completely lacking an understory, allowing extensive visibility for long distances (Rooney 2001).

Such drastic changes in forest structure can impact wildlife. Species richness and abundance declined significantly for intermediate canopy nesting birds on heavily browsed sites, with a number of species absent entirely from browsed areas (DeCalesta 1994). Casey and Hein (1983) found bird species nesting in forest understory and midstory at higher abundance on lightly-browsed sites versus heavily-browsed sites, with many species found exclusively on the lightly-browsed sites.

For those birds that actually succeed in fledging young within heavily-browsed areas, there is still concern. Viga-River et al. (1998) found that wood thrush (*Hylocichla mustelina*) seek shrubby, second-growth areas within the forest during the post-fledging stage to take advantage of heavier cover and food sources available in these areas. Young fledglings lacking adequate areas close to the nest site face a greater predation risk as they move longer distances in search of cover and food.

McShea and Rappole (2000) studied density and diversity of vegetation and birds for nine years at eight sites, four of which were fenced to exclude deer. Both the density and diversity of understory woody plants increased following the exclusion of deer. Bird populations also increased, particularly for ground and intermediate canopy species.

A local study at Mianus River Gorge Preserve in Bedford, comparing data from 1965-2004, indicates that deer are an important factor in preventing the regeneration of the hemlock forest, contributing to declines in species richness and total stem density, making long term persistence of the hemlock-dominated forest unlikely (Weckel et al. 2006). More about this effort is included in Appendix 6: Case Studies Illustrating Current Practices, and Lessons Learned.

Task Force members visited the 13-year-old deer exclosure at Lasdon Arboretum in Somers, which clearly illustrates the difference in plant diversity, numbers, understory, and saplings in areas with and without deer.

Effects of browsing by the white-tailed deer are clearly highlighted by the 13-year deer exclosure fence at Lasdon Arboretum.

The link between deer and forest health has only recently been broadly discussed in Westchester. In other parts of the Northeast, research scientists, forest managers, timber companies and others have been grappling with a range of forest growth issues related to deer, other pests, and diseases for several decades. Westchester County's forests are subject to a number of direct and indirect influences that together have created forest conditions that we see today. These influences run the gamut: herbivory by deer; non-native, invasive plants and animals (including insects); diseases; acid rain and other forms of pollution; patterns of development and land use; and climate change.

This picture, taken inside a deer exclosure in Bedford, New York, shows a healthy understory with plant regeneration.

Despite the scientific complexity of the issue and the many factors that influence these conditions, deer overabundance is having a demonstrated negative impact on the biodiversity and health of our native forests. Of special concern is that the loss of forest biodiversity brings compromised ecological systems and loss of natural integrity.

Deer can and do have a significant impact on our Northeastern forests. Although deer impacts can be very visible, and deer browsing can alter forest structure, single species management in itself is but one important component to manage a complex, multi-faceted problem. In certain instances deer have been shown to contribute to the control of the spread of certain invasive plants while helping the proliferation of others. While intensively managing one component of a forest, we need to be prepared for any potential negative side effects such as increased spread of certain invasive species. It is important to reiterate that this issue is complex and not just a "deer problem," but an issue to which human activities have contributed significantly.

D. Deer Management Concepts and Practices

Improving strategies for "living with deer" will require combining an informed understanding of community attitudes and values with science-based management principles and techniques. The starting point for refining deer management in Westchester County, or anywhere, is to clearly articulate goals and objectives. What does the program hope to accomplish? How will success be monitored and measured? A number of factors contribute to setting goals and objectives for deer management programs. For example, managers typically consider the status of the deer herd and habitat quality characteristics. Equally important is to have an understanding of stakeholder values and attitudes, and deer impacts on the entire ecosystem (Decker et al. 1992; Minnis and Peyton 1995). Ultimately, whether to actively manage for the same, more, or fewer deer, is a human decision made by wildlife managers, civic leaders, and local communities.

The goals of suburban deer management programs historically have focused on reducing the most visible effects of deer, such as impacts to ornamental plants, damage to agricultural crops, collisions with vehicles, and occurrences of Lyme disease. In the years

since the publication of the 1991 Deer Committee Report, however, a gradual shift in the mindset of resource managers, conservationists, and others has occurred --- away from a strictly human-centered view of deer to a more holistic approach that incorporates values regarding the conservation of biodiversity and protection of ecological services. This trend grew as a greater number of conservationists recognized that scientific research has demonstrated that deer can affect biodiversity and ecological health by altering forest plant communities and wildlife habitat. The convening of this Task Force partly reflects this shift in thinking, both in an increased awareness of the ecological consequences of high deer populations, and in a realization that biodiversity conservation is a societal responsibility with both intrinsic and economic value.

1. Adaptive Management

One approach to developing a management program is to first determine current conditions and set goals (including value-based goals), and then look to past experience and science-based knowledge to design a management process that achieves goals and simultaneously satisfies stakeholder values. This management process also should integrate both management and research into an "adaptive management" framework to enable and empower managers to constantly improve their approach and increasingly better inform the public. This idea of adaptive management stems from the fact that deer management often requires immediate action, based on the currently best available information, but as research and experience improve the understanding of the complexities of deer management, the management system needs to evolve.

Deer management in Westchester County should have the mechanisms to adapt as the science-based understanding about deer-human ecology changes and improves. This adaptive management approach places special emphasis on team learning and management modification based on scientifically valid data and conclusions. In adaptive management approaches, important process steps include: 1) clearly defining what the problems and research questions are; 2) collecting and compiling data to better address the problems and answer the research questions; 3) initiating management objectives to address the problems; 4) setting clear and measurable management objectives based on the program's overriding

goals; and 5) creating an ongoing monitoring and research program to assess the program's progress towards its goals. The need for more and better scientific research in conjunction with local deer management was noted by Task Force members.

2. Public Attitudes and Responses toward Deer

A number of studies have been done on deer and the public's perceptions and attitudes toward them. In order to determine whether Westchester communities were responding to deer problems, task force subcommittee members devised a two-question survey that was sent to Westchester municipalities. The two questions asked were "Have you surveyed your residents on attitudes toward deer or problem occurrences?" and "Has your municipality formed any sort of deer committee to look at deer issues in your town?" The results are presented in Appendix 3. The Task Force finds that there needs to be more local attention and involvement.

E. Deer Impact Management Strategies

Numerous methods of addressing deer impacts have been developed (Coffey and Johnson 1997). These methods can be separated into two general categories: 1) population management (reducing impacts by lowering the population), and 2) impact prevention (preventing impacts without population control). Most of the techniques are not mutually exclusive, and in fact, an integrated management approach, in which multiple techniques are used concurrently, is often preferable and yields the best results in reducing impacts.

1. Population Management

Deer impacts are generally correlated with deer population size relative to biological carrying capacity, i.e. the closer the population is to carrying capacity, the higher the impacts (deCalesta and Stout 1997). Thus, by reducing the population size below critical thresholds, impacts can be lessened. Because population size is a function of recruitment (births), mortality (deaths), immigration, and emigration, population management techniques focus on influencing one or more of these factors. Techniques include hunting, culling, trap and transfer (translocation), encouragement of predators, and fertility control. Of these

techniques, hunting and culling are the most commonly-used. Hunting is preferred by state wildlife agencies, including NYSDEC, because no other technique can equal the cost-effectiveness of hunting or its potential for sustainable, large-scale reductions in deer populations; and it also provides recreational opportunities. Culling, although expensive, can often provide more immediate results than hunting and may be used in areas where hunting is neither feasible nor desirable. Trap and transfer is currently illegal in New York State. Predator encouragement alone is insufficient to control deer populations and raises public social concerns. Fertility control is not Environmental Protection Agency-approved, has questionable efficiency, and is designed for site specific deer control. For any population management technique to be successful, it must target female deer because managing females is key to regulating deer populations (Smith and Coggin 1984). For additional details on population management techniques, see Appendix 4.

2. Prevention of Deer Impacts

These techniques focus on preventing the negative impacts of deer without active population control. The goal is to resolve human-deer conflicts by physically excluding deer or altering their behavior. Other than population management, fencing is the best option for preventing impacts (Wingaur et al. 1981). However, because fencing is not always desirable or affordable, multi-sensory repellents and deterrents (i.e. a combination of frightening sounds, sights, smells and bad tastes) should be considered. Repellents and deterrents, especially when combined, may be effective in dissuading deer from using a particular area or eating targeted plantings. Another prevention technique is the use of non-preferred or deer-resistant plantings. The effectiveness of all of these techniques, with the exception of fencing, is greatly diminished in the presence of deer densities close to or at their biological carrying capacity (Matschke et al. 1984). For further discussion of prevention methods, see Appendix 5.

F. Deer and Lyme Disease

It is generally believed by the public that there is a direct cause and effect relationship between deer as the carrier of the infecting agent and the acquiring by humans

of Lyme disease. The organism responsible for the disease is a spirochete bacterium which is transmitted by black-legged ticks (often called "deer" ticks) which may, but often have not, had contact with deer at some time in their life cycle. The exact relationship however is inconclusive. Ticks carrying the spirochete acquire it from small mammals, predominately the white-footed mouse. Attempting to control human risk of Lyme disease by reducing deer numbers alone does not address all the elements involved.

Because of these complexities, any in-depth investigation and recommendations on the Lyme disease issue as it pertains to deer lie outside the charge to this Task Force – namely the study of deer and their impact on the regeneration of our forests. See Appendix 8 for Westchester County and other websites for more information on Lyme disease.

G. Deer Management Case Studies: Illustrating Current Practices and Lessons Learned

White-tailed deer management and the need for improved co-existence between deer, people, and all species is a challenge not unique to Westchester County. The Task Force looked at over twenty programs across the USA, at the level of states, counties, and towns and private preserves. In examining the various deer management programs, we looked for a clear identification of the problem, an indication of a public dialogue, the development and implementation of objectives, and measurement of results on an ongoing basis.

While no two counties, towns or villages are exactly alike, there are those whose physical and demographic characteristics closely match Westchester County and many of its subdivisions.

It is important to note that none of the case studies has put a funded mechanism in place for measuring deer impacts post-hunt, although some expressed a desire for better record keeping and data collection. It is an unfortunate reality that funding limitations and other issues can restrict the ability of communities to assess and monitor the success of a

hunt or other strategies in meeting stated goals to manage deer. Anecdotal observations cannot suffice for solid science-based conclusions.

In reviewing those six case studies and many other similar efforts to co-exist with white-tailed deer, four key characteristics of successful programs became evident:

1. A study team should be commissioned to assemble all existing information concerning deer for the region; to identify the deer-human conflict issues in the area; and to make recommendations to resolve the deer-human problems affecting the community. These teams should be made up of ecologists and other experts, public officials, representatives of all effected groups, and local residents. The team should issue a well documented report.

2. Public meetings should be held to educate the public on the challenge, to get public feedback on what options they consider viable and desirable, and to ensure that there is public support for any recommendations. The public has to agree that there is a problem(s) serious enough to take action and has to be supportive of the techniques used in the recommended actions. It is essential that the actions chosen must be in keeping with the public consensus of attitudes and values.

3. The program should have very clearly defined goals - what is to be accomplished. These goals should be measurable and assessed by rigorous, scientifically-valid methods and adequate funding made available at the program's initiation. Since most deer management programs are funded by taxpayers, it is vital that the public can see how its money is being spent and if the program is accomplishing stated goals.

4. After initiation of the program plan, there need to be annual assessments done on a change in damage complaints, deer browsing, biodiversity measures, or whatever problems were identified as being in need of resolution --- in order to measure the program's effectiveness in meeting its goals and to provide information that can be used to modify the program. It is essential to set measurable goals so that a rigorous program evaluation can take place. This process of "planning, doing, and evaluating" is often referred to as "an adaptive management approach." It should be understood from the onset that any program

(and the necessary management and data collection structures and organization(s) associated with it) must extend over many years to achieve long-term ecological goals.

See Appendix 6 for a summary of six noteworthy case studies and lessons learned.

H. Laws, Regulations, and the Role of Government in Deer Management

Under New York's Environmental Conservation Law, the Department of Environmental Conservation is responsible for managing wildlife within the State. However counties may enact legislation and regulations consistent with the state's deer management goal, which is to maintain white-tailed deer populations at levels that ensure optimal recreational hunting opportunity commensurate with range carrying capacity and tolerable conflicts with other land uses. At present, the State will consider allowing deer hunting in those state parks in Westchester where it is requested, but to date Rockefeller State Park Preserve, in 2007, is the only one which has had hunting. Westchester's County Charter forbids hunting in County parks in Westchester, and most of New York City's watershed lands in Westchester are not open to hunting. Thus, about 30,000 acres, or 10% of the county's land area, is currently off limits for hunting.

The state has recognized the rising number of deer damage complaints in Westchester, and has issued increased Deer Management Permits (DMPs) and Deer Management Assistance Program (DMAP) for hunting, and Deer Damage Permits (DDP; "Nuisance" Permits) for taking of deer on private lands. The hunting season, which used to begin November 1, has been extended to mid-October through December 31. In Westchester, all hunting, including hunting pursuant to DMPs and DMAP permits, can be by bow-hunting only. With a DDP, deer can be taken by rifle or other means. The only other allowed use of rifles is at the Westchester Airport, for public safety. The state has forbidden rifle use during open deer season. Recent pilot programs of deer hunting by expert archers have proven successful for many years on Rockefeller private lands and in 2007 in Rockefeller State Park Preserve. Hunting is allowed in town lands in Pound Ridge, by Town permit. Archery has played the largest human role in attempting to manage Westchester's white-tailed deer population.

Requirements and contact numbers and addresses for hunting licenses, DMPs, DDPs, DMAP permits and archery permits, are set forth in New York's Environmental Conservation Law, as are limits on deer harvest pursuant to these. Further details are in Appendix 7.

IV. TASK FORCE RECOMMENDATIONS: MANAGING DEER ADAPTIVELY WITHIN AN ECOSYSTEM CONTEXT

After a thorough review of scientific literature, field observations, case studies, regulations, deer management techniques, expert testimony, and discussion of public perception, the task force found that Westchester's forests are increasingly at risk due to deer over-browsing of forest understory, and this and other impacts of deer overpopulation must be addressed now. Because the social and ecological complexity of the issue is constantly evolving, and involves many stakeholders, the Task Force recommends the creation of a flexible, responsive deer management program which includes public education, legislative actions, and funding.

The task force concludes that managing deer for the purposes of forest health and biodiversity protection will require the implementation of the following recommendations:

Deer Management and Monitoring

1. Establish a multi-year pilot deer management program (controlled population reduction by hunting) at a minimum of **three county parks (such as the severely deer-impacted Ward Pound Ridge Reservation, Muscoot Farm/Lasdon, Mountain Lakes Park or Blue Mountain Park)** and monitor and assess its effectiveness to promote a balance among deer numbers and forest health, biodiversity protection, and humans

2. Initiate and encourage deer management strategies on other public and private lands, including appropriate deer hunting opportunities.

3. Ensure data collection to monitor the effectiveness of deer management programs, which might include:
   - Hunter and resident sighting logs to establish trends.

- Aerial surveys – such as the NYCDEP and Rockefeller State Park FLIR surveys.
- Regular deer pellet/browse impact/vegetative regeneration surveys. These will serve as a baseline for the program and will provide a basis for evaluating the results of the program.

4. Provide a menu of possibilities to local decision makers for controlled deer population reduction that is safe, responsible, and feasible.

5. In conjunction with NYSDEC, determine management strategies and develop short, medium, and long-term biodiversity conservation goals.

6. Serve as an information center and as a liaison to state, county, and local governments, especially the NYSDEC and NYCDEP.

7. Set forth a research agenda needed for improved deer management.

8. Monitor and evaluate deer impacts in Westchester County on natural resources and human activities.

9. Monitor public attitudes using local and regional surveys and other methods.

10. Continue to investigate and support development of effective non-lethal means of deer population control.

Public Education

1. Disseminate this report to the public, local governments, and private organizations and make it available online.

2. Organize a biennial White-tailed Deer Conference to present the latest research findings and management approaches.

3. Implement a program of public education about White-tailed deer in Westchester County to:

   • Encourage the understanding of deer's role in forest ecosystems.

   • Inform property owners of techniques to minimize deer damage.

   • Increase awareness that the feeding of deer is prohibited by New York State law.

   • Provide training for local officials engaged in any deer management.

4. Develop and support programs to educate citizens and local officials about the importance of biodiversity and the need for proactive human stewardship.

5. Encourage dialogue with NYSDEC Region 3, hunters, and land managers to use biodiversity as a key criterion to meet deer management goals.

6. Encourage the creation of a Wildlife Management Plan concurrent with all acquisitions of open space.

Legislation and Public Funding

1. Amend the County law to allow hunting on County-owned park lands and other properties where appropriate.
2. Create a funding source for the adaptive deer management program and staff.
3. Create a fund for deer management research.
4. Create grant funding availability for non-county deer management activities.
5. Enact legislative and regulatory changes at the state, County, and local levels to create additional deer hunting opportunities in Westchester County.

Adaptive Deer Management Program

In order to best achieve the above recommendations, it is further recommended that an ongoing public-private adaptive deer management partnership be established, involving a broad and diverse group of stakeholders, including but not limited to Westchester County,

state and local governments, wildlife experts, environmental advocates, private organizations, hunting and other sporting groups, and property owners. This partnership should be led by the County with dedicated, qualified staff support, and adequate funding. Participation of the NYS Department of Environmental Conservation is essential as they have ultimate legal responsibility for managing all wildlife in New York State. The NYC Department of Environmental Protection should also be included as a very large landowner in Westchester County.

Appendices

Appendix 1: White-tailed Deer Ecology

The white-tailed deer is the most wide-spread and abundant member of the deer family, and the best recognized large mammal in Westchester County. The buck, or male deer, stands 3 to 3 1/2 feet tall at the shoulder and can weigh up to 300 pounds, while female deer are smaller and lighter than males. They are red brown during summer with a white belly and tail, but develop a brown-gray pelage in winter. The distinctive white tail is readily visible when they bound away from a real or perceived danger. Life span in the wild is 10 years, but white-tailed deer have lived up to 20 years in captivity.

White-tailed deer breed from mid-September through late February, with the peak of breeding season, or rut, occurring in November. Fawns are born in May and June after a 200 day gestation period. Does usually give birth to one fawn in their first pregnancy, but twins, and even triplets are possible when food is abundant. Sex ratio of fawns is generally even with more males born in overpopulated herds and more females born in expanding herds (Verme 1985). Fawns have red-brown hair with white spots, which they lose as they grow their first winter coat. They weigh 5 to 8 pounds at birth, but quickly gain weight and can run within a week. Cared for only by the mother, they are nursed for about 5 weeks before weaning. Fawns are able to walk at birth and nibble on vegetation only a few days later.

Bucks begin to develop a pair of spiked antlers in spring of their second year, and the antlers continue to grow until late summer. The size of the antlers and numbers of "points" depends primarily on age, genetics, and nutrition; older bucks usually have larger antlers. Growing antlers are covered with soft "velvet" which contains blood vessels that supply nutrients to the antlers. When the antlers stop growing, the velvet dries and is shed or rubbed off by the buck as he polishes his antlers on saplings, shrubs, or rocks. Bucks shed their antlers at the end of breeding season in preparation for the growth of a new set.

White-tailed deer are a ruminant species. Their multi-chambered digestive system allow a browse strategy where they can opportunistically ingest copious amounts of vegetation, their diet varying with season, and showing preference for some plant species over others.

The spring and summer diet consists of tree leaves, broad leaved herbs and berries. In the absence of green foliage during late fall and winter, deer forage on woody twigs, seedlings, buds, and evergreen needles. Deer will also seek out acorns, beechnuts and fruits when available. In areas with agricultural activity, white-tailed deer will opportunistically feed on crops throughout the year, but they especially prefer corn in the winter and alfalfa fields in the spring. Deer will also browse orchard trees and nursery stock.

It is important to note the negative impact of artificial feeding of deer by well-intentioned, but unknowing citizens. The ruminate nature of deer (no strong digestive juices, reliance upon bacteria to break down food) requires up to three weeks for the deer's stomach culture to transition. Deer will eat new food, but receive very little nutrition from it. And on a broad scale, little is gained from feeding large numbers of deer. In fact it can position the deer population for a bigger crash at a later time and can deplete the region's natural food supply.

Good deer habitat is characterized by forested areas with some young, brushy stands and scattered openings, or agricultural areas with a combination of crop fields, woodlots and wetlands. Areas which contain a lot of early succession vegetation are especially good for deer in forested areas. The transition zone between forest and shrub land or meadow, referred to as 'edge', provide these animals opportunity to forage suitable browse items.

In suburban areas, like Westchester County, deer will also roam into neighborhoods to feed on horticultural or garden plants, cared for and maintained by humans. There is some evidence *(see NYCDEP infrared flyover study data)* that deer may show a preference for foraging in these areas.

Deer are crepuscular, being most active in the early morning or evening. White-tailed deer show fidelity to their home range which averages 640 acres. Males generally have larger ranges which are expanded during the rut. Territorial behavior in deer is seasonal. Bucks become quite aggressive during the breeding season. Generally, during the fawning season, does are intolerant of other females, except within their family groups. Deer are most social in winter when they often form groups in 'deer yards'. In forested areas, they

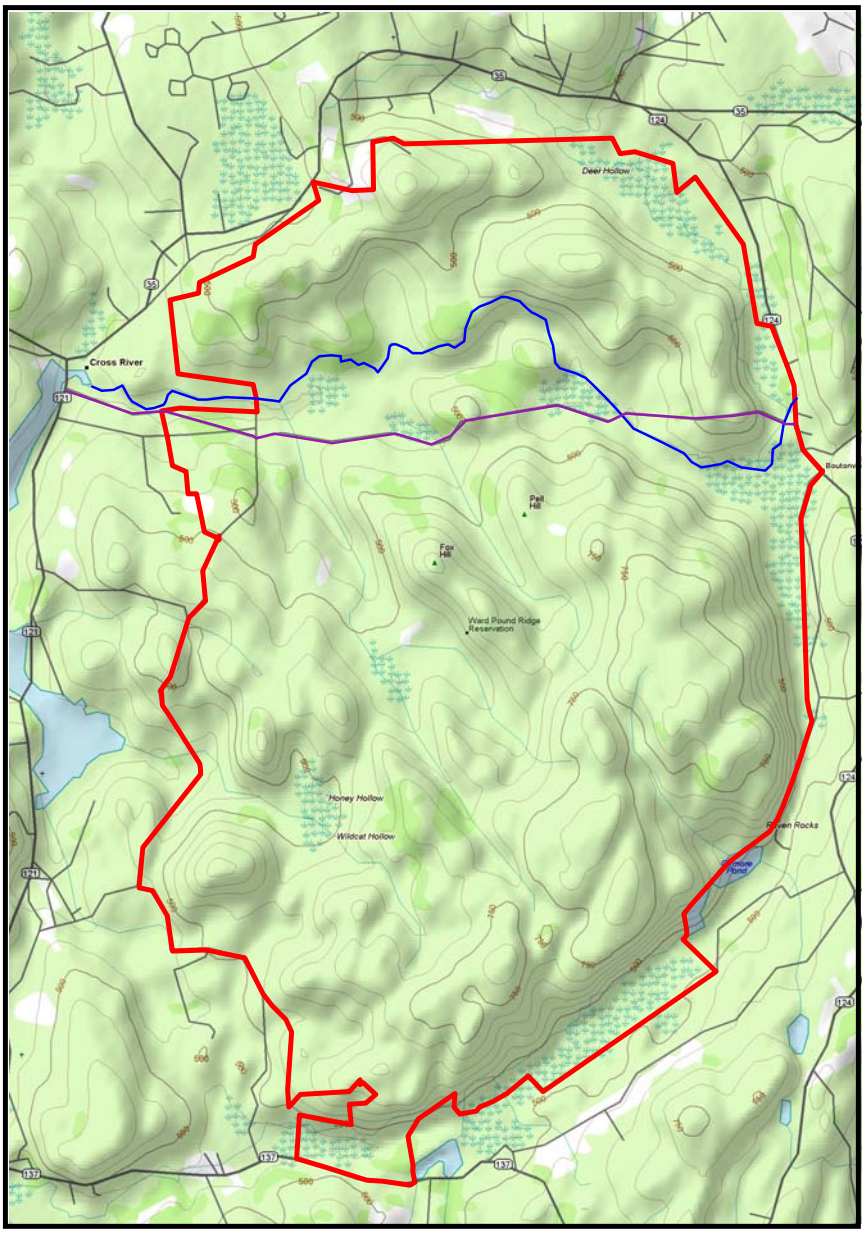
may, depending on snow depth, migrate to traditional winter yards in December or January and stay there until March. Stands of evergreens are especially preferred for yarding because they provide cover and the greatest interception of snow. South facing slopes are selected because they provide warmth. This seasonal clumping may be casually misinterpreted as a dramatic increase in a localized population.

Appendix 2: Deer Density and Habitat Impact Survey Workshop at Ward Pound Ridge Reservation

Density & Habitat Impact Workshop
Ward Pound Ridge Reservation
April 8, 2008

David deCalesta, Ph.D.
Wildlife Analysis Consulting

Timothy Pierson, Ph.D.
Penn State Cooperative Extension


Deer Hollow
Cross River
Pell Hill
Fox Hill
Ward Pound Ridge Reservation
Honey Hollow
Wildcat Hollow
Raven Rocks
Bouton
121
124
35
55
137

Executive Summary

A one-day workshop on deer density and impact was conducted for approximately 35 individuals from various state, federal, and private organizations at the Ward Pound Ridge Reservation at Cross River, New York. The morning session detailed deer biology, management philosophies regarding deer management, integrated deer biology with forest management, and described methodologies for collecting deer density and impact data. Included were methods for data entry, analysis, and interpretation. During the afternoon students were divided into five teams: each team collected deer density and impact data on each of five 5,280 foot-long transects. Data from each team were entered into an Excel spreadsheet and an average value computed for deer density (in deer/square mile ± 95% confidence interval) and deer impact (percent plots with no regeneration, percent plots with no impact, and percent plots with 1-5 levels of deer impact for each of 6 indicator seedling species, each also with 95% confidence intervals *where appropriate*). **Deer density averaged 63.7 ± 7.9 deer/mile^2. Deer impact was reflected by average percent plots no regeneration at 91.5% ± 2.7% and average percent plots no impact at 2.3% ± 1.4%.** There were too few plots with regeneration of any indicator seedlings present counted: of 130 plots observed, only 6 contained beech seedlings, 2 plots contained black cherry seedlings, 1 plot contained white pine seedlings, one plot contained red maple seedlings, and no plots had any hemlock seedlings. **Deer impact level within the area sampled was judged to be severe.** A number of recommendations for additional data collection and subsequent management actions were made at the conclusion of the workshop.

Introduction

On April 8, 2008, a Deer Density & Impact workshop was held at the Ward Pound Ridge Reservation (WPRR) at Cross River NY. Sponsored by the Watershed Agricultural Council and the New York State Department of Environmental Conservation, the workshop was presented to approximately 35 individuals from various organizations, including the NY DEC, Watershed Agricultural Council, USDA Forest Service, Cornell Cooperative Extension Service, Quality Deer Management Association, sportsmen's clubs, and managers of private and public forestlands.

The purpose of the workshop was to provide background information on deer biology and management and on methodologies for estimating deer density and deer impact on forest ecosystems. The workshop provided hands-on field experience in collecting requisite data and demonstration on how such data are analyzed to provide quantitative estimates of deer density and deer impact. The workshop concluded with a discussion of how deer density and impact analysis may be used to guide management decisions for local deer populations and affected forestlands. Fred Gliesing, Senior Forester/Forestry Coordinator, NYC DEP Bureau of Water Supply, provided information on the Forward Looking InfraRed (FLIR) technology (aerial videography of deer) as methodology for estimating deer density and included results of FLIR flights within areas directly south of WPRR).

Set-Up

Morning PowerPoint presentations of deer biology, management, and methodology for estimating deer density and impact were given in the Trailside Nature Museum ~ 9am-11:30am. A short demonstration of appearance of indicator seedlings (used in estimating deer impact), appearance of deer pellet groups (used in estimating deer density), and methodology for recording data was given following the PowerPoint demonstrations.

After a short lunch break, participants were assigned to one of five teams, taken along the Reservation Road to starting points on one of five transect lines (5,280 feet long, 1,000 feet apart: Fig. 1), and directed to collect deer density and impact data along the transect lines. At 100 foot intervals along transect lines, teams counted all deer pellet groups detected within a 4 foot radius plot centered on the transect line according to a described protocol (Appendix A).

At every other deer density plot (every 200 feet) teams assessed and recorded deer browsing impact on 6 pre-determined indicator seedling species, again according to established protocol (Appendix B). Because overhead canopy closure may influence presence and abundance of indicator seedlings used in the technique, measures of overstory canopy closure were taken also at browse impact plots (Appendix C). Dead deer observed along the transect line were to be recorded. Team members took turns recording data, counting pellet groups and evaluating deer impact levels, and pacing along predetermined transect line compass bearings (180^0) between plots. When teams

reached the end of the 5,280 foot transect lines they were picked up in vehicles and returned to the classroom. Deer density and impact data were recorded on waterproof data sheets provided by the instructors (Appendix D).

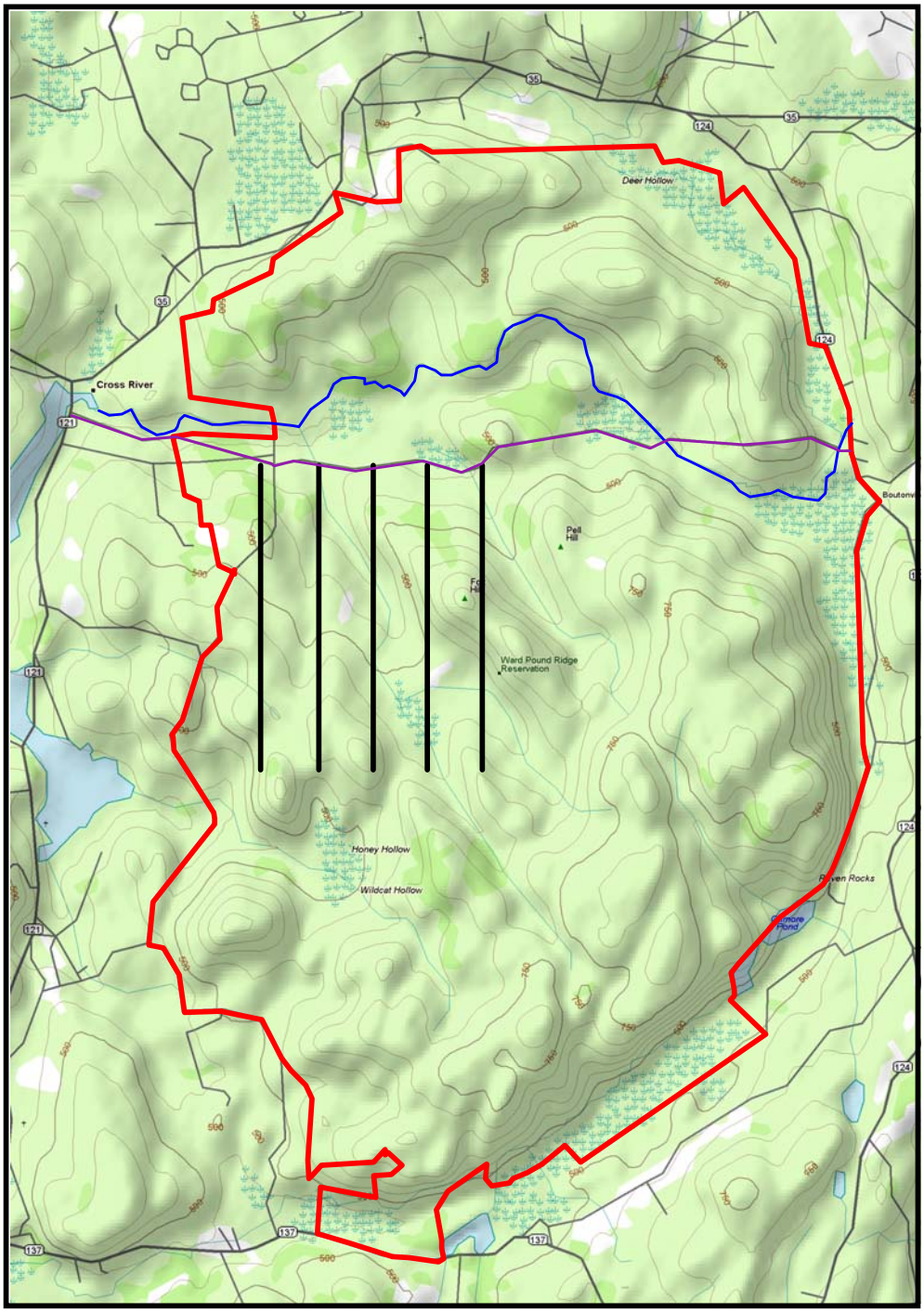


Figure 1. Location and layout of transect line grid within Ward Pound Ridge Reservation.

Raw data were entered into an Excel spreadsheet and deer density and impact were calculated according to established protocols (Appendix 5). Confidence intervals were constructed around mean deer density and impact estimates to provide estimates of the precision of the mean values, again according to established protocols (Appendix 6).

Results & Discussion

Deer Density

The five teams recorded a total of 110 deer pellet groups on 260 plots along 26,400 feet of transect line (Table 1). Estimated deer density for the area sampled was 63.7 deer per square mile; 95% confidence interval for this estimate was ± 7.9 deer. The fairly large confidence interval was a result of unusually high variability in pellet groups counted among transect lines, suggesting deer density/habitat use was not uniform within the grid of 5 transect lines. This deer density was the highest observed by either of the presenters anywhere on continuously forested areas throughout New York, Pennsylvania, Maryland, and Vermont in over 10 years of such work.

Table 1. Pellet group, impact, and canopy closure data for 5 transect lines for the whole area.

Transect	1	2	3	4	5	Total
Pellet Plots	52	52	52	52	52	260
Pellet Groups	11	14	17	36	32	110
Deer Density	**31.8**	**40.5**	**49.2**	**104.2**	**92.6**	**63.7**
Veg Plots	26	26	26	26	26	130
No Regen	24	26	21	24	24	119
% No Regen	**92.3**	**100**	**80.8**	**92.3**	**92.3**	**91.5**
No Impact	0	0	0	1	2	3
% No Impact	**0**	**0**	**0**	**3.8**	**7.7**	**2.3**
Open	2	3	6	12	3	26
% Open	**7.7**	**11.5**	**23.1**	**46.2**	**11.5**	**20.0**
Closed	24	23	20	14	21	102
% Closed	**92.3**	**88.5**	**76.9**	**53.8**	**80.8**	**78.5**

Mean deer density = 63.7 deer/mile^2 ± 7.9 deer/mile^2
Mean % plots no regeneration = 91.5% ± 2.7%
Mean % plots no impact = 2.3% ± 1.4%
Mean % plots open canopy = 20.0% ± 4.9%
Mean % plots closed canopy = 78.5% ± 9.3%

The number of pellet groups deposited per line, and resultant estimates of deer density per line, represent a gradient of lower deer density to higher deer density from the

interior of WPRR to the outer western boundary (Fig. 2). The gradient suggests that, at least for that portion of WPRR represented by the grid of 5 transect lines; deer make the least use of the interior of WPRR and the greatest use of the boundary between WPRR and adjacent properties. It was suggested during the discussion of the results during the workshop that white-tailed deer might be using WPRR as a safe haven refuge, probably foraging in adjacent areas outside of WPRR, likely increasing the amount of browsing/foraging on vegetation in surrounding forestlands/residential areas.

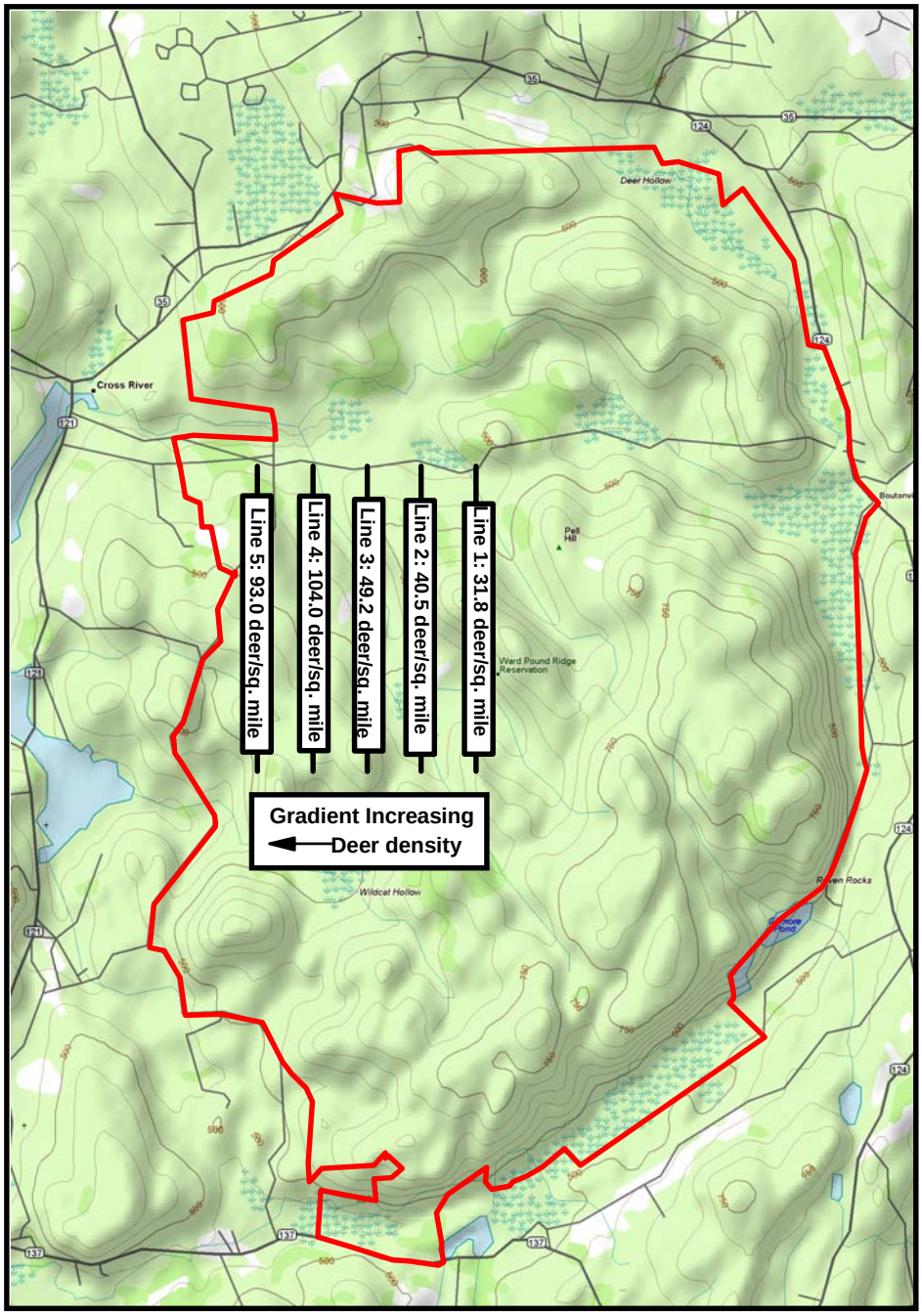


Figure 2. Gradient of deer density on WPRR from low density interior to higher density along the boundary between WPRR and adjacent ownership(s).

We hypothesize that there are two zones of deer density within the WPRR: a core area of ~ 40 deer/mile^2 and a surrounding "Hot Zone" of approximately 2,000-3,000 feet wide with ~ 100+ deer/mile^2 (Fig. 3). Possibly, adjacent landowners may be feeding the deer and contributing to the pattern of deer use of the WPRR and adjacent landscape. To determine whether this pattern of deer use within WPRR is consistent within the rest of WPRR, sampling for deer density and assumed related habitat use within WPRR could be conducted over the entire property.

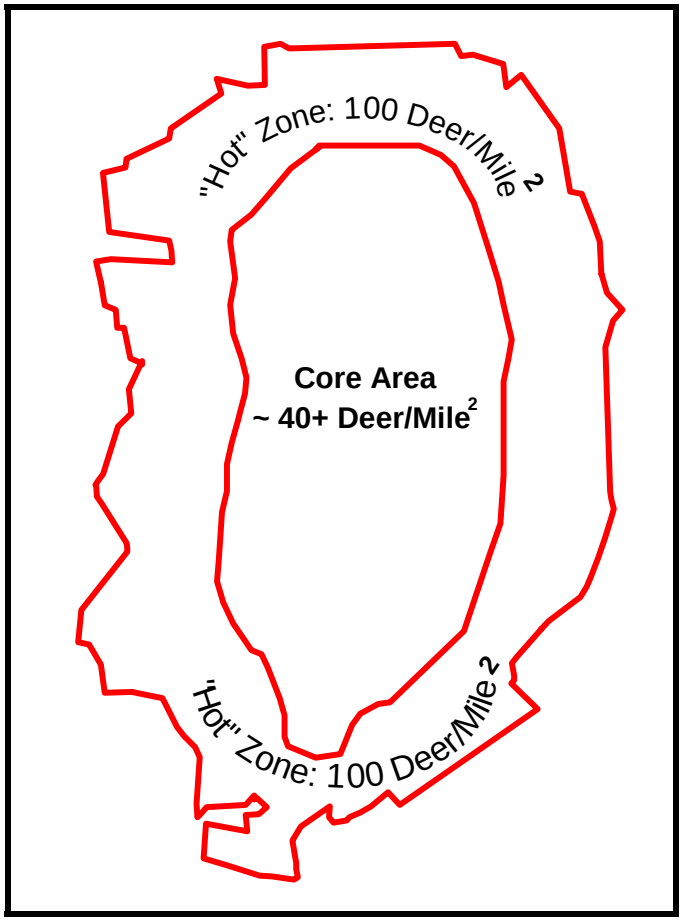


Figure 3. Hypothesized zones of deer density within the WPRR: a core area of ~ 40 deer/mile^2 and a surrounding "Hot Zone" on the periphery of ~ 100 deer/mile^2.

Deer Impact

The five teams recorded deer impact on 130 plots along 26,400 feet of transect line (Table 1). Estimated deer impacts for the area sampled were 91.5% plots with no regeneration of any woody species and only 2.3 % of plots had regeneration of any species at any level of deer impact.

Very few seedlings of any indicator species at any level of impact were detected: on the 130 plots observed, only 6 plots contained beech/ironwood seedlings, 2 plots contained black cherry seedlings, 1 plot contained white pine seedlings, one plot contained red maple seedlings, and no plots had any hemlock seedlings. Overstory canopy closure (Table 1) was relatively closed with maturing trees (20% of plots were under open canopy) and there should have been more plots with shade-tolerant seedlings (e.g., beech/ironwood) than occurred (only 4.6% plots with beech/ironwood).

Impact levels suggested heavy to severe deer impact: one plot contained seedlings with 0 impact, 3 plots contained seedlings with moderate impact, 2 plots contained seedlings with heavy impact, and 4 plots contained seedlings with severe impact.

Using the protocol for evaluating deer impact based on % plots with no regeneration, % plots with no impact, and relative levels of impact on indicator species (Appendix 7) resulted in a determination of severe deer impact. At this level of impact there should be virtually no shrub or herbaceous species palatable to deer surviving in the understory, the songbird population should be heavily impacted with reduced species richness and greatly reduced abundance of remaining species, there should be no seedlings of tree species palatable to deer, and invasive/interfering plants (stilt grass, mile-a-minute, New York and hay-scented ferns) should dominate the understory where openings result from blowdown or individual trees falling. Were deer to have no alternative sources of forage off the WPRR (where they undoubtedly go to feed at night) there would be a high likelihood of a large winter starvation die-off if snow persisted into April.

The extremely high deer density within the WPRR is a contributing factor to the high frequency of deer ticks encountered by participants in the workshop. Undoubtedly, persons utilizing the WPRR for recreation are also exposed to these vectors of Lyme disease in humans.

Recommendations

1. To confirm the above assessment of ecological conditions on the WPRR, additional deer density and impact data should be collected over the remainder of the reservation. Three additional grids of five transect lines, 5,280 feet long and spaced 1,000 feet apart could be located on the reservation as suggested by Figure 4. A team of 2 experienced (must be able to identify indicator seedlings by species) counters can collect density and impact data on 1½ grids of five transect lines a day: the suggested three additional grids could be assessed for deer density and impact in two days by such a crew.
2. If the recommended additional data are collected, in addition to assessing deer density and impact, deer density on individual transect lines should be calculated to determine whether the postulated gradient of deer density within the reservation does indeed occur. Should the gradient be a reservation-wide phenomenon, the likelihood of the reservation serving as a refuge for deer to forage out into neighboring properties and create unacceptable ecological and economic damage to adjacent forestlands and housing developments should be

acknowledged as an unwanted result of failure to maintain deer densities at ecologically sound densities within the reservation.

3. The deer herd within the WPRR must be brought down to ecologically viable levels: on the WPRR this density is in the 5-10 deer per square mile range. Maintaining the herd at this population level for at least 10 years will be required for the overstory trees to revegetate the understory with seedlings. It may take a decade or longer for missing shrubs and herbs to repopulate the WPRR: adult plants never escape the browsing height of deer and possibly some populations have been eliminated and may need to be re-introduced to regain what once was a diverse vegetative community.

4. The only reliable, proven method for reducing deer density within ecosystems and landscapes similar to those on the WPRR is population reduction, either through public hunting or with professional marksmen. The social cost and effort required to obtain and maintain yearly population reduction are high, but the ecological cost of not achieving deer herd reduction is collapse of the ecosystem on the WPRR.

5. Removing excessive numbers of deer within WPRR by population reduction will be compromised by immigration of deer from the surrounding landscape. The only way to prevent such immigration (and prevent emigration from WPRR) is to construct and maintain a 10 foot high deer-proof fence with an apron at the bottom to prevent deer from crawling under. Either the fence may first be constructed and excessive numbers of deer removed by professional marksmen, or the fence may be constructed such that one end is left open and a large-scale deer drive is conducted to force deer out the open end. Such an effort would be massive, requiring a high degree of coordination and approximately 250 drivers. Neighboring landowners across from the open end from whence deer were driven from WPRR might also strenuously object.

6. Once the herd is reduced to 5-10 deer per square mile, it should be kept there by regular density estimates followed by culling by marksmen to keep the herd at desired density. The reservation must retain a viable, regulated deer population to help maintain vegetative balance once the ecosystem is restored.

7. Attention, monitoring, and control of native and non-native interfering /invasive species (e.g., New York fern, winged euonymous, Japanese barberry, stilt-grass and mile-a-minute) will also be required.

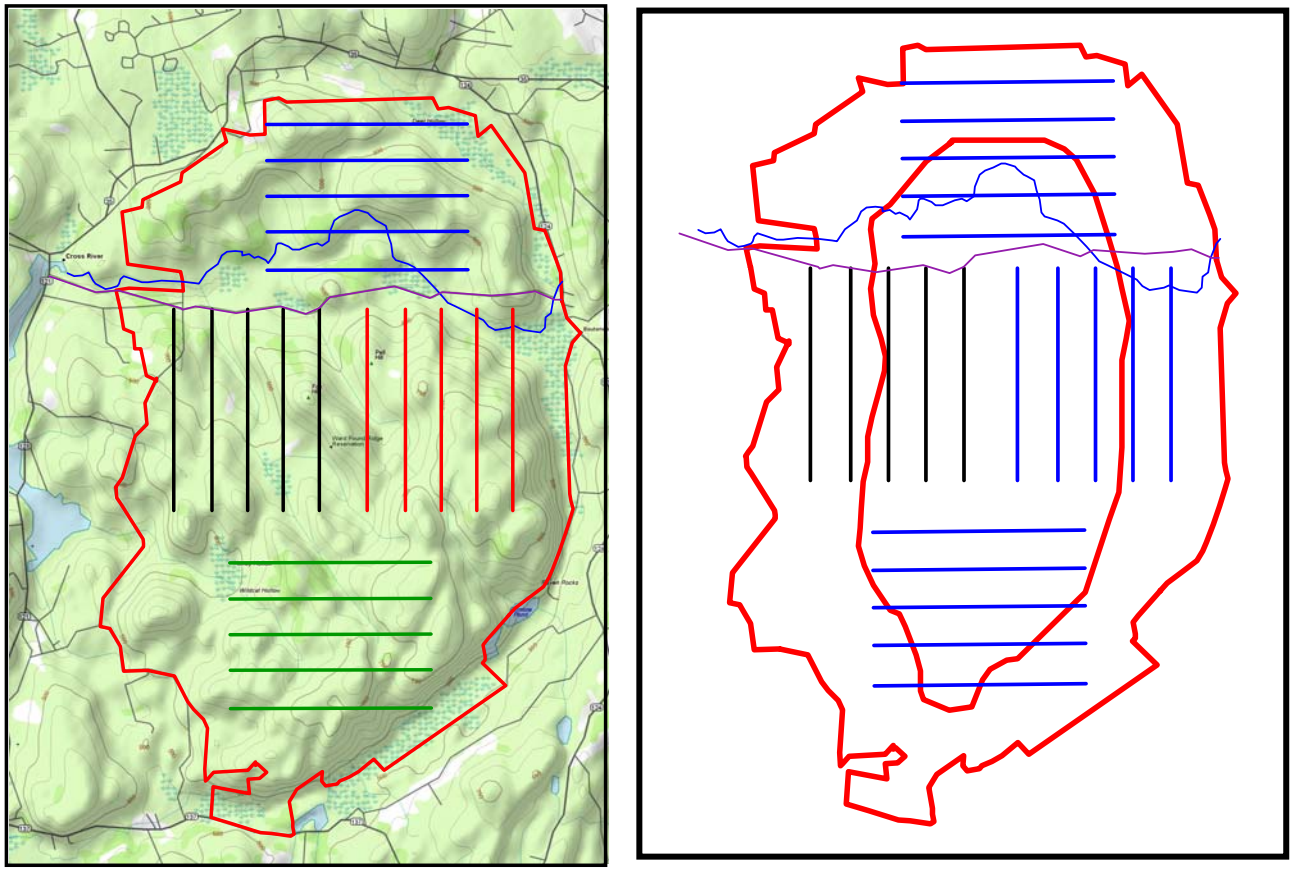


Figure 4. Potential location and layout of three additional deer density and impact grids on the WPRR for additional data collection. Existing grid lines are black, suggested new grids are in green, blue and red lines. Left map displays topographic layout of grids; right map displays layout of grids within core area and "Hot Zone".

Appendix A – Protocol for Collecting Deer Density Information

1) Pellet groups are counted within 4 foot radius plots located at 100 foot intervals along transect lines one mile long. The first plot taken is 100 feet from the starting point from the beginning of each transect line, and the last plot is ~ 100 feet from the end of the line. At the end of each transect take a 90° bearing and travel 1,000 feet to the starting point of the next transect. There should be 52 plots per line (exceptions: plots inside fenced enclosures, or that fall in water – streams, ponds, lakes - aren't counted).

2) There must be at least 10 pellets in a group before it is counted, at least half of the pellets must be within the 4 foot radius plot, and pellets must be on top of leaves or other vegetation. Record pellet groups with a dot tally (see instructions below).

3) If fenced enclosures or ponds/lakes are encountered along the transect line, either climb over the fence/wade through the water and continue along the transect line, or take a sighting on the other side of the fence/water, walk around, and resume the line. Do not count plots, pellet groups, or impact inside the fence or body of water but do monitor distance inside fence (to keep total transect length to 5,280 feet).

4) Record the total number of plots and pellet groups for each transect line (top of form other side of page).

5) Record dead deer sighted. Record data as dot tally (see below). Do not differentiate between adults and fawns.

Recording dot tally data: 1st data entry = one dot (**.**). 2nd data entry, add another dot (**..**). 3rd data entry, add another dot (**.:**). 4th data entry, add one more dot (**::**). 5th entry, connect 2 dots with a line (**::**). 6th entry, connect another 2 dots with a line (**::**). 7th data entry, connect 2 more dots with a line (**::**). 8th data entry, connect 2 more dots with a line (**::**). 9th data entry, connect 2 dots diagonally (**::**). 10th data entry, connect the last 2 dots diagonally (**::**). The eleventh data entry starts with a new dot.

Appendix B – Protocol for Collecting Deer Impact Data

1) Record deer impact to seedlings within the 4 foot radius plot by each of six species (beech/ironwood, striped maple/black cherry, red maple, white pine/birch, hemlock/sugar maple, white ash/oak). **Record data for seedlings over 6 inches tall and less than 6 feet tall.**

2) **Impact will be recorded at every other pellet group plot**.

a) If no regeneration between 6 inches and 6 feet exists on plot, record as a dot in box **"Plots Without Regen."**

b) If regeneration between 6 inches and 6 feet is present but is not browsed, record as a dot in box **"Plots With Regen, no Impact."**

c) Record impact for each of the 6 indicator species as follows, but only for species present on the plot. Record impact in appropriate impact level box.

0 = no impact

L = light impact – 1-50% of stems are browsed, seedling > 6 inches tall, < 6 feet tall.

M = moderate – more than 50% of stems are browsed but seedling is not hedged, seedlings > 6 inches tall, < 6 feet tall.

H = heavy – more than 50% of stems are browsed, seedling is hedged (browsed to ball of short twigs), seedlings > 6 inches tall, < 6 feet tall.

S = severe – more than 50% stems are browsed, seedling is hedged and is less than 6 inches tall.

3) Record all data as a dot tally for all data entries for each transect line (instructions for dot tallies above).

Appendix C – Protocol for Recording Open/Closed Canopy Cover

Determining whether canopy is open or closed:

Open:

Recent clearcut - If the plot falls in a recent clearcut and seedlings/shrubs haven't grow up tall and thick enough to shade out the ground when leaves are on, record in the open box

Maturing stand that is thinned - If the plot falls in a maturing stand (trees in sawlog category – diameters over 10 inches) and the stand is thinned or shelterwood cut and the overstory is sufficiently opened to stimulate regeneration of seedlings (canopy of overstory trees are not touching other tree canopies on at least two sides) when leaves are out, record in the open box

)***Old growth stand with open canopy*** - If an you are lucky enough to be assessing impact in an old-growth stand, record in the open box if plot falls in a spot where there tree canopies of overstory trees touch on 2 or fewer sides and if there is no intermediate canopy of dense sapling or pole trees that would suppress regeneration when leaves are on. Record in the closed box if overstory trees touch on 3 or more sides and/or if there is dense shade provided by an intermediate canopy by sapling or pole trees.

Closed:

Older clearcut, seedlings over 6 feet tall - If the plot falls in an older clearcut with seedlings over 6 feet tall and the ground below is likely completely shaded out when leaves are on, record in the closed box

Sapling/Pole stand - If the plot falls in a dense, unthinned sapling/pole stand (individual trees less than 10 inches in diameter, densely packed) with little sunlight reaching the ground when leaves are on, record in the closed box

Maturing stand not thinned - If the plot falls in a maturing stand (trees in sawlog category – diameters over 10 inches diameter) and the stand is not thinned or shelterwood cut so that little light will reach the forest floor when leaves are out, record in the closed box

Appendix D – Data Sheet for Collecting Deer Density & Impact Data

NY DEC Density/Impact Data Sheet 2008

Site _____ Date _____ Observer(s) _____ Weather _____

Pellet Groups

Transect Line	1	2	3	4	5
Number Plots					
Number Pellet Groups					
Number Dead Deer					

Deer Impact (record data at every other pellet group plot.)

Transect Line				1			2			3			4			5		
Number Plots																		
Plots Without Regeneration																		
Plots With Regen, No Impact																		
Canopy Closure (Open)(Closed)																		
Low Pref. Beech/Ironwood	0	L	M															
		H	S															
Low Pref. White Pine/Birch	0	L	M															
		H	S															
Med. Pref. Striped Maple Black Cherry	0	L	M															
		H	S															
Med. Pref. Hemlock/ Sugar Maple	0	L	M															
		H	S															
High Pref. Red Maple	0	L	M															
		H	S															
High Pref. White Ash Oak	0	L	M															
		H	S															

Appendix E – Protocol for Calculating Deer Density and Deer Impact

Deer Density

$$\text{Deer Density} = \frac{\text{number of pellet groups counted}}{\text{Pellet group deposit rate x days x area of transects in square miles}}$$

It was assumed that because of the small plot size observers would miss few, if any, pellet groups: daily defecation rate (pellet group deposit rate = 25 per day). Days is length of time in days from leaf-off (generally between ~ November 1 and November 15, every year the date of leaf-off is noted for use in calculations the following spring) to the day the transects were run in spring. Area of transect in square miles was calculated as plot area (50.4 square feet) times number of plots divided by area of square mile (5,280' X 5,280').

Separate density estimates were derived for each transect line to provide estimates of relative deer abundance among transect lines. Jack-knifed replicates of density were obtained by deriving 5 separate estimates of density. The first estimate was derived from pooling all data from transect lines 1-4, omitting line 5 and calculating deer density by the formula above. The next estimate was derived by pooling all data from transect lines 1 and 3-5, omitting line 3 and calculating deer density by the formula above. The process continued, deriving estimates using 4 of the 5 transect lines until all combinations obtained in this way were completed (n=5).

Deer Impact

Individual measures of deer impact were obtained to derive estimates for: 1) % plots with no regeneration; 2) % plots with no impact; 3) five levels of impact for each of six indicator seedlings. Impact was calculated by dividing each of the individual measures by number of vegetation plots and multiplying this dividend by 100.

Jack-knifed replicates of impact were obtained by deriving 5 separate estimates of for each of the measures of impact in the same manner as for deer density estimates. The first estimate was derived from pooling all data from transect lines 1-4, omitting line 5 and calculating deer density by the formula above. The next estimate was derived by pooling all data from transect lines 1 and 3-5, omitting line 3 and calculating deer density by the formula above. The process continued, deriving estimates using 4 of the 5 transect lines until all combinations obtained in this way were completed (n=5).

Appendix F – Protocol for Calculating Precision

Sample variance (s^2) was calculated by the standard formula:

$$s^2 = \sum_{1..i}(y_i - \hat{y})^2/n$$

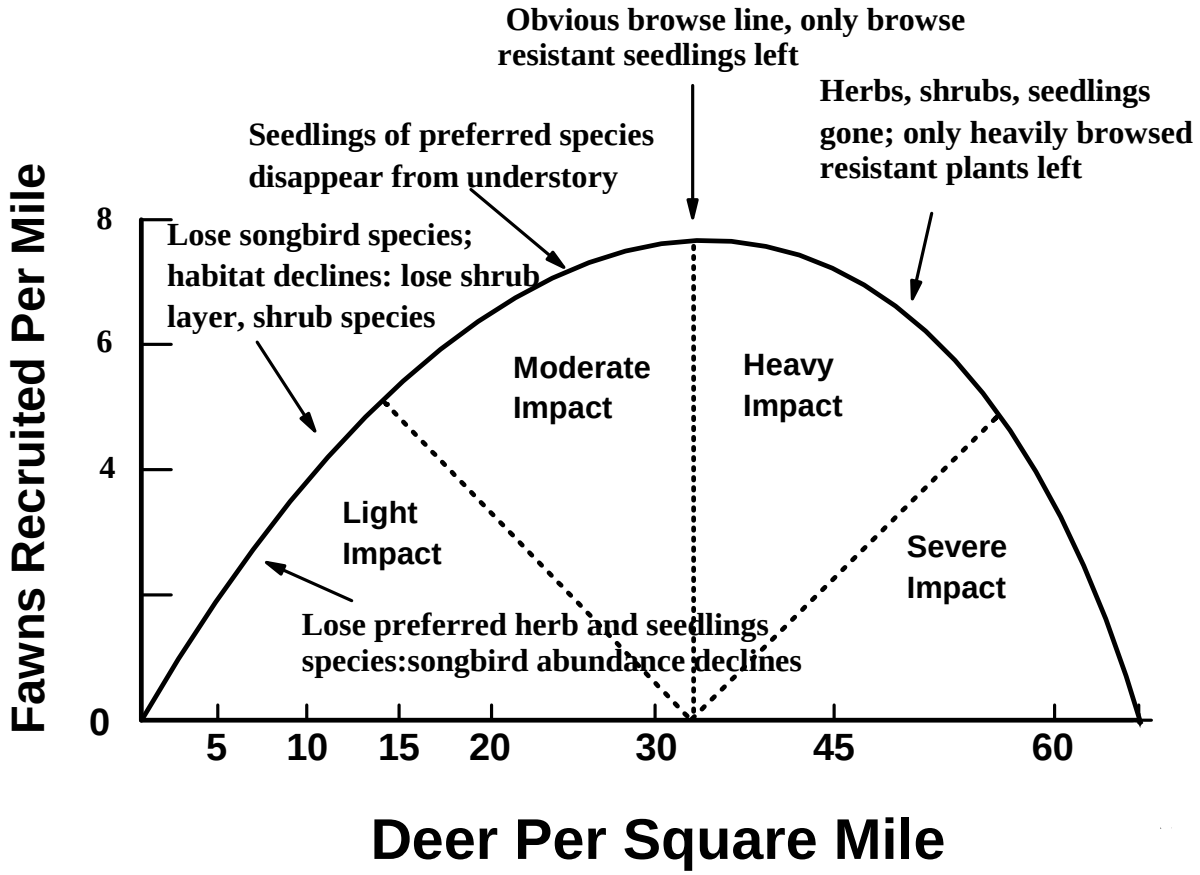
where y_i = density estimate from each jack-knifed replicate (combination of four transect lines), $\hat{y}$ = average of all replicates, and n = number of replicates (5).

Precision of the deer density and impact estimates was estimated by constructing a confidence interval (C. I.) about the mean value of density and impact estimates.

$$C.I. = \hat{y} \pm \tau_{\alpha/2} \sqrt{s^2/n},$$

where $\hat{y}$ = average of all replicates, $\tau_{\alpha/2}$ = t value for selected significance level/2 (2-tailed test), s^2 = sample variance, n = number of replicates. Selected significance level was 95%. Deer density and impact estimates are reported as the average density and impact from the 5 jack-knifed estimates ± the 95% confidence interval.

Appendix G – Protocol for Determining Level of Deer Impact



Light impact: Impact level is light to moderate for preferred and less-preferred species, and none to light for non-preferred species. Plots with no impact to regeneration are > 50%, plots with no regeneration are < 20%.

Moderate impact: Impact level is moderate to heavy for preferred species, and light to moderate for less-preferred and non-preferred species. Plots with no impact to regeneration are 20-50%, plots with no regeneration are >20% and < 60%.

Heavy impact: Impact level is heavy to severe for preferred species, and moderate to heavy for less-preferred and non-preferred species. Plots with no impact to regeneration are 10-20%, plots with no regeneration are >60% but less than 90%.

Severe impact: Imact level for all indicator seedlings, is heavy to severe. There is less than 10% of plots with no impact to regeneration and >90% plots with no regeneration.

Appendix 3: Public Attitudes and Responses toward Deer

A number of studies have been done on deer and the public's perceptions and attitudes toward them. The initial attitudinal studies were conducted by Stephen Kellert of Yale University School of Forestry and Environmental Studies, who did one of the first nationwide and most comprehensive surveys of public attitudes towards wildlife in the mid-1970s. His survey launched the academic field of human dimensions in wildlife management and many of his findings are applicable to the challenges of modern day urban wildlife management (Kellert and Berry, 1980; Kellert 1982).

One of the attitudinal trends Kellert noted was that our landscapes have become more urbanized, and city-born residents exhibit markedly different attitudes than their rural counterparts. Kellert felt that city dwellers exhibit much higher humanistic and protectionist attitudes (i.e. based on concern for the welfare of individual animals) versus the more utilitarian attitudes of rural dwellers. It is estimated that 80% of the United State's population now lives in metropolitan areas and 20% in rural areas, as opposed to a reversed ratio decades ago. More recent research indicates that this protectionist attitude may be changing in New York State and even urban dwellers may be exhibiting more utilitarian attitudes toward wildlife (Butler et al. 2003).

It is fair to say that the top concerns of the public about deer are deer-car collisions followed by damage to shrubs, gardens, and Lyme disease (Chase et al. 1999; Kilpatrick and Walter 1997). The public's priority concerns are generally not the same as those voiced by parks departments and nature centers, which generally cite biodiversity concerns as their main concern about overabundant deer. That said, a recent study in New Jersey indicates that residents surrounding parks have a greater concern about the negative impacts of deer, due to their first- hand exposure to deer on a regular basis, than residents farther from these parks (Siemer et al. 2007). As a result, they better understand the need to manage deer within the park boundaries. As Westchester County becomes more urbanized like northern New Jersey, public education will play an increasingly important role as park managers attempt to protect dwindling plant and animal species and reduce deer-human conflicts.

In terms of managing deer populations, lethal control is more acceptable to people if it is done to prevent severe consequences for humans (e.g. spread of disease, deer collisions) or if human tolerance levels for deer damage have been exceeded (Fulton et al. 2000; Messmer et al. 1997; Mcaninch 1995; Loker 1996). Surveys indicate that preventing minor negative aesthetic impacts (e.g. damage to ornamental plants) is of lesser importance.S In addition, the degree to which the public accepts lethal control vs. non-lethal techniques is a function of how well the public is educated about the efficacy of such techniques. Accepting hunting as a method of managing deer is also to some a function of the efficiency and manner in which the hunting is conducted (Kilpatrick and LaBont 2003). Kilpatrick's study in Connecticut found that "two out of every three residents who did not support hunting before the hunt indicated afterword that they would support hunting in their community in the future."

Municipal Deer Survey 2007

` In order to determine whether Westchester communities responded to deer problems by establishing "Deer Committees" or taking other actions, a task force subcommittee devised a two question survey that was sent to all County towns, villages, and cities.

Forty-five surveys were distributed and 41 returned (91%). Of the 41 returned surveys, 32 (78%) identified what jurisdiction they were, but nine were unidentified. All but one response said "no" to the question of whether their jurisdiction had sent out a survey or formed a Deer Committee. The only "yes" response to having addressed the deer issue with survey or committee was the Village of Irvington, which sent out a survey. Irvington's conclusion was that there is a perception of an increase in their local deer population, and that 74% of those answering perceived this as "a threat to their family and community." About the same percentage (74%) said that the deer population should be reduced.

Task Force members already knew before the municipal survey was sent that the City of Rye, Town of Greenburgh, and Town of Pound Ridge had taken action to address deer management. Rye undertook a survey in 2005 and 2006 and had a "Deer Committee,"

which was established in 2004. Conclusions from Rye's first opinion survey were that there was no "obvious town-wide deer population problem," but that there were two areas of concern in the city. One problem area was located around Grace Church Street (not far from Playland Park) and the other problem area was found in the Greenhaven area (near Marshlands Conservancy). Results of the 2006 Rye survey were that the respondents seemed to be slightly more concerned about overabundant deer, but paradoxically there were fewer deer complaints in 2006 to the Rye City Naturalist.

The Town of Greenburgh appointed a Deer Committee around 2004 and the Task Force learned that they produced a draft report in 2005, but it apparently was not approved by any Town body, or made public.

No definitive conclusions can be drawn from the amount of information received from these surveys.

Appendix 4: Population Management Techniques

Numerous methods of addressing perceived negative effects of overabundant white-tailed deer in suburban and urban areas have been suggested or developed over the last half century as deer populations in the United States have grown. This growth has been especially noticeable in the eastern United States. Many authors have summarized these methods (e.g. Coffey and Johnson 1997) and have produced a basic "laundry list" of techniques that has changed surprisingly little over the last 15-20 years. However, within individual deer control methods, minor advancements and refinements resulting from research and practical application have occurred in recent years. Furthermore, the concept of "integrated resource management," an approach in which multiple, compatible techniques are combined to best achieve resource protection goals, has been increasingly applied to white-tailed deer management problems. Also, of growing interest is the application of deer management methods to specifically prevent damage to biodiversity.

General Deer Management Techniques

In general, methods of addressing deer impacts can be separated into three distinct categories: no management of any type (often in conjunction with an outreach program directed at instructing affected parties on how to live with deer), population control (i.e. attempting to manage the deer population at a level where impacts are tolerable) or impact prevention (i.e. lessening impacts of deer without direct population manipulation). In this section, the first two categories are discussed. Appendix 5 covers prevention avoidance.

1. *No Management* As its name suggests, in this "do nothing" alternative, no actions are taken to address deer overabundance or population management. Typically, the less visible impacts of deer overabundance (e.g. loss of biodiversity and wildlife habitat) are ignored while the more obvious effects of deer are dealt with largely through changes in human behavior or attitudes; for example, planting more deer-resistant plants rather than highly preferred plants can resolve a deer browsing problem for avid gardeners, or utilizing a combination repellent and netting/fencing strategy.

It has been suggested that in the absence of human interference, deer populations will reach a natural (yet oscillating) balance with their habitat. Deer productivity and survival is tied to their nutritional status -- when deer have abundant food resources, they are better nourished, and respond by having more fawns, lower neonatal mortality, and a higher prevalence of pregnancy in yearlings (Verme 1969; Verme 1982; Mansell 1974). When the nutritional plane declines, deer productivity is lowered. Historically, Aldo Leopold and many other well-respected wildlife managers have suggested that unmanaged deer population can increase to a level exceeding biological carrying capacity. This population explosion is then followed by a population crash due to starvation, disease, and other factors. Ultimately, the population stabilizes at a level corresponding with a reduced carrying capacity. However, this classic paradigm does not appear to accurately reflect what happens to deer populations in many suburban and protected areas. For example, Underwood and Porter (1997) observed that the unmanaged deer herd at Saratoga National Historical Park has slowly grown since the 1960s and now far exceeds population densities at which deer cause significant damage to the natural ecosystem, without any evidence that a population crash was imminent.

2. *Population Control* Deer impacts often are assumed to be correlated with deer population size. Thus, a common thought is that by reducing the population size many impacts will be lessened. At its most basic level, population size is a function of recruitment (births), mortality (deaths), immigration, and emigration. Generally, in large populations, immigration and emigration are assumed to be equal. Therefore, population management on a large scale generally focuses on influencing recruitment and mortality. However, it is important to remember that when managing deer on a smaller scale, immigration and emigration may have a large effect on population dynamics. Deer physiology can confound population control attempts due to the fact that deer productivity increases when deer numbers lessen and more food becomes available for the remaining deer. Hence, a principle underlying managing deer for Maximum Sustainable Yield (MSY) is that you can remove 20-30 percent of the population at the point where deer are at mid-carrying capacity and exhibit the highest reproductive rate. By doing so, you can ensure that the population replaces itself post-harvest and therefore can be sustainably harvested year after year at the same population level.

A. *Hunting* Recreational hunting is the most commonly-cited control technique for white-tailed deer in the United States. Despite debate about its effectiveness in regulating deer populations and different ethical perspectives on the appropriateness of hunting for recreation, recreational hunting occurs in every state that white-tailed deer inhabit. New York State biologists believe that recreational hunting has generally proven successful and cost-efficient for both large scale (state or regional levels) and localized deer population management. It is important to note that the goals and strategies used for recreational hunting are different from those that might be used in hunting programs designed exclusively to manage deer population sizes. Hunting is very cost-effective relative to other population control techniques, but setting up and carrying out a controlled hunt can have significant administrative costs Doerr et al. 2001)

In New York, the New York State Department of Environmental Conservation (NYSDEC) regulates and oversees deer hunting, and is responsible for licensing deer hunters. In Westchester County, deer hunting is limited to archery equipment ("bow hunting"), whereas in other parts of the state, legal hunting implements include firearms (shotguns, handguns, muzzleloaders, and rifles). A variety of programs are available through NYSDEC for hunters and landowners to promote large-scale and localized deer population management and for recreational hunting opportunities. These programs include the Deer Management Permit (DMP) system (designed to manage deer at the Wildlife Management Unit level), the Deer Management Assistance Program (DMAP) (designed to allow for localized deer management), and the Bonus DMP system (used to augment the DMP system in areas where needed) specific to Westchester County only. All of these programs target antlerless deer (preferably females) because it has been demonstrated that managing females is key to regulating white-tailed deer populations.

Several elements are common to any type of recreational deer hunting, whether it be with archery equipment in Westchester County or a rifle in the Adirondack Mountains. Deer hunting is voluntary, i.e. participants are undertaking hunting at their leisure. Participants pay for a hunting license issued by DEC and are restricted by various state regulations, including hunting limits and established seasons.

In the past, deer populations were managed at levels intended to maximize the recreational enjoyment derived from deer hunting. Because studies and anecdotal evidence suggest a higher deer population equated to greater hunter satisfaction, deer populations were maintained at high levels to appease hunters. The rationale behind this management was that because hunters were paying for licenses (and typically funding the wildlife management budget for the state), providing a quality recreational experience was good customer service. In more recent years, biologists have tried to implement hunting programs to reduce to reduce the deer populations to lower levels that, while not necessarily providing the same level of hunting enjoyment of higher deer populations, are intended to minimize the negative ecological impacts associated with high deer populations. In most states including New York, fish and game agencies have a dual yet contradictory mandate: to manage deer at levels *high enough* to satisfy recreational hunters yet *low enough* to mitigate negative impacts for landowners. This often leaves agency biologists with a daunting juggling act trying to appease the desires of both parties.

Westchester County Bow Hunting

For more than 30 years, the DEC has worked with the Westchester County Bow Hunters Association to expand safe hunting of deer in the County. In an effort to reduce deer densities and deer impacts in Westchester County, NYSDEC has steadily increased the number of DMPs available for Wildlife Management Unit 3S (includes all of Westchester and a small portion of southern Putnam Counties) from 1,508 in 1987 to 9,050 in 2006 (DEC 2007, unpublished data). Over that same time period, the female portion of the harvest increased from 0.32 to 1.87 per square mile (DEC 2007, unpublished data). In addition, the deer hunting season in Westchester County was expanded from 30 days to approximately 2.5 months. To help ensure high standards of safety, bow hunters are required to attend a New York State bow hunter training and certification course and be licensed.

Deer hunting in Westchester is limited to bow hunting. In 2006, 3,834 hunting licenses were sold to Westchester residents and 1,724 deer were harvested, including 1,128 antlerless deer (male and females fawns, as well adult females). In addition 127 deer which were taken on Deer Damage Permits (DEC 2007, unpublished data).

Hunting opportunities in Westchester are primarily on private properties, but some limited opportunities exist on public lands owned by New York City Department of Environmental Protection, Rockefeller State Park, and town-owned properties in Pound Ridge. A local municipality cannot ban hunting on private properties within its boundaries; however, some have effectively eliminated hunting through the implementation of no-firearm-discharge ordinances.

In 2006, two pilot bow hunting efforts on public land were started as a response to the negative impacts of deer on local habitats: (1) the Town of Pound Ridge certified 70 bow hunters and allowed them to hunt three town parcels, resulting in the taking of 33 deer; and (2) Rockefeller State Park (in the Town of Mt. Pleasant) certified 12 bowhunters who took 23 deer. No accidents or mishaps were reported in these test cases.

B. Culling Culling, which involves the killing of deer and can take many forms, has been used to reduce local deer populations in the eastern United States in some situations with varying levels of success. Examples of culling techniques include bait and shoot, trap and euthanize, and tranquilize and euthanize. While culling is lethal and is sometimes carried out in a manner similar to recreational hunting (e.g. firearms), it is important to make a clear distinction between these two methods of population control. Culling operations are typically (although not always) conducted by professionals paid to remove deer from the population, and are often expensive. (Doerr et al. 2001). These professionals are often highly trained and proficient at what they do. On the other hand, recreational hunting is carried out by participants that pay for the privilege to hunt and derive enjoyment from this activity. Because hunting is free to the agency responsible for deer management (and in fact generates money on the state level) and culling usually requires the investment of money and/or effort, hunting is usually the most cost effective and hence preferred method of deer population control, especially on a large scale. However, sharpshooters differ from recreational hunters in their goals and strategies. Sharpshooters typically bait deer to a kill site and their goal is to take out as many deer as possible from an area in a concentrated manner. In contrast, recreational hunting is done with hunters spread out over a wider area and does not have the same intensity, efficiency or high volume

removal. In situations where recreational hunting cannot effectively control the deer population, or it is perceived that hunting would be unsafe or undesirable, culling may be preferable.

Culling programs in New York require a permit from the NYSDEC such as deer damage permits (nuisance permits), which allow property owners who are sustaining an unacceptable level of deer damage to remove deer from the local population. Generally, deer damage permits are issued to agricultural businesses for localized management and are not used to address landscape-level deer overabundance problems. Permit holders are not restricted by statewide hunting regulations; e.g. there is no established season, they may shoot from a motor vehicle, and they may shoot after dark.

C. Trap and Transfer This technique refers to the physical capture and removal of deer from an area where the impacts are exceptionally high and relocation to other areas. This technique is not practical on a large scale because of the cost and effort associated with capturing and relocating each individual deer. In addition to prohibitive costs, this technique merely shifts deer impacts from one location to another rather than providing a definitive solution. As white-tailed deer have come to occupy all suitable habitats in the eastern United States, this technique has fallen out of favor as there are no longer areas that lack deer. Additionally, concerns over the spread of disease and capture associated mortality make this approach less attractive for wildlife agencies. A trap and transfer program would require a permit from NYSDEC. For the reasons listed previously, such a permit would never be issued.

D. Encouragement of Deer Predators Predators thought to be capable of widespread deer population control (e.g. wolves, mountain lions) have been extirpated from New York since the 1800s. However, the natural spread of coyotes across New York over the last 30 years and the gradual range expansion of black bears and bobcats within the state have potentially helped to fill this long-vacant ecological niche.

Recent scientific research suggests eastern coyotes are more genetically similar to red wolves (which are believed by some to be the indigenous wolf species in New York) than to western coyotes. Furthermore, coyotes in New York are more likely to actively hunt deer

than their western counterparts and deer comprise a significant portion of their diets, especially during the spring fawning season and fall hunting season. Bobcats, while still uncommon in most areas of New York, are becoming an increasingly common sight in the Hudson Valley and undoubtedly consume some deer. In addition to coyotes and bobcats, black bears represent a significant predator on white-tailed deer fawns.

Coyotes and bobcats are classified as furbearers in New York and are subject to annual hunting and trapping seasons. Black bears, as a game species, are subject to an annual hunting season in the core areas of their New York range, which does not include Westchester County. In theory, by eliminating or at least curtailing hunting and/or trapping seasons for these deer predators, their populations might increase and subsequently, their impact on the deer population might also increase. However, this approach comes with its own set of problems (e.g. the public can and do view coyotes as a public safety threat). In suburban areas, such as Westchester County, where coyotes may be more visible or in closer proximity to people, the perception that coyotes are a threat or problem is generally more pervasive than in rural areas. Complaints in regards to black bears are similarly frequent, especially in areas with high bear and human populations. Furthermore, because there is currently no hunting season for black bears in Westchester, nothing more could be done to encourage a larger bear population in the county outside of a trap and transfer program. Reintroduction of extirpated predators such as wolves or mountain lions to Westchester County would require NYSDEC involvement and permits. For a number of reasons, first and foremost public safety, this would not occur.

In addition to the social concerns that would likely result from an increase in predator populations, there is some evidence that the deer predator guild in the eastern United States (coyote, black bear, and bobcat) do not prey upon white-tailed deer at rates sufficient to control white-tailed deer populations. A recent research project with radio-collared fawns in Pennsylvania suggested that depredation rates on fawns, while high (80% of the 55% total mortality rate in a forested landscape), were not, by themselves, capable of controlling the deer population (Vreeland et al. 2004)

E. Fertility Control Experimental research on fertility control for white-tailed deer has been ongoing across their range, but this technique has never been applied on a large scale basis. However, two published studies do report population level decline on specific sites where the vaccine has been utilized on a local deer population (Rutberg et al. 2002; Naugle et al. 2002). Whereas hunting, culling, and predators target population size by increasing mortality rates, and trap and transfer increases emigration, fertility control targets recruitment. Of late, most research on fertility control has focused on immunocontraception, a technique in which the target animal ingests a protein that induces an immune response which attacks the reproductive system, rendering the animal temporarily sterile. Currently, all deer contraceptive vaccines are being utilized under an experimental use permit until FDA and EPA requirements for registration are met. No immunocontraception vaccine is currently EPA approved for commercial use. However, the USDA National Wildlife Research Center is conducting extensive research with GonaCon and expects to have the vaccine registered within a relatively short time frame. However, current contraceptive vaccines are designed for site specific, very local deer management uses, not large-scale control.

Sterilization of female white-tailed deer requires immobilization and surgery in the field, and has proven very expensive and is little used, and inappropriate for large scale use.

Appendix 5: Preventing and Mitigating Deer Impacts

The goal of impact prevention and mitigation is to resolve the problem by removing the attractant or making it less accessible to deer – that is, resolving the conflict at its source. For example, a landowner who is experiencing ornamental or garden plant damage may opt for one of these impact avoidance strategies. The best types are multi-sensory –i.e. a combination of frightening sounds, sights, smells and bad tastes that together teach deer that certain areas are dangerous. With multi-sensory deterrents, the ever-changing and novel stimuli create a predator association that signifies danger to the deer, or triggers other aspects of aversive conditioning.

1. Exclusion Fencing Exclusion fencing is undoubtedly the most effective deer impact prevention technique because it physically excludes deer from the fenced area, allowing for the complete protection of the target resource (e.g. ornamentals, backyard vegetable gardens, agricultural crops, regeneration, or biodiversity) without the need for active management of the deer population outside the fence. Fencing comes in many types, including electric fence, non-electrified wire, woven wire fence, and plastic fence, and can differ in scale (individual plant shelters to woven wire fences enclosing regenerating timber harvests of hundreds of acres), cost, and maintenance requirements. Property owners in Westchester County may be restricted in their fencing options by local ordinances. Fencing can have aesthetic impacts and negatively affects the movement of other wildlife species. Also, in areas of high deer density, fencing can merely shift deer on to neighboring properties.

In New York, fencing has not received widespread use as a forest management technique. In general, deer exclosures in forests have been small and used to experimentally assess and educate the public on the effects of deer on vegetation. However, larger scale exclosures are often used in agricultural settings in New York (e.g. orchards). Furthermore, in other states, such as Pennsylvania, fencing has received acceptance as a means of promoting forest regeneration and biodiversity on a large scale.

2. Deterrents Deterrents, which unlike fencing do not physically eliminate deer access to valued resources, attempt to discourage deer damage by disrupting undesirable behavior through hazing. Examples of deterrents include pyrotechnics, motion-sensitive lights or sprinklers, electronic stakes, motion-sensitive audible devices, and dogs. Deterrents often offer temporary relief from deer damage, but deer quickly become habituated to sounds and lights. Dogs, constrained by underground, "invisible" fencing, have been successful at preventing agriculture damage and it has been suggested that two dogs can effectively exclude deer from approximately 60 acres during snow-free periods.

3. Repellents Numerous commercial and home-remedy deer repellents have been suggested and/or introduced in recent years as the incidence of deer-human conflicts in suburban and urban settings has increased. Generally, repellents use an offensive taste (contact repellents) or odor (area repellents) to protect palatable plants from damage. Repellents can be quite successful at protecting individual plants if they are applied correctly and diligently, if the active ingredients are sulphurous (like rotten eggs), and deer populations are relatively low. Repellent effectiveness can be dependent on a number of factors including seasonal changes in plant palatability, local deer taste preferences and nutritional needs, availability of alternative foods, time of year, deer density, type of repellent and concentration of active ingredients, and durability for the repellent and how often it is applied. Furthermore, their effectiveness is best when the plants being protected are not highly preferred forage species.

4. Deer-Resistant Plantings and Cultivars Because deer are selective foragers that show strong preferences for certain plant species while avoiding others, ornamental gardens planted with non-preferred species for landscaping projects often incur lower levels or no deer damage than gardens planted with preferred deer browse species. Many environmental organizations produce lists and post website information on deer-resistant trees, shrubs, flowers and other ornamentals. It is recommended that people consult with their local garden clubs and plant nurseries for what species work best in their area since deer food preferences may vary locally and regionally.

5. Provision of Alternative Food Sources It has been hypothesized that providing deer with supplemental "artificial" food resources (food plots) will alleviate browsing pressure, and hence reduce impacts, on natural food sources (e.g. tree seedlings and saplings and native herbaceous plants). The use of strategic small clear-cuts in commercial forestry to increase advance regeneration in the face of high deer densities is reliant on this strategy, yet it is a relatively short term food "swamping" effect. However, many biologists believe that provisioning over time may increase deer productivity, so supplemental feeding is not generally recommended as a long-term strategy. Moreover, this technique may artificially concentrate deer resulting in unnaturally high damage levels to native plants near the supplemental food sources.

Appendix 6: Case Studies Illustrating Current Practices and Lessons Learned

It's important to note that none of the case studies have put a funded mechanism in place for measuring deer impacts post-hunt, although some expressed a desire for better record keeping and data collection. It is a unfortunate reality that funding limitations and other issues can restrict the ability of communities to assess and monitor the success of a hunt or other strategies in meeting stated goals to manage deer. Anecdotal observations cannot suffice for solid science-based conclusions. Many programs aim to have clearly stated measures of success to evaluate their efforts. Such evaluations require a scientifically-based monitoring process.

In reviewing those six case studies and reviewing many other similar efforts to co-exist with white-tailed deer, four key characteristics of successful programs were evident:

1. A study team should be commissioned to assemble all existing information concerning deer for the region; to identify the deer-human conflict issues in the area; and to make recommendations to resolve the deer-human problems affecting the community. These teams should be made up of ecologists and other experts, public officials, representatives of all effected groups, and local residents. The team should issue a well documented report.

2. Public meetings should be held to educate the public on the challenge, to get public feedback on what options they consider viable and desirable, and to ensure that there is public support for any recommendations. The public has to agree that there is a problem(s) serious enough to take action and has to be supportive of the techniques used in the recommended actions. It is essential that the actions chosen must be in keeping with the public consensus of attitudes and values.

3. The program should have very clearly defined goals - what is to be accomplished. These goals should be measurable and assessed by rigorous, scientifically-valid methods and adequate funding made available at the program's initiation. Since most deer management

programs are funded by taxpayers, it is vital that the public can see how its money is being spent and if the program is accomplishing stated goals.

4. After initiation of the program plan, there needs to be annual assessments done on a change in damage complaints, deer browsing, biodiversity measures, or whatever problems were identified as being in need of resolution --- in order to measure the program's effectiveness in meeting its goals and to provide information that can be used to modify the program, if needed. It is essential to set measurable goals so that a rigorous program evaluation can take place. This process of "planning, doing, and evaluating" is often referred to as "an adaptive management approach." It should be understood from the onset that any program (and the necessary management and data collection structures and organization(s) associated with it) must extend over many years to achieve long-term ecological goals.

Below we present two local and four out-of-state studies of community deer programs:

Case Study 1. Pound Ridge, New York, Deer Management

Pound Ridge, NY, is 45 miles North of New York City and has a population of 4,726. In 2005, at the request of the Town Board, the Conservation Board studied the alternatives available to deal with the destruction of the understory in the wooded areas of town. A significant cause was determined to be an overabundance of white-tailed deer. After reviewing other municipalities' efforts to deal with the challenge, the Board made the recommendation to allow deer hunting on three town-owned properties and to encourage private landowners to allow hunting on their properties.

Five public meetings were held, and the majority of opinion favored allowing hunting. There was some opposition based on 1) the inhumane treatment of deer, 2) the safety of residents, and 3) the specter of a wounded deer dying on neighboring properties. The Town implemented the plan which is based upon the NYSDEC regulations for deer hunting in Westchester County. There were several additions to those regulations to enhance safety: 1) no minors allowed, 2) hunting from tree stands only, 3) all hunters are qualified by the Police Department, and 4) all hunters are scheduled by time and location.

The plan was in effect in October to December 2006 and the results were reviewed at a Town Board meeting. Several large privately-owned properties were open to hunting. There were no serious incidents between hunters and residents. Photographs of the effected areas are taken for annual comparison of the under story growth. The program will continue in 2008. Each year, the results will be reviewed to determine if the program should continue. The review will include number of deer taken, automobile accidents, and pictures of the understory.

In summary, the Pound Ridge program identified deterioration of the understory as the primary concern. The public was given many opportunities to review and comment upon the program. Annual reviews are done to review the results and to make recommendations for the following year. At this time, it is too early in the program to have definitive results.

Case Study 2. Mianus River Gorge Preserve Deer Management Program

In 2000, the Mianus River Gorge Preserve (MRGP) - located in suburban Westchester County -began an internal review process to evaluate the impact of white-tailed deer on the preserve's woody regeneration and floral biodiversity. The MRGP (763 acres) protects old-growth eastern hemlock (*Tsugae Canadensis)* and mid-successional hardwood forests. Deer density in adjacent Bedford, NY was estimated at 60 deer/sq mile from aerial surveys (Fordham University, Vector Ecology Lab, 2001; *pers. comm.*); however, subsequent modeling exercises suggest this figure may be an underestimate. Exclosure studies at the MRGP showed rapid recovery of wildflower abundance and diversity (Christie 2003; *unpublished data*) following the exclusion of deer. A historical study of the MRGP woody vegetation community from 1966 to 2004 showed drastic declines in all juvenile tree species, save American beech (Weckel et al. 2006)– a characteristic response of old-growth forests to deer overbrowsing (Whitney 1984).

Studies suggest that deer densities can be locally reduced (2-20 sq km) – suitable to the scale of nature preserves such as the MRGP – through the removal of philopatric social groups (see Porter et al. 2004). From 2001-2004, MRGP managers researched all management options including trap and transfer, sharpshooting, immunocontraception,

hunting, and nuisance culling. Transfer of deer in New York State was discouraged, and sharpshooting was and continues to be illegal in Westchester County. Immunocontraception was considered; however, effective implementation required the treatment of unrealistic proportions of female deer (minimum 50%; Seagal 1996), at prohibitive costs ($800-1,000/deer, Warren 2000). The efficacy of immunocontraception relative to culling continues to be debated (Hobbs et al. 2000) and is believed to depend on accurate knowledge of the fertility status of treated deer (Hobbes et al. 2000). Lastly, immunocontraception may have adverse repercussions on deer biology such as late-born fawns (Underwood and Verret 1998) and increased extended estrus periods (Shea et al. 1997) although the net impact on doe health is assumed negligible (Fraker et al. 2002). The impact of extended rut activity on buck energetics is unknown, yet may be adverse (Hernandez et al. 2006). Hunting in Westchester was and continues to be limited to archery. New York State Department of Environmental Conservation (NYS DEC) nuisance permits sanction the use of shotguns in a cull period conducted outside the regular hunting season where substantial losses to private property, food crops, or biodiversity have been demonstrated.

In 2004, the Board of the MRGP approved a three-year pilot program (subsequently expanded to 2010) to implement a controlled archery hunt to reduce the MRGP deer herd. Details of the program are as follows:

Use of a controlled archery program to locally reduce the deer population.

Hunters use their own permits supplemented by NYS DMAP permits during the NYS archery season.

Implementation of a cull by archery using nuisance permits provided by NYS DEC. (*NOTE: Nuisance permits require a cull by shotgun. Use of archery is experimental.*)

MRGP research investigating the impact of coyotes on deer dynamics and public education on the role of coyotes as predators on deer.

Continued on-going monitoring of woody and herbaceous vegetation at MRGP to evaluate the effectiveness of the program.

On-going population dynamics research to study the affect of archery hunting on deer social structure and population growth.

Case Study3. Montgomery County, Maryland Deer Management Program

Montgomery County, MD is a suburban county that is slightly smaller than Westchester County. The population is 873,341 and land area is 1,762 square miles. In response to glowing resident concerns about deer – devastation of landscape plantings, natural vegetation, and farm crops and deer automobile collisions, the County established a citizen Task Force to Study White-tailed Deer Management. The Task Force recommended the establishment of a work group, made up county and federal representatives to develop and oversee a deer management plan. The plan was completed in 1995 and updated in 2004. The goal was to reduce deer-human conflicts to a level that is compatible with human priorities and land uses.

The objectives of the plan were:

- Reduce the number of deer-vehicle collisions
- Reduce depredation on crops and ornamental shrubs and gardens to acceptable levels
- Reduce the negative impacts of deer on natural communities to preserve of flora and fauna
- Have an education program to information on deer and how to minimize deer-human conflict.

The work group collects data on deer-related vehicle collisions, citizen complaints, Lyme disease, crop damage, damage to natural vegetation, and deer population. The locations of the deer incidents are mapped and analyzed to determine where problems are most severe. These "hot spots" are prioritized and recommendations are developed.

The recommendations include:

- Continue efforts in educating the public on deer issues
- Continue efforts to make improvements to road fencing, signage and design
- Monitor progress in the use of Immunocontraception to regulate deer population
- Encourage more local community involvement in deer management efforts

- Continue and expand efforts of effective population management on private properties
- Continue and expand population reduction programs on select state and county lands.

These plans and their results are reviewed annually and recommendations for the next year are made. The results in the period 1996 to 2006 have had an effect. Deer-vehicle collisions peaked in 2002 and have stabilized since. The number of complaints from residents has stabilized. Estimates of deer population indicate that there has been a decline over this period as the deer harvest increased. Over 900 citizens have participated in county workshops. Educational efforts (brochures, cable TV programs, public service announcements) have made residents better aware of deer problems and solutions.

In summary, the Montgomery Deer Management Program identified the areas of concern, involved the public in the plan development and annual reviews, set objectives and measured outcomes annually.

Case Study 4. Burnsville, Minnesota Deer Management Program

The City of Burnsville, MN (located 15 miles SW of the Twin Cities with a population of 60,220) prepared a Natural Resources Master Plan in 1999 which identified the need for a citywide deer management program. The concerns were woodland restoration or regeneration, biological integrity of the city's natural areas, increasing complaints about nuisance deer, car/deer crashes and the long-term health of the deer herd. The Deer Management Program was adopted in 2001 to minimize the conflicts among deer, habitat and residents. The Program provided recommendations in four areas: education, monitoring, population control and feeding ban.

Education

The education program included use of a web page, newspaper articles, and workshops. Since the workshops were poorly attended in 2002-3, they were dropped. Cable TV has been added and videos are planned for the future.

Monitoring

Annual reports are prepared which contain deer census data, car/deer crash counts, resident complaints – number a type (a form has been designed for residents to use), effects of fence enclosed areas compared with open areas, and harvest counts – bow and sharp-shooter. Goals are set for these measures each year.

Population Control

Each year recommendations for various areas of the City are made for the number of deer to be harvested. Hunting seasons are set and Bowhunters and sharp-shooters are recruited to meet the established goals. The aerial count of deer has neen reduced from 239 in 2003 to 180 in 2007.

Feeding Ban

A feeding ban ordinance was approved in 2001. Letters were sent to residents informing them on the ban. In 2006, the City received no reports of feeding violations.

The program will continue in 2007 with some refinements based on analysis of the 2006 data. In summary, Burnsville has a well thought-out plan that monitored annually. The annual reviews give residents an opportunity to comment and provide data that are used for the plan for the following year.

Case Study 5. Brookfield, Wisconsin Deer Management

In June 2001, the City of Brookfield, WI (located 15 miles from Milwaukee with a population of 35,649) set up a task force to assess and analyze the deer population and related impacts – automobile collisions, damage to crops and ornamental vegetation, and the

experts and local public officials. There were many public meetings and much communications with the residents before the recommendations of the task force were adopted. The recommendations included nonlethal measures of control emphasizing public education and deer population reduction and maintenance using sharpshooters and trapping and relocating. Some of the specific recommendations were installation of cautionary signage on roadways, increased public awareness of the effects of feeding, deer repellents, and unpalatable landscape plants through the use of direct mailings, City Newsletter and the City website. The population reduction initiative has focused on areas where deer numbers exceed the recommended number of deer per square mile.

These recommendations have been implemented during the last five years. Each year an aerial survey is done and population goals for various areas of the City are developed. The program continues today.

In summary, Brookfield studied the concerns and developed recommendations with significant public input. Goals are set for various areas of the City and results are measured annually.

Case Study 6: Essex County, New Jersey – South Mountain Reservation

Essex County, New Jersey's second most populated county, located in the New York metropolitan area, while somewhat lower in population than nearby Westchester county, shares a similar demographic and geography. The County Executive,Joseph N. DiVincenzo Jr. announced on January 25, 2008 that "The growing number of deer is destroying the forest understory and ecosystems, as well as jeopardizing the future health of South Mountain Reservation.. Organizing a controlled hunt was a difficult decision, but there is no other effective means to address the deer population"… "Our Deer Management Program is the first step we are taking to reduce the size of the deer population to a manageable level so it no longer adversely affects our quality of life."

Addressing the growing deer population has been an issue in Essex County for more than a dozen years. In 1995, while serving as President of the Board of Chosen Freeholders,

DiVincenzo hosted a series of public meetings to discuss the problem. Since then, he has been working with the municipalities where South Mountain Reservation is located to reach a consensus about the best course of action. In 2007 the governing bodies of those three municipalities adopted resolutions supporting a controlled hunt. In addition, the County Executive, and senior staff met with a variety of animal rights organizations and environmental groups – including the Humane Society, DeerPeace, New Jersey Audubon Society and the Department of Fish and Wildlife to gauge the problem and listen to potential solutions. The deer management experience of nearby Union County was also used as a resource.

The County Executive noted that decision to remove deer from the reservation was based on overwhelming evidence that the animals were destroying vegetation in the forest of South Mountain Reservation. The loss of vegetation had a number of effects including a declining number of animal species that rely on the plants for food or protection, preventing new trees from growing, creating erosion problems and allowing invasive plant species to grow.

The plan for the culling of deer was designed with safety in mind. Essex County decided to use 15 sharpshooter agents of the County stationed in trees at least 20 feet above ground. The agents were selected by lottery, were licensed and had demonstrated their marksmanship. Their services were at no cost to the taxpayer. Those completing at least 8 half-day shifts were reimbursed with 40 pounds each of venison, the balance going to the needy and the homeless through the Community Foodbank of New Jersey.

Appendix 7: Laws, Regulations, and the Role of Government in Deer Management

New York's Fish and Wildlife Law, Article 11 of the Environmental Conservation Law, provides that the State owns all fish, game, wildlife, shellfish, crustacea and protected insects in the state, and their habitats, §11-0105. The New York State Department of Environmental Conservation ("DEC"), and specifically its Bureau of Wildlife, manages these assets. The mission of the Bureau of Wildlife is to provide the people of New York with the opportunity to enjoy all the benefits of the state through scientifically sound management of wildlife species in a manner that is efficient, clearly described, consistent with law, and in harmony with public need. Counties are preempted from enacting legislation at odds with the state statute, except to appropriate money, §11.0111.

The general purpose of the Fish and Wildlife Law is found in §11-0303(2):

> "To such extent as it shall deem feasible without prejudice to other functions in the management of fish and wildlife resources of the state and the execution of other duties imposed by law, the department is directed, in the exercise of the powers conferred upon it, to develop and carry out programs and procedures which will in its judgment, (a) promote natural propagation and maintenance of desirable species in ecological balance, and (b) lead to the observance of sound management practices for such propagation and maintenance on lands and waters of the state, whether owned by the state or by a public corporation of the state or held in private ownership, having regard to (1) ecological factors, including the need for restoration and improvement of natural habitat and the importance of ecological balance in maintaining natural resources; (2) the compatibility of production and harvesting of fish and wildlife crops with other necessary or desirable land use uses; (3) the importance of fish and wildlife resources for recreational purposes; (4) requirements for public safety; and (5) the need for adequate protection of private premises and of the persons and property of occupants thereof against abuse of privileges of access to such premises for hunting, fishing or trapping."

The deer management goal of the Bureau of Wildlife is: the perpetuation of the white-tailed deer resource, with the maintenance of populations at levels that ensure optimal

recreational opportunity commensurate with range carrying capacity and tolerable conflicts with other land uses.

Westchester County is classified by the DEC as Wildlife Management Unit (WMU) 3S, its own deer management unit. In most of the state, physiographic or ecological zones are used to demark WMU. However because Westchester is unique in many ways, bordered by the physical limitations of the Hudson River, Long Island Sound, and the City of New York, and with a north-to-south mixture of low density rural and high density urban areas, an exception has been made and the entire county is considered one WMU Because the DEC is aware of and sensitive to the rising number of deer damage complaints in Westchester, it has made Deer Management Permits (DMPs) available in sufficient numbers to achieve a reduction in the size of the deer herd in areas of Westchester where hunting is permitted. Such permits are intended to stimulate a greater harvest of antlerless deer through recreational hunting. The DMPs are issued by the DEC in those areas of the state where, in its opinion, "additional harvest of deer is reasonably necessary to properly manage the deer herd in the state in balance with the available deer range and natural food supply, " §11-0913. A DMP allows the take of anterless deer only and is valid during any open season in the WMU they are issued for. Another program, the Deer Management Assistance Program, is designed for localized deer management, and DMAP permits may be issued through it.

In addition to the harvest of deer during open deer seasons, the DEC allows the taking of nuisance deer outside of any open season by issuing deer damage permits (DDPs), to aggrieved property owners who are undergoing economic or property damage from white-tailed deer. These permits specify the number of deer that can be taken on the affected property, by any appropriate means, to reduce or halt the damage being done. Importantly, the intent of the DMP is to halt current damage, and the permit is not to be used in retribution against the deer for damage done in the past. With a DDP, deer (typically anterless only) may be taken up to 11:00 p.m. and with the use of spotlights and other methods of attracting the deer. Only under these controlled conditions can firearms be used to take deer in Westchester.

All persons who hunt deer must be at least 14 years old and must purchase a big game hunting license or a junior bowhunting permit (ages 14-16; longbow only, not crossbow). There are a variety of big game licenses, including lifetime licenses for both residents and non-residents of New York State. The DEC, county, town, city and village clerks, and DEC-designated issuing officers, may issue them, §11-0713. During special bowhunting seasons, a bowhunting privilege must also be purchased. Licenses are non-transferable, except for DMPs, which may be transferred to any person licensed to hunt deer in the State.

All persons applying for a big game license in New York State must possess a previously issued hunting license or a valid hunter education certificate. The hunter education course for firearms is a minimum ten hours in length. Bowhunters must also complete an additional bowhunter education course in order to be able to purchase the bowhunting privilege with their hunting license. Hunters must be a minimum of 14 years old to purchase a big game license, and those 14-15 years old must be accompanied by a licensed big game hunter at least 18 years old with at least one year of big game hunting experience. Since 2004, a big game hunting license costs $19.00 for New York State residents, and the junior bowhunting permit costs $9.00. The required bowhunting stamp is an additional $16.00. A non-resident big game license costs $110.00. All big game kills must be reported to the State; a person who kills a deer must report it by telephone under a system called DECALS, or mail the "duplicate" Deer Report portion of the big game tag within 10 days after the deer is killed, or within 48 hours for deer taken on a DMP.

Deer hunting seasons vary in different parts of the state. All deer hunting seasons in the Northern Zone of New York State (basically north of the Mohawk River Valley) open earlier than those in the Southern Zone, which includes Westchester County. Typically, in most parts of the State, the regular season allows the use of any legal hunting implement, and deer tags are for bucks only. However, in WMUs which do not allow rifle hunting and that allow bowhunting bow only, such as Westchester or Suffolk, deer of either sex may be taken on a regular season deer tag, with the bowhunting privilege.

In the Northern Zone, muzzleloading seasons precede and/or follow the regular seasons and may overlap with bowhunting seasons. In the Southern Zone, the muzzle-loading season follows the regular season, which ends in December. Muzzleloading and

bowhunting seasons typically allow the harvest of deer of either sex, but may be restricted to bucks only in WMUs where deer population are well below management level objectives.

In Westchester, the deer hunting season is from mid-October through December 31st. As noted, the State may limit the type of deer taken depending on the hunting implement used. Hunting hours are between sunrise and sunset, unless DEC regulations provide otherwise.

All DMP applicants in Westchester County (WMU 3S) are guaranteed two tags (DMPs) at the original time of purchase. Bowhunters that successfully fill a WMU 3S DMP with an anterless deer can acquire an additional either-sex Bonus DMP for that unit, which can be used to obtain additional Bonus DMPs if filled with anterless deer. Therefore, Westchester hunters, through the Bonus DMP system, can take an unlimited number of anterless deer in WMU 3S.

Deer hunting is allowed in several state parks throughout New York, but in many, such as Clarence Fahnestock and Hudson Highlands in Putnam County, and Lake Taghkanic in Columbia County, hunting is limited to bowhunting only. Several other state parks limit the hunting implements to archery equipment and muzzleloaders. In 2007, a pilot program of bow hunting of deer was conducted in the Rockefeller State Park Preserve, in Mount Pleasant, to cull the herd. It was considered successful and may be replicated in other State parks or, with changes in the laws, in County parks.

The state reports continuing serious problems of deer underharvest in many southern zone WMUs, including suburban areas where hunters and access to areas where deer live are limited.

In Westchester, hunting has historically not been, and is not, permitted on any state land, in any of the County parks, or on most New York City watershed lands, a combined area of over 30,000 acres, or roughly 10 percent of the County's land area. However, as noted, in a recent 2007 pilot program on the state-owned Rockefeller Park Preserve, the State allowed limited deer hunting by qualified archers to control the size of the herd.

There is no minimum size of the property on which hunting can take place. However, it is unlawful to discharge a firearm or a longbow within 500 feet of an occupied dwelling without permission from the land owner. In Westchester, a great many private properties are "posted" against trespassing; this is a legal action and, if violated, trespassers may be prosecuted. Hunters may, however, go on posted lands with permission. The state-

sponsored "ASK" program alerts hunters to ask permission of land owners to enter their property and to respect it while it is being used. Land owners can indicate their willingness to consider such requests by placing "ASK" stickers on their regular posting signs on the perimeter of their property.

According to the DEC, bowhunters play the largest human role in reducing white-tailed deer on Westchester's private lands, and on some public lands, including New York City Department of Environmental Protection ("NYCDEP") watershed lands that are open to bowhunting.

One early private landowner's response to the growing deer population (and neighbor complaints) was on the Greenrock Corporation's property in Mt. Pleasant. Since 2000 on twenty to forty bowhunters, shooting down at an angle from trees, were used by Greenrock to harvest deer from its land.

In contrast to the no-hunting policy in Westchester County Parks and most local nature preserves, in 2003 the NYCDEP opened some of their watershed property to bowhunting --- and based on the results opened additional land in 2005. In 2006, two pilot bowhunting efforts on public land were started: (1) the Town of Pound Ridge certified 70 bowhunters and allowed them to hunt three town parcels, resulting in the taking of 33 deer; and (2) Rockefeller State Park Preserve certified 12 bowhunters who took 23 deer. No accidents or mishaps were reported in these test cases.

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http://www.lyme.org/

Deer Resistant Plants

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