# WATCHUNG BOROUGH

## WILDLIFE MANAGEMENT ADVISORY COMMITTEE

## 2018-2019 WATCHUNG WILDLIFE MANAGEMENT REPORT AND RECOMMENDATION

**December 2018**

This is the Watchung Wildlife Management Advisory Committee (WMAC) Report and Recommendation for the fall of 2018. A new feature was added to support our Recommendation that has been absent in previous years. That feature is the October 10/23/18 report by Jay F. Kelly who was engaged and compensated by the Borough Council, to evaluate the state of the Watchung forested areas. The report is entitled "Effects of White-tailed Deer on Forests in Watchung Borough in October 2018."

The Kelly Report presents seven pages of comprehensive research and reflects substantial field study and evaluation. Reference is made to the findings of two recent surveys which concluded that the Watchung deer population can range between "44-80/mi (i.e., after fawning)." Going further the Kelly report noted the population must be reduced to "10/mi to sustain the health of forest and other ecosystems."

The 10/23/18 Report stated that "it is advisable not only that hunting continue in Watchung Borough in 2018-2019 and future, but that efforts are made to increase its effectiveness in reducing deer numbers. This may be accomplished by increasing the number of properties hunted, implementing policies that would incentivize increased take (e.g., management targets, quotas, subsidizing cost, and/or hunter training), and eliminating restrictions on bow hunting."

It is worthy to note that a comprehensive study of alternate deer herd management methods was undertaken by the WMAC this past spring and summer. The non-lethal study data that was available was experimental in nature and might or might not be reflective of an environment as it exists in Watchung. Furthermore, the management methods (generally contraceptive in nature) are prohibitively expensive involving the tagging of individual deer and often administering more than one contraceptive treatment to each animal. Even more to the point any of the non-lethal methods would not be feasible under the current NJ firearm regulations, as darting is done with a gun and the 450 foot discharge rule would apply. There is no precedent for handling permission for this activity on private property as the darted animal often runs some distance before the tranquilizer takes effect. In summary, there exist no feasible non-lethal methods currently available for deer herd management. The only effective methods to reduce the level of the environmentally destructive deer herd population is hunting with all means permitted by the State of New Jersey.

Consistent with the Kelly report of 10/23/18, this committee's recommendations for the 2018-2019 deer hunting season follow.

(1) Establish a procedure to periodically apprise Watchung residents about the health of their woodlands as is relates to deer herd density.

(2) Locate and obtain permission for more hunting sites within the community.

(3) Require the state mandatory safety restriction of 450 feet for firearms hunting.

(4) Remove the Watchung inclusion of bow hunting from the firearms restriction and adopt the State of NJ bow hunting restriction to 150 feet and the related safety bow hunting requirements.

(5 ) In addition to using firearm hunting, permit the use of bow hunting to help in facilitating an increase in the number of culling sites. Adding new culling sites will have an effect on bringing down the 2018 surveyed deer population from as many as 80 deer per square mile toward the scientifically and generally accepted 8 to12 deer square mile density necessary to achieve forest regeneration.

Additional recommendations for the 2018-2019 season include: additional deer crossing signs, vigorous community education of the seriousness of the deer/forest situation, endorsement of forest restoration projects with town incentives and the recommendation that the Watchung Environment Commission address the issue of native ground cover species restoration.

Therefore in summary, it is the consensus of the WMAC that currently there is no economic method to accomplish deer herd population reduction in Watchung **without reintroducing bow hunting**. However, the WMAC understands that research into non-lethal deer management approaches are underway. The WMAC will continue to monitor (as it has done in the past) the applicability of these techniques in Watchung.

In addition, the following is a requested input for inclusion into the 2018-2019 Report, on the current status of non-lethal deer management techniques, from one of the WMAC committee members. " At the present time restrictions put into place by the former governor as well as cost considerations make contraception and sterilization prohibitive. It should be noted though that Dr. Anthony De Nicola had great success in Princeton, N.J. a few years ago before these restrictions were put into place. He is currently having success in Pa. and NY and has been able to reduce costs from $2000 per animal to $1000, and with the participation of local volunteers to $500. It is conceivable that these costs can be lowered to a point where it could be used in our Borough. As other towns struggle with this their approach it is also conceivable that our new governor will see fit to lift the restrictions which make contraception and sterilization so difficult to apply. Therefore, I believe this approach of contraception and sterilization should be revisited from time to time to consider its future use in Watchung. For more information: Google search, Wildlife Fertility Control White Buffalo Dr. Anthony De Nicola."

Attachments:

(1) Results of the White Tailed Deer Survey in Watchung Borough in April 2018
(2) Effects of White Tailed Deer on Forests in Watchung Borough in October 2018
(3) Correspondence from the Watchung Environmental Commission
RE: Need for Professional Evaluation on "State of the Forest" in Watchung
(4) Five (5) Forest Health NJ data slides from Dr. Jay Kelly's 12-6-2018 presentations

Recommended:

Paul Michaelis, Member — 12/12/18 Date

Richard Wellbrock, Member — 12/12/18 Date

Ray Miller, Member — Date

Hans Juette, Chair — 12/12/18 Date

Heidi Rubino, Member — 12/12/18 Date

Note:

Subsequent to the last meeting, where all committee members agreed to support the above recommendation, Ray Miller advised the Committee that he would not support the Recommendation due to his opposition to bow hunting.

ATTCHMNT: 1

# Results of White-Tailed Deer (*Odocoileus virginiana*) Surveys in Watchung Borough in April 2018

5/15/2018

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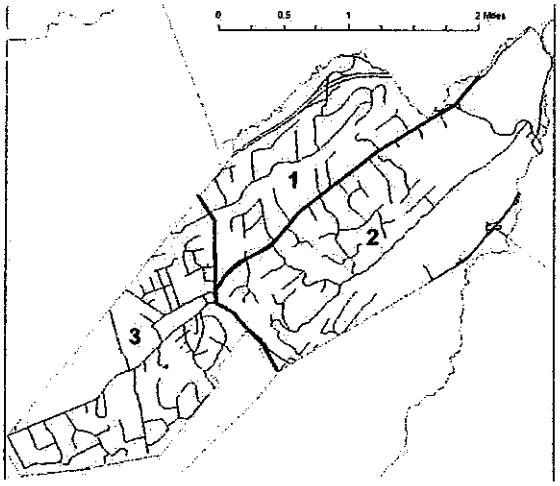
We documented densities of white-tailed deer (*Odocoileus virginiana*) in Watchung Borough in early spring of 2018 using roadside spotlight survey techniques. The Borough was divided into three sections (Figure 1), which were surveyed simultaneously by two different teams of Raritan Valley Community College wildlife research interns, on 4/5/2018 (Section 1 and 2), 4/10/2018 (Section 1 and 3) and 4/12/2018 (Section 2 and 3). Surveys were conducted on clear nights from 9:30 PM to 2:00 AM, counting the number of deer for each 0.2 mile segment of road using high-powered flashlights (600 yard max. range), and measuring search area using laser rangefinders. Density was calculated by dividing the total number of deer observed by the total search area, and was determined for both the first and second round of surveys for the Borough as a whole, as well as for each individual segment. The average density was then calculated for each in order to estimate town-wide densities. The total deer population in the town was calculated by extrapolating the average number of deer observed per survey across the area of the town. Because survey results may be biased by landscape and other factors, a second estimation was calculated by taking the proportion of deer observed during infrared fly-overs in 2017 compared to spotlight censuses (2.28), and multiplying the 2018 deer numbers by this factor.

**Figure 1. Location of survey sections of Watchung Borough**

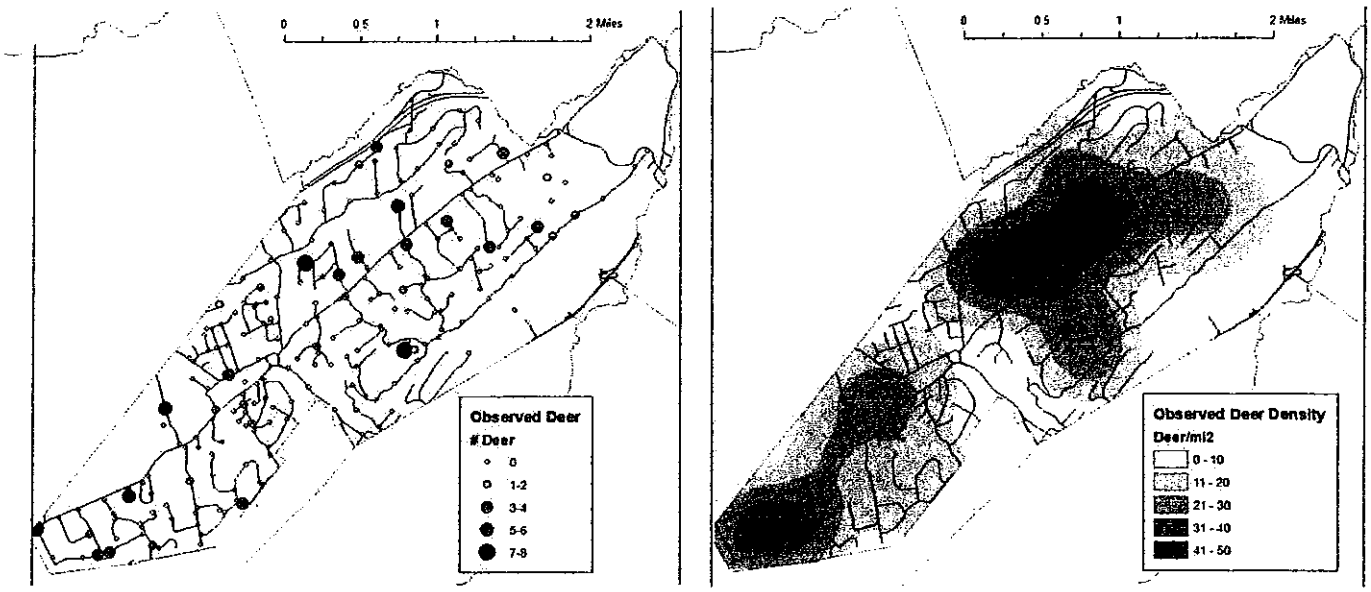



A total search area of 1.91 mi$^2$ was covered during each survey, or 31.6% of the approximately 6.05 mi$^2$ in the Borough as a whole. A total of 101 deer were observed during the first census, resulting in a total density of 52.8 deer/mi$^2$. A total of 56 deer were observed during the second round of surveys, resulting in a density of 29.3 deer/mi$^2$. The average density of deer for the Borough as a whole was 40.1 deer/mi$^2$. Based on these numbers, the total deer population in the Borough was estimated at 179-248 deer. Groups of deer numbered from 1 to 10 individuals (average = 2-3). Numbers of deer and associated densities varied greatly between individual Borough sections and between surveys, from 10-46 deer per section, and densities of 14.5 to 88.6 deer/mi$^2$. Variation in maximum observed numbers and densities are displayed in Figure 2.

**Table 1. Results of individual surveys for each section of Watchung Borough including search area, number of deer observed, and density (deer/mi$^2$)**

| Section | Search Area | Survey 1 - # (density) | Survey 2 - # (density) |
|---|---|---|---|
| 1 | 0.35 mi$^2$ | 24 (69) | 31 (89) |
| 2 | 0.87 mi$^2$ | 31 (36) | 15 (17) |
| 3 | 0.69 mi$^2$ | 46 (67) | 10 (15) |

**Figure 2. Number (left) and density (right) of deer observed.** Note that the figure on the right does not show actual deer density per section, but merely density of *observed* deer in order to illustrate spatial variation in deer distribution. The data illustrated in both figures is the greater results of the two surveys for each respective section of town.




The densities of deer observed in Watchung Borough in 2018 at 40/mi$^2$ are substantially higher than those observed by both ground (22/mi$^2$) and aerial (21/mi$^2$) surveys in 2017 (Kelly unpublished data; Vision Air Research 2017), and much higher than both historical and target deer densities for ecosystem management. Studies suggest that precolonial deer densities were likely to be approximately 5-11 deer/mi$^2$ (McCabe and McCabe 1997, Alverson et al. 1988), with impacts to preferred browse species at densities above 10/mi2 (Alverson et al. 1988) and impacts to forest regeneration above 20/mi$^2$ (Drake et al. 2002). the New Jersey Department of Environmental Protection estimates statewide deer densities to be approximately 38/mi$^2$ with the highest regional densities of 78/mi$^2$ occurring in central New Jersey (NJ Division of Fish and Wildlife 1999). Local densities may be even higher, with populations of over 200/mi$^2$ recorded in Delaware Township, Hunterdon County (Drake et al. 2002), and nearby Somerset County (Kelly, Almendinger unpubl. data).

Several possibilities may explain the apparent deer population increase in Watchung Borough from 165 observed in 2017 (including deer observed in adjacent areas) to an estimated 179-248 in 2018. These include immigration of deer from surrounding municipalities, reduction of hunting, increases in fecundity, or observer error. The last of these, however, seems unlikely to be a factor, as more than 100 deer were physically counted in the first survey, in an area comprising less than a third of the total area of the town. Deer movement between survey sections may also be a factor; however, given that two sections were surveyed simultaneously on each night and deer ranges are highly local in the winter season in suburban landscapes (Williams et al. 2008), this seems likely to be only a minor factor if at all.

Impacts of deer overabundance are not limited to plant species, but cascade throughout the food web. The majority of forest insects are specialists that feed on one or few species of plants, for example, and most forest birds depend primarily on insects, spiders and other arthropods for food (Tallamy 2007). For this reason, the decline in plant diversity resulting from deer overabundance, has been shown to lead to concomitant declines in insect and bird density (Blossey pers. comm.). Ground and shrub nesting birds also depend upon understory vegetation for nesting habitat, and the deterioration of these habitat conditions has resulted in greater declines for these nesting guilds than mid-story and canopy nesters (Baiser et al. 2008). For ecological reasons, then, targets for management of deer should be 10/mi$^2$ to best maintain ecosystem health and integrity, with a maximum of 20/mi$^2$ to allow for forest regeneration.

The effects of overabundant deer are not limited to natural areas, but to human populations as well. Tens of thousands of deer-vehicle collisions also occur annually in New Jersey, for example, resulting in more than $100 million in vehicle damage alone (Augenstein 2014). Deer are also the primary vectors of ticks in the eastern forests, which spread Lyme's Disease among other infectious diseases.

Lastly, it is important to note that the number and densities of deer observed were recorded at the most conservative time of year; i.e., after the cessation of the hunting season, and before the pregnant females had given birth. With females in this area regularly

birthing 2-3 fawns per year, it is possible that the actual population size for the majority of the year is double or more the numbers documented here.

**Literature Cited**


Alverson WS, Waller DM, Solheim SL. 1988. Forests to deer: edge effects in northern Wisconsin. *Conservation Biology* 2: 348-358.

Augenstein, S. "Why the fall is when most of N.J.'s deer get hit by cars, 26k struck yearly," October 6, 2014, *NJ Advance Media for NJ.com* http://www.nj.com/news/index.ssf/2014/10/deer_in_nj_hit_by_cars_50k_times_annually_-_drivers_cautioned_during_this_mating_season.html

Baiser B, Lockwood JL, La Puma D, Aronson MFJ. 2008. A perfect storm: two ecosystem engineers interact to degrade deciduous forests of New Jersey. Biological Invasions 10:785–795.

Centers for Disease Control and Prevention (CDC) 2016. County-level Lyme disease data from 2000-2016. https://www.cdc.gov/lyme/stats/index.html [Accessed December 8, 2017]

Drake D, Lock M and Kelly J. 2002. Managing New Jersey's Deer Population. Rutgers Agricultural Experiment Station, Rutgers University Press.

McCabe RE, McCabe TR. 1984. Of slings and arrows: an historical retrospective. In Hall, LK (Ed.), White-Tailed Deer: Ecology and Management. Stackpole Books, Harrisburg, pp.19-72.

New Jersey Division of Fish and Wildlife. 1999. Governor's report on deer management in New Jersey. New Jersey Department of Environmental Protection, Trenton, NJ, USA.

Tallamy, D. W. 2007. Bringing Nature Home: How Native plants Sustain Wildlife in Our Gardens. Timber Press. Portland, Oregon. http://bringingnaturehome.net

Vision Air Research, Inc. 2017. Aerial Deer Survey – Watchung, NJ. Final Report.

Williams SC, deNicola AJ, Ortega IM. 2008. Behavioral responses of white-tailed deer subjected to lethal management. *Can. J. Zool.* 86: 1358–1366.

ATTCHMNT: 2

# Effects of White-tailed Deer on Forests in Watchung Borough in October 2018

10/23/18

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**Summary**

Studies of forest conditions were conducted at 11 sites in Watchung Borough to determine the effects of local deer populations on forest health. The forest areas with no hunting had extremely low levels of tree regeneration compared to those with deer hunting or deer exclosures. The sapling category, which is the most indicative of deer damage, was 95% lower than the regional average on unhunted properties, and 99.4% lower than the historical average for the region. Properties that were hunted had 25x more saplings than unhunted properties, and exclosures had 136x more. The small tree category, which is the best indicator of longer-term deer damage, was also substantially reduced, with unhunted properties having 40% less than hunted areas or exclosure areas and 90% less than the historical average. Native shrub and woody vine cover was also substantially reduced compared to historical and regional averages, and invasive species were more abundant than natives in all areas, with the only major exception being the herb cover in deer exclosures. Native herbs were 85% higher in exclosures than unhunted areas, and invasive herb cover were 12x higher in unhunted areas and 6x higher in hunted areas compared to exclosures.

In the past two years, Watchung Borough deer surveys were found to be between 22-40/mi$^2$ in late winter-early spring after the hunting season (Kelly 2018), suggesting an average growing season deer density of approximately 44-80/mi$^2$ (i.e., after fawning). Higher numbers of deer are therefore present in all seasons than the recommended targets of 10 deer/mi$^2$ to sustain the health of forests and other ecosystems. Although hunting in Watchung is clearly enhancing forest regeneration compared to unhunted areas, the resulting sapling numbers are 82% lower than areas with exclosures and 60-83% lower than other nearby towns and park systems where more intensive management hunting occurs (Hopewell Open Space, Duke Farms, Princeton Township). Given the elevated numbers of deer present and the impacts observed to forest understories in this study, it is advisable not only that hunting continue in Watchung Borough in 2018-2019 and future years, but that efforts are made to increase its effectiveness in reducing deer numbers. This may be accomplished by increasing the number of properties hunted, implementing policies that would incentivize increased take (e.g., management targets, quotas, subsidizing costs, and/or hunter training), and eliminating restrictions on bow hunting, which would not only diversify the methods available to hunters but would dramatically increase the length of the hunting season in town.

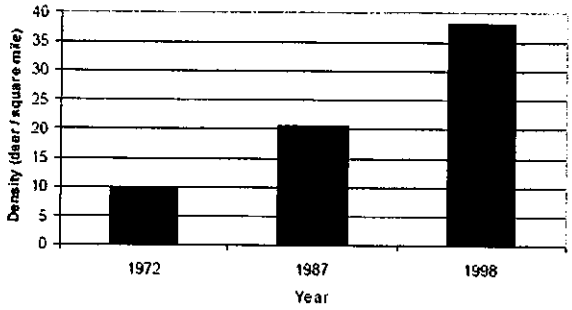
**Introduction**

Studies suggest that precolonial deer densities were likely to be approximately 5-11 deer/mi$^2$ (McCabe and McCabe 1997, Alverson et al. 1988). However, due to the extermination of major predators and the banning of commercial hunting in the 19$^{th}$ century, along with warming winters, increased forest fragmentation and suburban development in the 20$^{th}$ century, deer numbers have increased dramatically throughout their range (Cote et al. 2004). Based on hunting statistics, the New Jersey Department of Environmental Protection estimates statewide deer densities to be approximately 38/mi$^2$ with the highest regional densities of 78/mi$^2$ occurring in central New Jersey (NJ Division of Fish and Wildlife 1999). In the past two years, Watchung Borough deer surveys were found to be between 22-40/mi$^2$ in late winter-early spring after the hunting season and prior to fawning (Kelly 2018), suggesting a growing season deer density of approximately 44-80/mi$^2$. This is problematic, given that preferred browse species begin to decline when deer densities rise above 10/mi$^2$ (Alverson et al. 1988), and impacts to forest regeneration and the overall structure of the forest understory occur when densities exceed 20/mi$^2$ (Drake et al. 2002). Given the high numbers of deer observed, studies are needed to determine the extent of their impacts on forests in the Borough.

For research of this kind, we are fortunate to have a large number of prior ecological studies that were conducted in our region by researchers at Rutgers University in the 1940's through early 1970's (e.g., Cantlon 1953, Buell and Wistendahl 1955, Monk 1961). These studies used standard scientific techniques to measure different size classes of trees, along with shrub and herbaceous cover, and included a representative variety of forests and soil types for the region. By using the same methods to study forests today, we

may thus determine precisely how our forests have changed in the 40-50 years since. Because deer densities were far lower at that time in New Jersey (Figure 1), moreover, we may also be able to infer the effects of deer in causing these observed forest changes. In order to gain more precise evidence for causation, however, it is also necessary to include areas where deer exclosures and/or intensive deer hunting have been in place for at least 10 years, allowing for forest understory conditions to respond to these controls. By comparing the results from these areas, where deer numbers are few to none, to other areas where deer are not hunted, I hope to be able to more clearly ascertain the effects of deer on forests in Watchung Borough.

**Figure 1. Estimated deer population density trends in New Jersey from NJDEP data (from Van Clef 2004)**




**Methods**

A total of eleven forest sites were selected for study in Watchung Borough in 2018, based on a list of sites provided by Borough officials that were either public property or private properties where permission was granted. Sites included six unhunted properties (Nottingham, Tall Timbers, Wildwood Terrace, Municipal Building, Brookdale Park, Johnston), three hunted properties (High Tor, Elsinore, Camp Endeavor), and two deer exclosures (Sherwood)(Figure 2). The sites were visited on 10/12/18 and 10/15/18 and data was collected by Dr. Jay F. Kelly and two field technicians with Bachelor's Degrees in Ecology and five years of experience working in forest ecology. Study plots were 400 to 600 $m^2$ in area, depending upon property size, consisting of 100 $m^2$ quadrats arranged along two parallel transects spaced 20 m apart, with individual quadrats spaced 10 m apart. Trees were identified, measured and categorized by height and diameter at breast height (dbh), including: seedlings (<1' tall, <1" dbh), saplings (>1' tall, <1" dbh), small trees (1-3.9" dbh), medium trees (4-9.9" dbh) and large trees (>10" dbh). Saplings, small, medium and large trees were counted in the 100 $m^2$ quadrats, and seedlings were counted in two 0.5x2 m (1 $m^2$) quadrats located at the beginning and end of each 100 $m^2$ quadrat. Percent cover or herbaceous plants were also recorded in the 1 $m^2$ quadrats, and shrub and woody vine cover were recorded using the line intercept method, recording the amount of overlap of each species with the transect line running through each 100$m^2$ quadrat. These categories were consistent with both the regional and historic data sets used for comparison, including 135 sites in the current and 40 sites in the historic data sets (Kelly unpublished data). Shrub, liana and herbaceous data were analyzed in terms of cumulative % cover of individual native and invasive species, respectively. Photos were also taken to document and illustrate site conditions.

**Results**

Forest understories showed clear signs of major deer impacts. Areas with no hunting had extremely low levels of tree regeneration compared to those with deer hunting or deer exclosures (Plate 1). The sapling category is the most indicative of deer damage, as it represents trees that are generally 2-10 years in age and 1-15' in height, which are highly vulnerable to deer browse. Because it takes years for individual trees to transition out of this stage, the numbers of saplings remain highly vulnerable to continual browsing over time. Sapling numbers observed in unhunted properties in Watchung were 95% lower than the regional average, and 99.4% lower than the historical average for the region, representing some of the lowest numbers recorded in my research (Table 1, Figure 2; Kelly unpublished data). In contrast, properties that were hunted had 25x more saplings, and exclosures had 136x more (Plate 3). Hunted properties in Watchung had 26% more saplings than the regional average, where only recreational or no hunting occurs.

The small tree category, which is the best indicator of longer-term deer damage, also exhibited major declines, with 40% less than hunted areas or exclosure areas in Watchung and 90% less than the historical average. While the trees in this category are not directly vulnerable deer browse due to their larger size (typically >15' tall), if saplings are continually browsed over time, it leads to reductions in the numbers of small trees as insufficient numbers of saplings are produced to replace small trees as they either die off or develop into the next size class (medium size trees).

Seedling numbers were comparable between Watchung and both historical and regional averages, however, this category of trees is not a useful indicator of deer browse. Trees of this size are less than a year old, replenished annually from seed fall, and not typically browed until after the growing season, when less herbaceous vegetation is available. Given that the amount of seed produced may also vary depending upon annual weather conditions, masting events, and cyclical predator populations, we would not necessarily expect to see any signs of impacts to this layer of the forest. Similarly, we would not expect to major impacts to medium and large trees. However, the consistently high number of medium and large trees compared to unhunted areas suggests that the long-term deer exclosures (15-20 years) may indeed have protected trees long enough to begin to see the numbers bolstered from saplings and small trees developing into these larger classes as well.

**Figure 2. Locations of Forest Study Sites in Watchung Borough in October 2018.** Exclosure locations are shown in red. Basemap from Conservation Blueprint (www.njmap2.com)

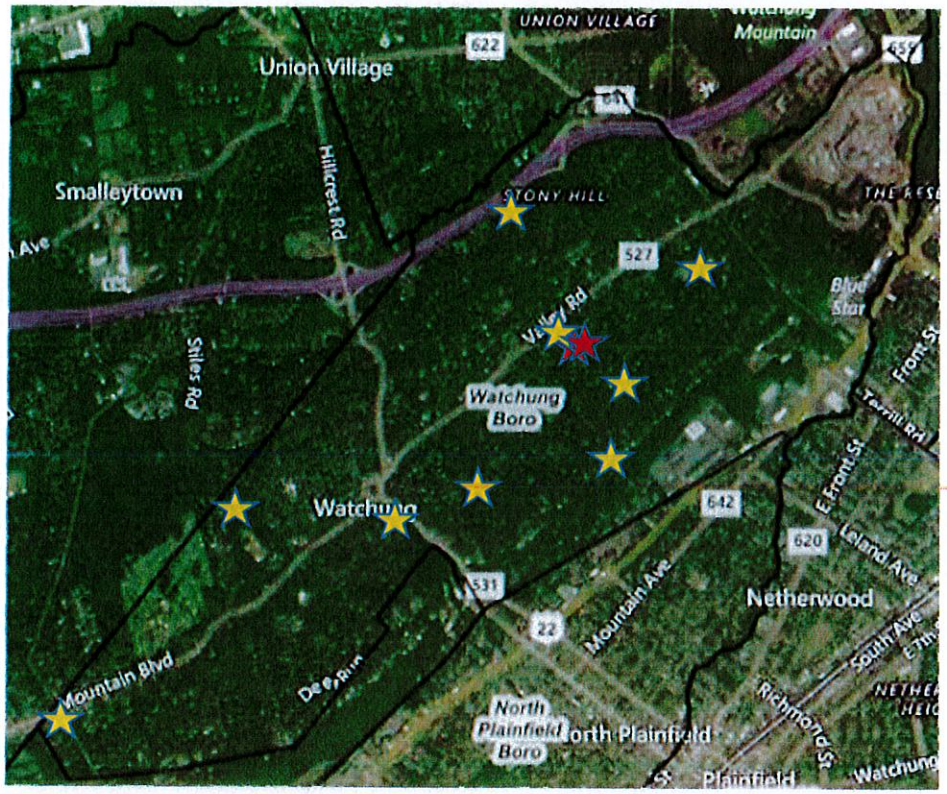
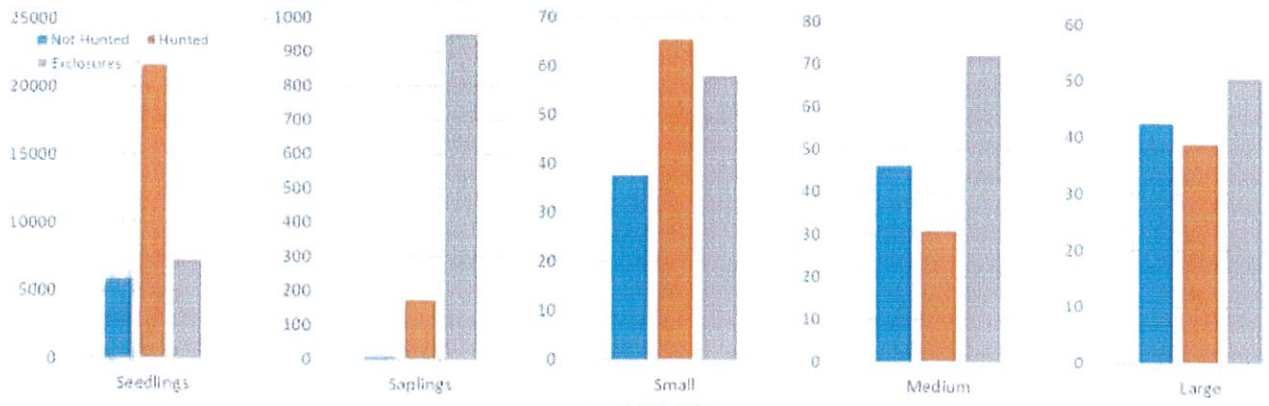



**Figure 3. Density of Trees in Different Size Class Categories in Relation to Management Type.**
Note: Figure units are standardized to number of individuals per 2000 $m^2$




Other understory conditions also showed signs of significant deer browse by both the reduction in overall shrub and liana (woody vine) cover and the overwhelming predominance of invasive plant species, which deer avoid eating when possible. Forest understories in Watchung Borough were in fact more invasive than native on average, with the only major exception being the herb

cover in the deer exclosures (Figure 5, Table 2). Native shrub and woody vine cover were substantially reduced compared to historical averages, but comparable to regional averages in areas with no hunting or recreational hunting only (which also suffer from exceedingly high deer densities of >70/mi$^2$). Native shrubs represented only 0-9% cover compared to 41% historically and 13% regionally. Woody vines were 1-5% compared to 7-8% historically/regionally. In both these categories, the amount of invasive species was substantially higher than historic levels, but lower than the regional averages.

Herbaceous ground cover was much higher than historical or regional averages, likely in response to the absence of shrubs and vines. Native herbs were 85% higher in exclosures than unhunted areas, and invasive herb cover were 12x higher in unhunted areas and 6x higher in hunted areas compared to exclosures. The worst incidences of invasive species overall was on the south-facing slope of Watchung Mountain, where the shallow soil and high degree of exposure has increased the number of tree blowdowns. In these areas, the light gaps are filling with invasive shrubs (*Aralia elata*, *Rhodotypos scandens, Rosa multiflora, Lonicera maackii*) and trees (*Ailanthus altissima*)(Plate 2). Significant effort is needed to restore the native species composition to these areas.

**Figure 4. Comparison of un-hunted Watchung forests to historical, regional, and intensive deer management averages**
Note: Figure units are standardized to number of individuals per 2000 m$^2$

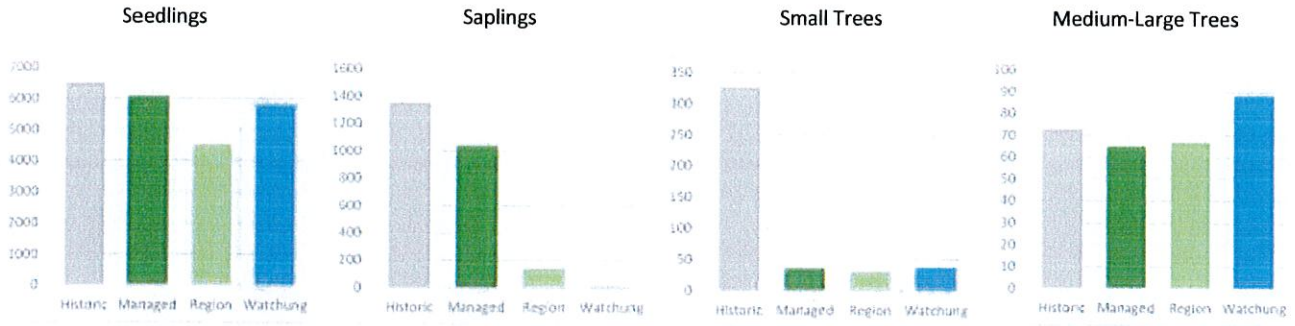
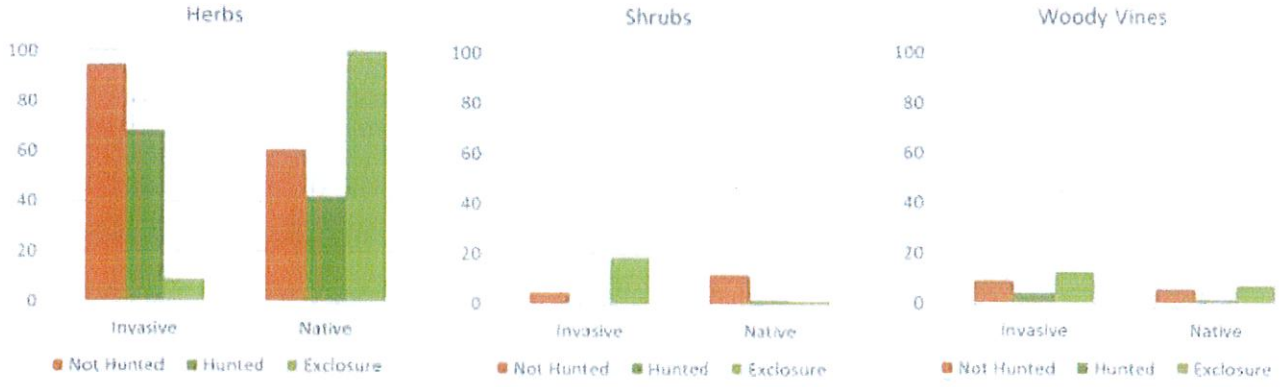



**Table 1. Comparison of Watchung Borough tree data to regional, historic, intensive deer management, and exclosure averages from Central New Jersey. Note: Densities are standardized to number of individuals per 2000 m$^2$**

| Location | Seedlings | Saplings | Small Trees | Medium Trees | Large Trees |
|---|---|---|---|---|---|
| Watchung Borough – Non Hunted | 5800 | 7 | 38 | 46 | 42 |
| Watchung Borough – Hunted | 21600 | 172 | 65 | 31 | 39 |
| Watchung Borough – Exclosures | 7250 | 952 | 58 | 72 | 51 |
| Central NJ Region | 5208 | 137 | 30 | 34 | 34 |
| Intensive Deer Hunting | 4633 | 809 | 10 | 29 | 35 |
| Deer Exclosures | 4800 | 1953 | 29 | 40 | 40 |
| Central NJ Historic (1948-1972) | 6481 | 1353 | 326 | 74 | |

**Figure 5. Cumulative Percent Cover of Native and Invasive Herbs, Shrubs and Woody Vines in Relation to Deer Management Type in Watchung Borough**



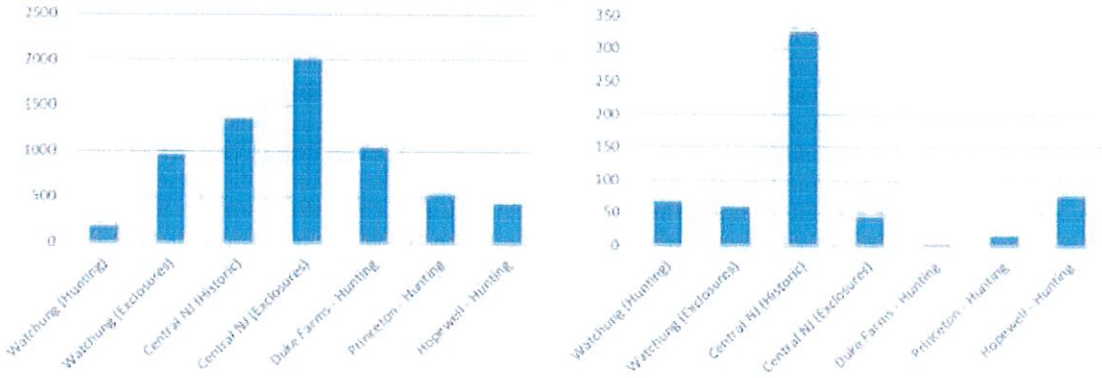
Although hunting in Watchung is significantly enhancing forest regeneration compared to unhunted areas, the resulting sapling numbers are 82% lower than areas with exclosures in Watchung Borough and 60-83% lower than other nearby towns and park systems where more intensive management hunting occurs (Hopewell Open Space, Duke Farms, Princeton Township; Figure 6), showing that there is significant room for improving the effectiveness of the hunting program. The higher numbers of small trees in these areas, which are comparable to exclosure numbers, are likely the residual effect of more intensive hunting practices that took place earlier, in the 2000's, as these tree sizes are typically reached after 10 years of growth. The lower numbers of saplings in Watchung exclosures compared to others in the region are likely due to their being 5-10 years older than the others, which is sufficient time for the major flush of sapling growth to dissipate as many either grow into the small tree category or die from competition. This younger age of the regional exclosures is also the reason that small tree numbers have not yet recovered to historical levels (Figure 4).

In the past two years, Watchung Borough deer surveys were found to be between 22-40/mi$^2$ in late winter-early spring after the hunting season (Kelly 2018), suggesting an average growing season deer density of approximately 44-80/mi$^2$ (i.e., after fawning). Given the elevated numbers of deer and the impacts observed to forest understories in this study, it is advisable not only that hunting continue in Watchung Borough in 2018-2019 and future years, but that efforts are made to enhance its effectiveness in reducing deer numbers. This may be accomplished by increasing the number of properties hunted, implementing policies that would incentivize increased take (e.g., setting management targets, quotas, subsidizing costs for butchering or bait, and/or hunter training), and eliminating restrictions on bow hunting, which would not only diversify the methods available to hunters but would dramatically increase the length of the effective hunting season in Watchung Borough.

**Table 2. Cumulative Percent Cover of Herbs, Shrubs and Woody Vines in Watchung Compared to Historic and Regional Averages**

| | Herbs | | Shrubs | | Lianas | |
|---|---|---|---|---|---|---|
| | Invasive | Native | Invasive | Native | Invasive | Native |
| Watchung (Not Hunted) | 95 | 60 | 3 | 9 | 7 | 5 |
| Watchung (Hunted) | 51 | 32 | 0 | 0 | 4 | 0.7 |
| Watchung (Exclosures) | 8 | 111 | 14 | 1 | 10 | 1 |
| Central NJ Region (Historic) | 1 | 29 | 0.1 | 41 | 0.8 | 8 |
| Central NJ Region (Present) | 22 | 17 | 28 | 13 | 25 | 7 |

**Figure 6. Comparison of Saplings and Small Trees in Watchung (Hunted and Exclosure Areas) to Historic Averages and Other Area With Intensive Deer Management (Hunting or Exclosures)**




**Literature Cited**

Alverson WS, Waller DM, Solheim SL. 1988. Forests to deer: edge effects in northern Wisconsin. *Conservation Biology* 2: 348-358.

Buell M, Wistendahl WA. 1955. Floodplain forests on the Raritan River. *Bulletin of the Torrey Botanical Society* 82: 463-472.

Cantlon, JE. 1953. Vegetation and Microclimates on North and South Slopes of Cushetunk Mountain, New Jersey. *Ecological Monographs* 23: 241-270.

Côté SD, Rooney TP, Tremblay JP, Dussault C, Waller DM. Ecological impacts of deer overabundance. *Annual Review of Ecology, Evolution and Systematics* 2004; 35: 113–147.

Drake, D., M. Lock and J. Kelly. 2002. Managing New Jersey's Deer Population. Rutgers Agricultural Experiment Station, Rutgers University Press.

Kelly, JF. 2018. Results of white-tailed deer (*Odocoileus virginiana*) surveys in Watchung Borough in April 2018. Raritan Valley Community College.

McCabe RE, McCabe TR. 1984. Of slings and arrows: an historical retrospective. In Hall, LK (Ed.), White-Tailed Deer: Ecology and Management. Stackpole Books, Harrisburg, pp.19-72.

Monk CD. 1961. Past and present influences on reproduction in the William L Hutcheson Memorial Forest, New Jersey. *Bulletin of the Torrey Botanical Club* 88: 167-175.

New Jersey Division of Fish and Wildlife. 1999. Governor's report on deer management in New Jersey. New Jersey Department of Environmental Protection, Trenton, NJ, USA.

Van Clef M. 2004. Review of the Ecological Effects and Management of White-tailed Deer in New Jersey. The Nature Conservancy, New Jersey Chapter

**Plate 1** – Photos of Forest Understories in Unhunted Properties, including (left to right, top to bottom) Municipal Building, Brookdale, Wildwood Terrace, and Tall Timbers, showing a severe lack of tree regeneration and native shrub cover.

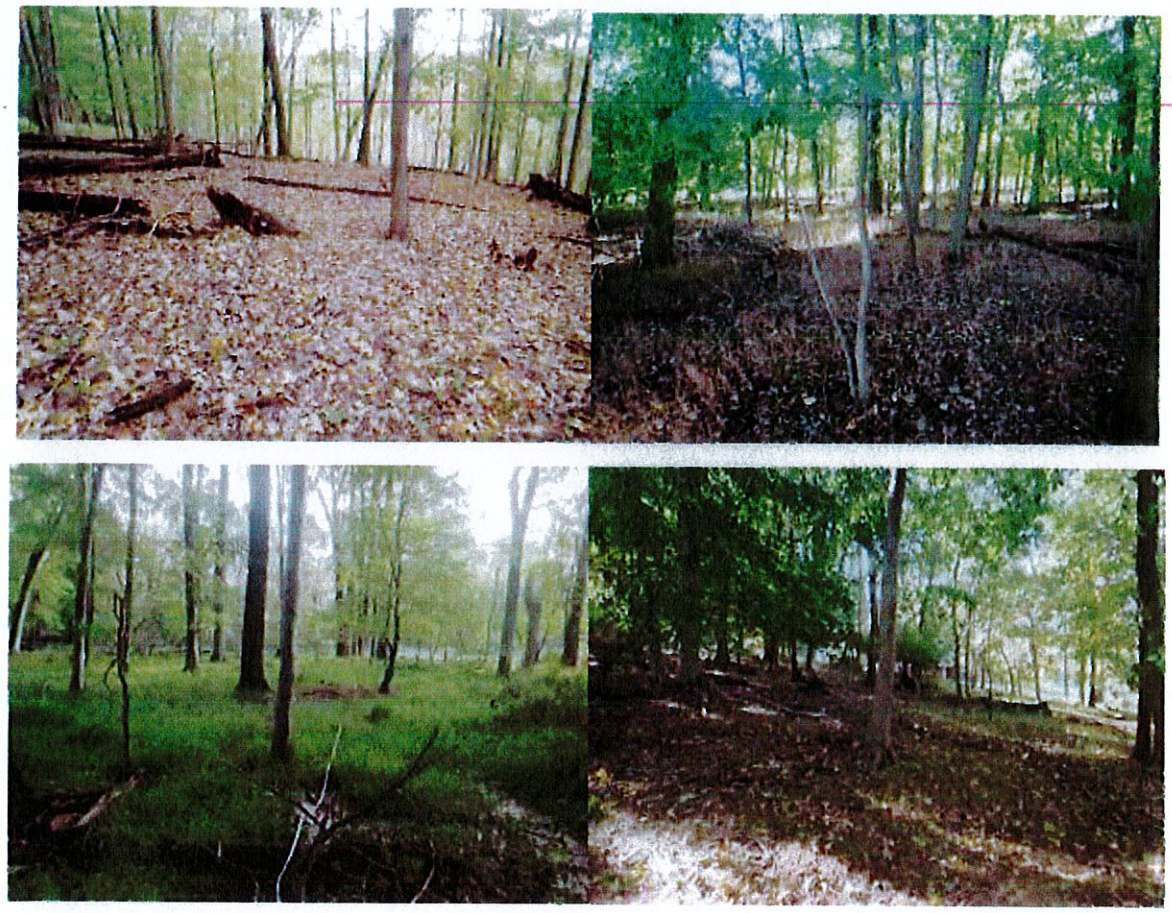


**Plate 2** - Photos of south-facing slope of Watchung Mountain below Johnston Drive, with major forest disturbance and exotic tree and shrub species invasion. Canopy trees in background are invasive *Ailanthus altissima*, and understory shrubs are *Aralia elata*.

**Plate 3 -** Photos of Deer Exclosure at Sherwood Lane, showing dense understory of native tree saplings and herb cover.

ATTACHMENT: 3

September 8, 2017

Wildlife Management Advisory Committee
Watchung Borough Hall
15 Mountain Blvd
Watchung, NJ 07069

To Members of the Wildlife Management Advisory Committee:

At the request of the Wildlife Management Advisory Committee, the Environmental Commission is submitting its input on the "state of the forest" in Watchung.
At the August meeting, members shared their observations about tree health, wildlife, and other environmental factors around the Borough and on their own properties. The following issues were raised as possible reasons for limited forest growth in Watchung:

- Invasive species suppressing growth of native species
- Pesticides and other harmful chemicals being used
- Over-development and clear-cutting of properties for construction
- Damage from deer eating vegetation
- Insects, such as the Emerald Ash Tree Borer and Pine Beetle
- Past drought conditions impacting growth of seedlings/saplings

Opinions were divided on some of these issues. We agreed that a professional would be needed to accurately research and analyze conditions here. In addition, we discussed the findings of USDA District Conservationist, John Kluthe, who came to Watchung this past spring and drove around many parts of town to look at our forested areas . In his assessment, the main issues are:

- Invasive species
- Dense mature tree canopy blocking sunlight
- Saplings too dense in some areas, crowding each other out
- Aging trees, typical of this area
- Fragmentation of the forest due to commercial and residential development. Fragments have become too small to support new growth of many plants.

The Environmental Commission is dedicated to preserving Watchung's natural environment. As we are not experts in forest health, the information above outlines our observations at this time. Professionals would be needed to provide expert analysis and make recommendations to protect our forests now and for the future.

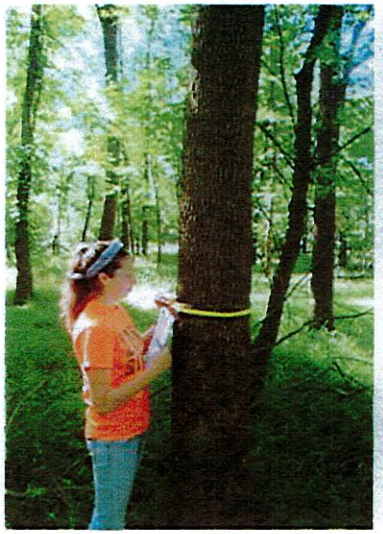
Watchung Environmental Commission

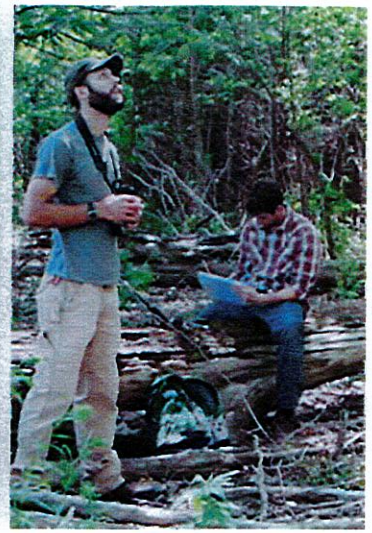
Cc Mayor Pote

SEP 13 2017

ATTCHMNT: 4

# Impacts of Deer and Invasive Plant Species on Forests in Central and Northern, New Jersey





RARITAN VALLEY COMMUNITY COLLEGE

Natural Lands Stewardship Workshop

**December 6, 2018**

**Jay F. Kelly, Ph.D.**
Raritan Valley Community College

SENCER

NEW JERSEY AUDUBON SOCIETY

RARITAN VALLEY COMMUNITY COLLEGE

## *Deer Population Benchmarks*

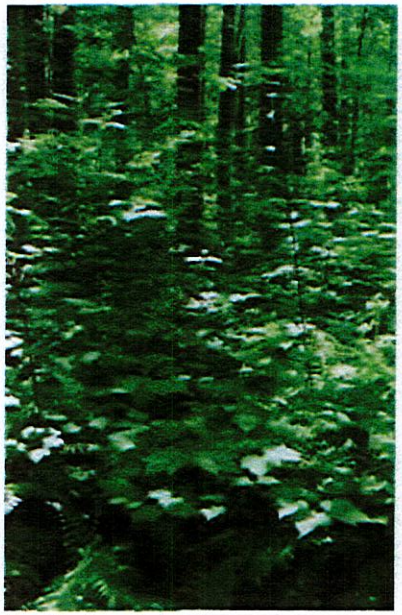
**>10 deer/mi²**
Impact preferred browse species

**>20 deer/mi²**
Prevent forest regeneration

**>100 deer/mi²**
Without deer management

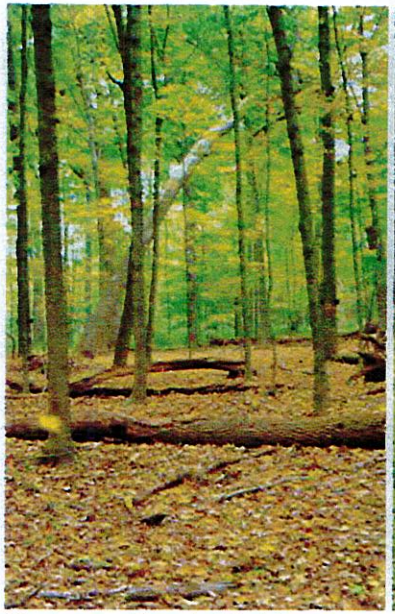
(Drake et al. 2002, Almendinger pers. Comm.)

Historic: **8-11 deer/mi²**

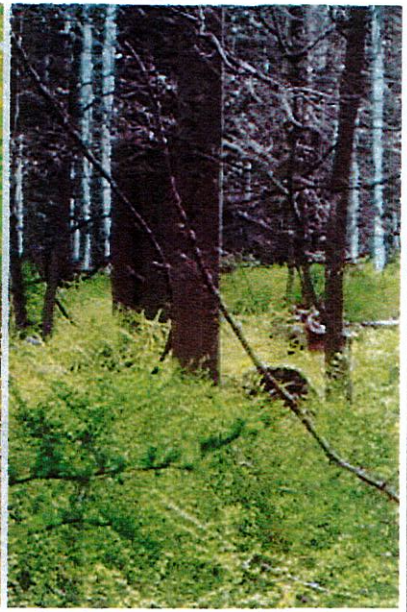


Healthy forest with dense understory vegetation and native plant species.

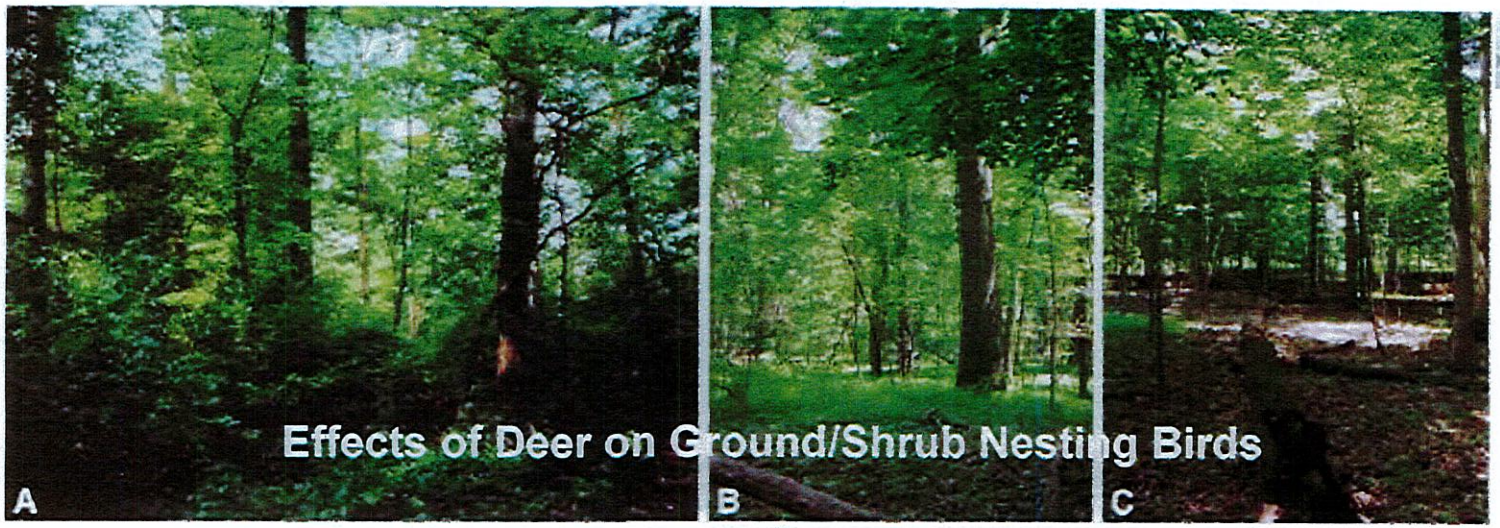
Current: **13-76 deer/mi²**



Overbrowsed forest at Hutcheson Memorial Forest in Franklin Township (2012)



Overbrowsed forest with invasive barberry shrubs at Peter's Tract in Bernardsville (2016)



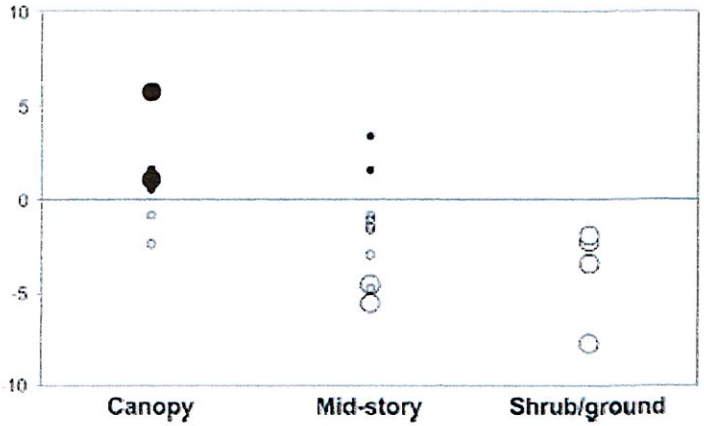




Fig. 1 Time series of photos from Hutcheson Memorial Forest (HMF) in Somerset County, New Jersey. HMF is mixed oak-hickory forest with 26 ha of old growth surrounded by secondary forest, old fields, and farm fields. (a) Shows the forest in 1976 with an intact shrub layer. Overbrowsing by deer and non-native plant invasion have changed the forest understory and midcanopy from native saplings, shrubs and herbs such as *Viburnum acerifolium*, *Circaea lutetiana*, and *Podophyllum peltatum* (Davison 1981) to, (b) a dense understory composed mostly of *Microstegium vimineum* and another exotic invasive, *Alliaria petiolata* (foreground) (2005) and (c) leaf litter with small patches of *Microstegium vimineum* (2005). Photograph (a) is courtesy of Jim Quinn and (b) and (c) are courtesy of Myla Aronson

Fig. 3 Plotted abundance trend estimates from 1980 to 2005 for 21 forest breeding bird species in New Jersey. Estimates are classified based on dominant vertical nesting location (canopy, midcanopy, or shrub/ground). Solid circles indicate species that show a positive trend in annual abundance change, whereas open circles represent species experiencing a negative trend. The zero line represents no change in abundance through time. Large circles indicate that the trend is statistically significant, whereas small circles indicate nonsignificance. On the y-axis labels can be translated as a percentage. For example, a species sitting at the –5.0 level can be said to declining in abundance by an estimated 5% per year

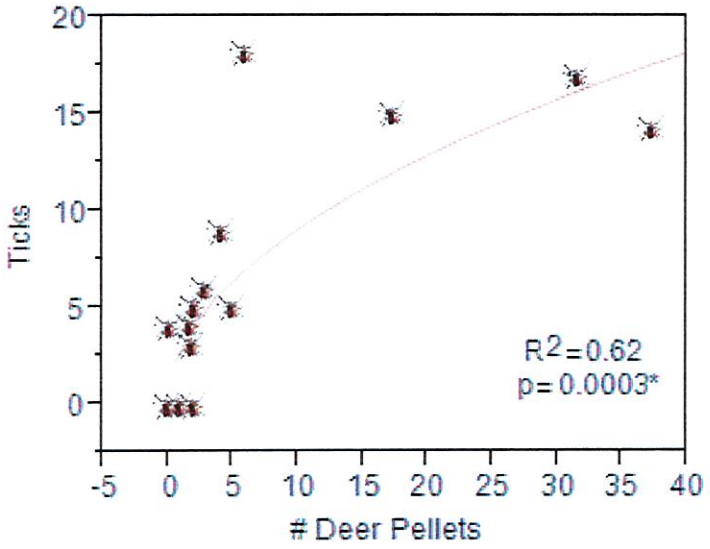
**Baiser et al (2008)**

# Public Health - *Lyme Disease*

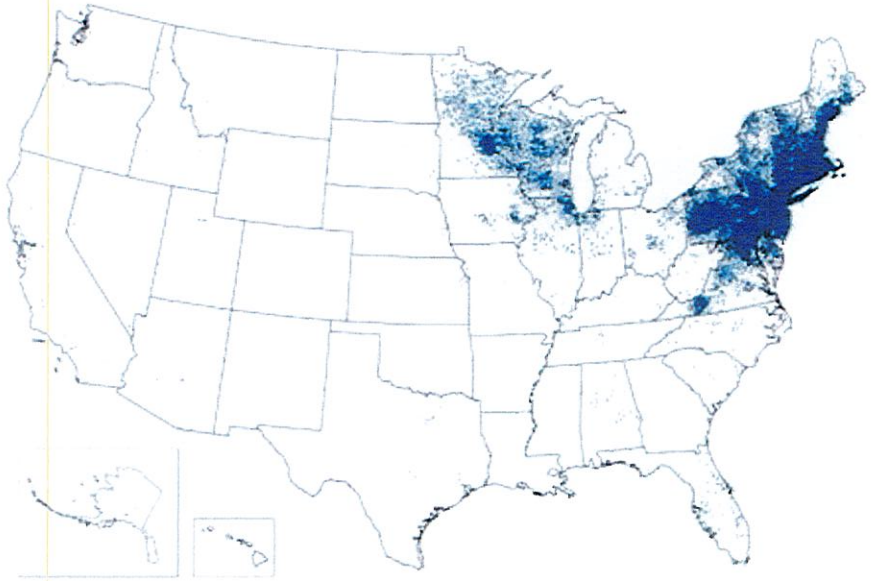
**207-528 cases/yr in Hunterdon County since 2000**
**330-640 cases/yr in Morris County**
**168-439 cases/yr in Monmouth County**

Center for Disease Control and Prevention (2016)

***Effect of Deer on Tick Abundance***




Reported Cases of Lyme Disease -- United States, 2014



1 dot placed randomly within county of residence for each confirmed case

RARITAN VALLEY COMMUNITY COLLEGE

# Public Safety - Vehicle Damage from Deer Collisions

**>1,000,000 DVCs/yr in U.S.; >200 deaths**

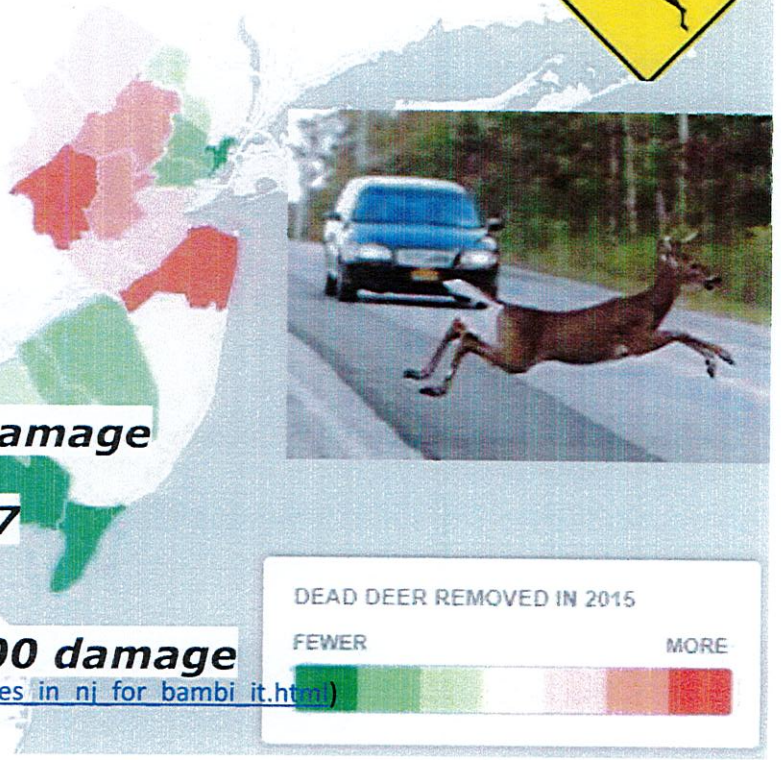
*(Conover et al. 1995, Luedke 2011)*

15-30,000 deer collisions/yr in NJ

13 deaths in 10 years

$111 million/yr. in vehicle damage claims
(*State Farm Insurance, NJ.com 2014-18, NJTPA 2015*)

***- $10-13 million/county in central NJ***
*(NJ.com 2015)*




***Manalapan Twp – 123 claims, $492,000 damage***

***Freehold Twp – 248 vehicle claims in 2017 =$992,000 in vehicle damage***

***Hillsborough Twp – 316 claims, $1,264,000 damage***
(https://www.nj.com/news/index.ssf/2018/07/where_are_the_deadliest_places_in_nj_for_bambi_it.html)