

NJ Biology Technical Note: White-tailed Deer Impacts and Forest Management

Introduction

The white-tailed deer (*Odocoileus virginianus*) is a large, hooved native mammal that occupies most of North America and has a range extending throughout New Jersey. This species can use a wide variety of habitats, including forests, open grasslands, agricultural fields, wetlands and suburban land. Typically, white-tailed deer thrive in areas made up of a mosaic of early to late successional forests as well as scrub-shrub meadows. As herbivores, deer play a crucial role in the ecosystem, providing food for large predators such as gray wolves (*Canis lupis*), cougars (*Puma concolor*), bobcats (*Lynx rufus*), and coyotes (*Canis latrans*). They feed primarily on grasses, herbaceous plants, fruits, and legumes and are active throughout the year. During the late summer through winter, white-tailed deer are more opportunistic, feeding on acorns, woody vegetation, and agricultural crops. After European settlement, the white-tailed deer population in eastern North America began to decline due to overexploitation and unregulated harvest. More recently, population trends over the past few decades have shown a rapid increase in the deer herd, particularly in New Jersey. As of 2010, the New Jersey white-tailed deer population was estimated at 111,250 individuals, with certain areas having a density as high as 114 deer per square mile. Although the population has decreased slightly since 1998, many areas still remain at a deer density that negatively impacts forest health, ecosystem balance, human activity, and the health of local deer populations.

Why Has the Population Increased?

Several environmental factors have influenced the deer population. These include predator abundance, habitat alteration, agricultural production, and



(Tom Stehn, USFWS, 2008)



Male white-tailed deer (US Fish and Wildlife Service, 2008)

land management regulations. When the deer population began to decline in the early 1900s, many eastern states implemented strict regulations to protect the species. This population recovery effort was very effective; however, the combination of this measure and other changes led to exponential growth. While the white-tailed deer population recovered, large predators, such as the eastern cougar (*P. concolor cougar*), were heavily hunted. Overexploitation of major carnivores in New Jersey eventually led to the extirpation of these species, so without pressure from predation, the white-tailed deer herd flourished. Land use in New Jersey has also changed dramatically, especially since the 1970s. Development has increased and large forest tracts have been fragmented and cleared to create agricultural land, roads, rights-of-way, and residential and commercial communities. This shift in land use throughout the state has created more open “edge” habitat, which provides valuable resources to white-tailed deer. When conditions are right, individual deer can reach sexual maturity in as little as 6 months and can give birth to 1 to 3 young per year. This potential to reproduce rapidly, along with changes to the ecosystem, has allowed white-tailed deer to reach numbers far above the presettlement population.

Impacts of Deer Overpopulation

Ecological

White-tailed deer can have significant effects on forest health and plant species composition. Because deer are herbivores, they dedicate a considerable amount of time to foraging. Individuals can consume 4 to 8 pounds of herbaceous flowers, shrubs, and seedlings a day. A large deer herd can easily lower the local abundance of these plants significantly. Alternatively, white-tailed deer generally avoid certain plants, including white snakeroot (*Ageratina altissima*), mayapple (*Podophyllum peltatum*), and several species of fern. This selective preference for certain flora ultimately causes a shift in the plant community on the forest floor and can also facilitate the colonization of invasive and non-native plants. Invasive species that are avoided by deer include Japanese stiltgrass (*Microstegium vimineum*), garlic mustard (*Alliaria petiolata*), Japanese barberry (*Berberis thunbergii*), and multiflora rose (*Rosa multiflora*). These may be sampled by deer, but they are relatively unaffected.

Large deer herds are capable of browsing the forest floor until it is void of native species. Invasive plants then take advantage of these gaps and become well established. White-tailed deer not only create a competitive advantage for invasive plants, but can also act as a catalyst for their spread. Transportation of seeds occurs when seeds stick to fur or hooves, or by consumption of the seeds, which are then excreted at new locations. The average home range of an individual deer is between 145 and 1285 acres, and many individuals will have overlapping territories, so seeds from invasive plants can spread over great distances very quickly.

Aside from facilitating invasive plant growth, high deer populations impair forest regeneration and natural succession. Historically, when gaps are created in the canopy from natural causes, seedlings and saplings take advantage of these openings and eventually replace existing trees. When deer populations are overabundant,

the repeated browsing of new native seedlings prevents recolonization of the opening.

This considerable change in plant diversity can also have adverse effects on birds, invertebrates, reptiles, amphibians, and other mammals that rely on certain plant communities. As the effects of excessive herbivory increase, ecological deserts are created. These areas lack the nesting sites, food, and cover that are required by many wildlife species.



A species of special concern, the hooded warbler (*Setophaga citrine*) relies on the shrub layer for nesting (USFWS, 2008)

Economic

Since white-tailed deer can be opportunistic, their diets include a wide range of foods. Among large populations, competition for the limited amount of naturally occurring forage drives many individuals to take advantage of agricultural crops and ornamental landscape plants. In the United States, wildlife damage to croplands is estimated at over \$500 million and white-tailed deer are frequently reported as the cause. For household property damage, it is estimated that deer cause more than \$251 million per year in the United States alone.

Signs

There are several signs a landowner can look for in order to determine if a forest stand has excessive deer browse. Generally, a forest will have a “browse line” five feet above the floor; this is the upper limit of the area that deer are able to reach and browse. The area below the browse line will lack vegetative cover and vertical structure. Plant species unpalatable to deer will begin to dominate the



The area 5 feet above the forest floor lacks vegetation (National Park Service, 2010)



Species such as hay-scented fern dominate the forest floor (USDA, Forest Service, 2010)



Chew marks are evident on individual plants (USDA, Forest Service)

forest floor, and many low-growing shrubs and herbaceous plants will show direct evidence of browse. Typically, these indicators will be addressed as part of a Forest Stewardship Plan prepared by a professional forester.

Management Options

Current density estimates of white-tailed deer are higher than optimal numbers, so management is essential to achieving sustainability and forest health. Many options are available to help reduce the effects of browsing on forest health. A Forest Stewardship Plan will usually present the best options based on the landowner's goals and the current site conditions.

Deer Exclosures

An efficient method of controlling deer damage is by constructing a fence around the problem area. This fence is designed to exclude deer from browsing the plant cover, but allow other animals to use the resources while also promoting new growth of seedlings. The abundance of seedlings in a fenced area can increase significantly and can ultimately lead to the healthy regeneration of a forest stand. The size of the plot can vary based on the landowner's desired outcome, resources, and the level of disturbance within the forest stand. Fencing can be made up of several types of materials, including plastic netting, woven wire, or chain link. The gauge of the fencing material can vary depending on the material used, but it should be big enough for small animals to enter, but keep deer from reaching plants within the plot. The height of the fence should be approximately 8 to 10 feet tall in order to ensure deer will not jump over the fence.

Although deer exclosures can be an effective tool for controlling herbivory damage, they don't help control



Exclosures protect new seedlings and saplings from over-browsing (Don Donnelly, NJA)

the actual deer population. Fences can also be expensive and require periodic maintenance, but they can help facilitate forest regeneration, leading to a healthier and more diverse habitat.

Seedling Protection

Forest owners can also protect individual seedlings from deer browse without fencing in an entire plot. Several designs are available, but an effective design is a tube (approximately 4 to 12 inches in diameter) made from fine mesh or plastic (or a combination of the two) that stands 5 feet or higher. This allows the seedling to grow to a height that cannot be reached by deer while the fine mesh or plastic prevents browsing during this crucial growing period. These tubes may require periodic maintenance, but can be an effective way to protect seedlings. Another option may include the use of small wire cages that can be reused at new locations, but this also requires some maintenance.



Plastic tubes protect new seedlings from deer browse (John Parke, NJA)

Chemical Deer Repellents

Although not as effective as other management options, chemical repellents can be used to discourage deer from browsing by using scents most often avoided. There are several commercial options available, but mixtures containing sulfurous odors and decaying animal proteins are most efficient. These chemical repellents should be reapplied every few months and possibly after rainfall, as most mixtures become less successful after 11 to 12 weeks.

Hunting

Hunting can be a very effective tool to control the white-tailed deer population. When managed correctly, it can benefit not only humans and forest health, but also the species itself. Recommendations for optimal deer density can vary, but 10 to 20 deer per square mile is a good guideline to use as a maximum deer density for the goal of protecting ecosystem integrity. The New Jersey Division of Fish and Wildlife (NJDFW) offers a program called Deer Management Assistance Program (DMAP) that offers assistance with an overabundance of white-tailed deer. Through DMAP, hunters can acquire permits to

harvest additional antlerless deer in specified zones. A landowner looking to control the deer population can also participate by allowing approved hunters to access their property and harvest deer during the appropriate hunting season. More information is available on the DFW website at: www.state.nj.us/dep/fgw/dmap.htm

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