The Influence of Natural Events and Hunting on a Small White-tail Deer (*Odocoileus virginianus*) Population

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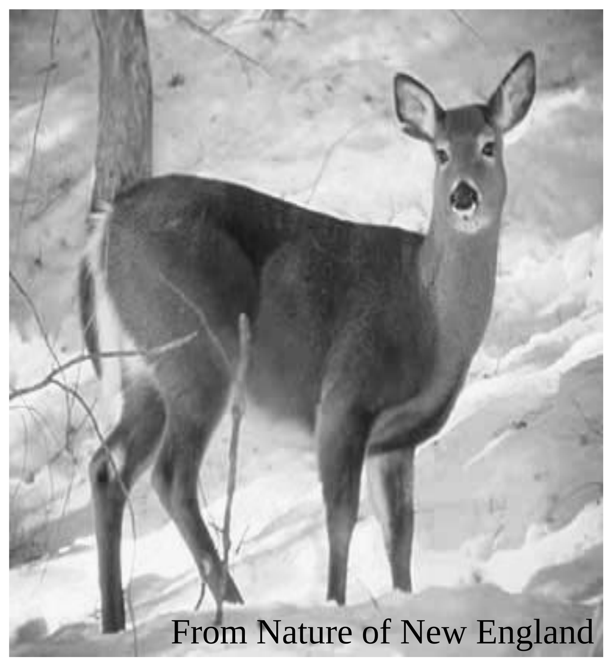

From Nature of New England

Abstract

In the northeast United States, white-tail deer populations have risen from near extinction to levels that may be too high for the environment to sustain. This study aims to determine quantitatively what annual factor most influences deer densities to use it to predict and manage deer populations in the future. The focus is on a small white-tail deer population at Black Rock Forest, on which hunting has been used as a population management technique since 1970. The density of this population fluctuates annually, which may be in response to a density-dependent factor such as hunting or density-independent factors such as natural events related to winter severity, precipitation, and acorn availability. Annual data for each of these variables are run through stepwise regression at zero time lag, one-year time lag, two-year time lag, and three-year time lag to identify any strong correlations between these factors and the deer population density. Results indicate that hunting and natural events both have an influence on this particular white-tail deer population. This research suggests that both the continuation of an annual hunting season and the monitoring of certain natural events are necessary in estimating and predicting white-tail deer population densities particularly at Black Rock Forest.

Introduction

In addition to inflicting human injuries via car collisions, high deer densities in areas have been shown to alter the composition of the environment by diminishing or eliminating the diversity of the canopy, understory, and shrub layers [2] (Figure 4). Black Rock Forest, nearly a 4,000-acre preserve and field station promoting scientific research, has collected a considerable amount of data on its white-tail deer population and the surrounding environment for more than thirty years [1]. Black Rock Forest is located on the northwest side of the Hudson Highlands between the New York towns of Cornwall-on-Hudson and Highlands, Orange County. The annual average deer population in the forest is about 113 deer with an average density of 19 deer per square mile[1]. This is the first in-depth analysis seeking to determine if hunting influences the Black Rock Forest deer population density and what, if any, density-independent factors may influence the population density. This research allows for the chance to propose changes to the current deer management approach at Black Rock Forest, creating a more effective plan of controlling deer density. It is possible that the results from this research can serve as a means to promote hunting in particular areas as well as annual monitoring of natural events such as snow depth and acorn abundance. The information from research can be used as a resource in other areas around the world in need of deer management.

Methods

Temperature and Precipitation

- Total number of days snow depth was greater than 12 inches
- Average daily precipitation (mm) recorded for April and for period of April to July
- Missing data obtained through the Department of Commerce, NOAA

Total Acorns and Total Viable Acorns

- Weekly sampling at 15 sites, hoop thrown 10 times, and acorns /acre calculated[1]
- All acorns within hoop dropped in water, floating acorns were nonviable, and a percentage of viable acorns calculated[1] (Figure 1)

Figure 1: Northern Red Oak Acorns. Acorns drop from trees in the fall between September and October.

From Loudoun Wildlife Conservancy

Figure 2: Deer Tracks in Snow. Tracks in the snow can indicate the number of deer in an area and the direction in which they are traveling.

Overwintering Deer Density

- Annual Deer Tracking Census (DTC) between December first and April first
- Deer per mile calculated from deer tracks and individuals spotted(Figure 2)

Buck Take, Doe Take ,and Hunter Success Rate

- Number of antlered male deer, buck, or doe killed during hunting season (Figure 5)
- Success rate, or average number of buck killed per hunter (Figure 3)

Picture taken by Peter Bower

Figure 3: Collection of Harvest Data. John Brady at the deer check station collecting data from the recently shot buck.

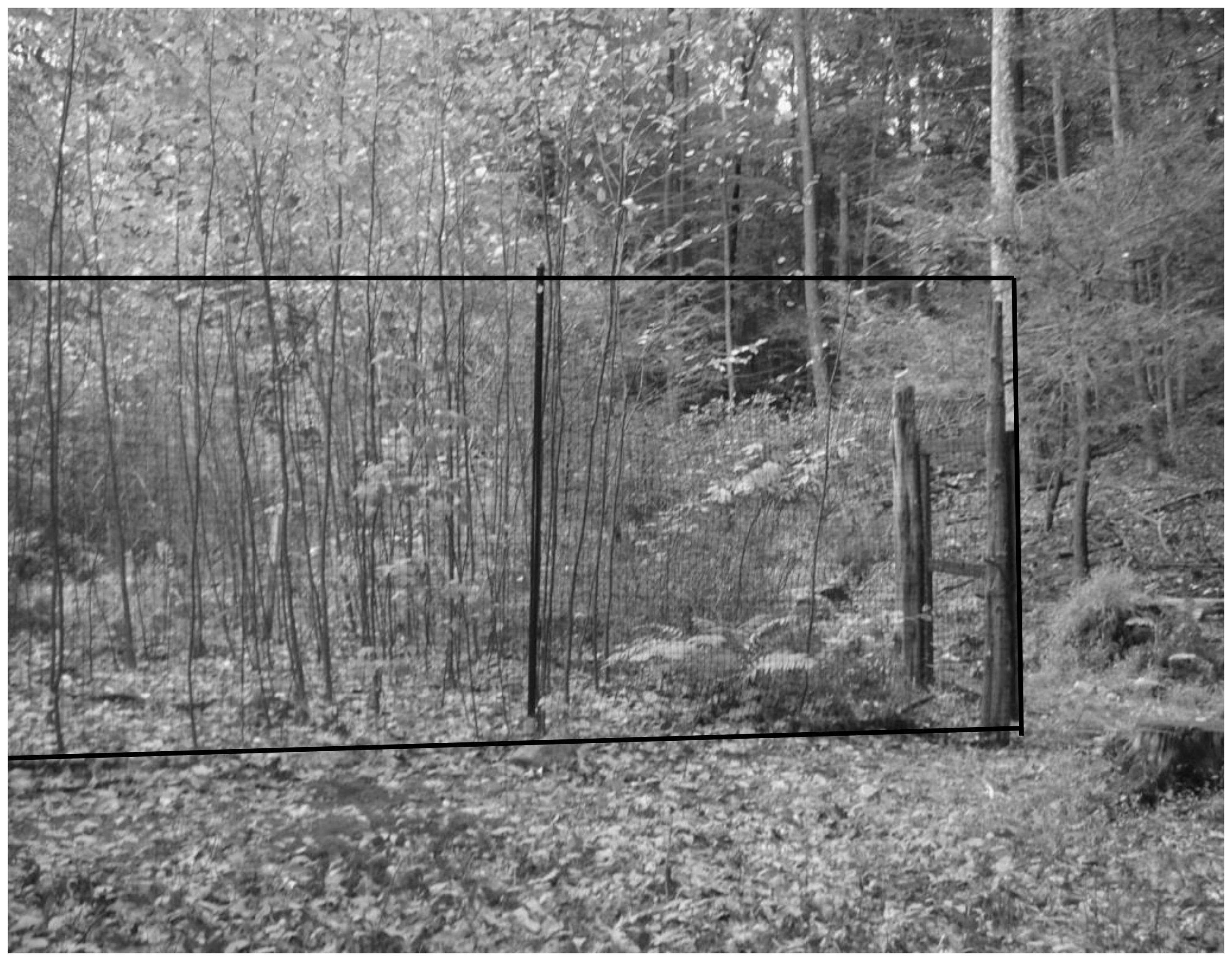

Figure 4: Long-term Exclosure at Black Rock Forest. This exclosure, or high fence to prohibit deer from entering, is outlined in black. A difference can be seen between the amount of trees and understory growing inside the exclosure where deer are not allowed and outside of the exclosure where deer regularly browse, or eat. Exclosures can depict the amount of forest regeneration possible in a given area if deer consumption is removed.

Results

Only strong correlations between variables are mentioned below. Strong correlations were indicated by the independent variable being entered into the stepwise regression for a particular dependent variable.

Zero Time Lag

- Total number of acorns and snow depth correlated with deer per mile
- Buck take and doe take correlated with the total buck take
- Buck take and doe take correlated with hunter success rate

One-year Time Lag

- Previous year's total buck take and snow depth correlated with deer per mile
- Snow depth correlated with total buck take
- Doe take correlated with deer per square mile

Two-year Time Lag

- Previous year's total buck take and snow depth correlated with deer per mile
- Snow depth correlated with total buck take
- Precipitation for April through July correlated with success rate
- Doe take correlated with deer per square mile

Three-year Time Lag

- No variables correlated with any index of abundance

The strongest R-squared value (.948) obtained from a stepwise regression was observed for the combination of snow depth and previous year's buck take and the dependent variable, deer per mile, with a two-year time lag.

The second strongest R-squared value (.799) obtained was from the stepwise regression of total acorns per acre and snow depth and the dependent variable of deer per mile.

Discussion

There does not appear to be any consistent time lag that can be applied to all of the data over the years. The number of days snow depth is greater than 12 inches is the only variable that can predict or reflect the trend in the white-tail density in the forest for all of the time lags tested. The total number of acorns per acre and the number of days snow depth is over 12 inches could provide an explanation for the current deer density The snow depth and the total buck take of a certain year could explain the trend in the deer density the next winter and the winter in two years. The strongest R-squared value suggests that snow depth can predict the trend in the deer density in two years and also that the buck take can be used to predict the trend in deer density in three years. Because most strong correlations were observed with the dependent variable of deer per mile, that may be the best estimate of deer density in the forest and should be continued to be calculated and interpreted annually.

Conclusions

1)Hunting and natural events have an influence on this particular population.

2)The current year's overwintering deer density can be estimated by observing snow depth the winter and the total number of acorns per acre the fall of the same year.

3)A trend of deer density for the following year and the density in two years can be predicted by trends in both the total number of buck and of doe killed during the hunting season, and the number of days snow depth is greater than 12 inches.

4)Hunting as well as the continued monitoring of snow depth and acorn abundance are necessary in effectively assessing and managing predicted white-tail deer densities at Black Rock Forest.

Picture taken by Aimee Kemp

Figure 5: Buck at Black Rock Forest. This buck is located at the edge of the forest adjacent to a field.

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