

Effect of Urbanization on Wild Turkey Reproduction in Staten Island, New York

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Abstract:

The encroachment of Eastern Wild Turkeys (*Meleagris gallopavo silvestris*) into urban and suburban areas has become a pressing ecological concern. Examining wild turkeys in developed regions is important, as it can help predict the effects of human expansion on other wildlife. This study aimed to investigate the effects of urbanization on wild turkey reproduction by comparing nest success rate, clutch size, and hatch rate between two suburban locations: Staten Island University Hospital North Campus/Ocean Breeze Park (SIUHNC) and Clove Lakes Park. Additionally, we aimed to compare the data gathered from these locations to other studies conducted in urban and wild regions. We picked these two locations to see if the level of development in the immediate area around a turkey affects its reproduction. We hypothesized that nests found in Staten Island University Hospital would have a slightly lower hatch rate and clutch size but a slightly higher nest success rate than nests found in Clove Lakes Park. 20 nests were monitored across both study areas, with 11 nests in SIUHNC and 9 nests in Clove Lakes Park. Notably, the mean clutch size (number of eggs laid) was higher in SIUHNC (10 eggs) than in Clove Lakes (8.29 eggs). Moreover, the hatch rate (proportion of eggs successfully hatched) was also higher in SIUHNC (81%) compared to Clove Lakes (76%). Similarly, the nest success rate (proportion of nests that hatched at least one egg) was higher in SIUHNC (45.5%) compared to Clove Lakes (33.3%). However, there was no significant difference between the two locations in any of the factors measured (2-sample T-test; $p > 0.05$). Compared with previous research, the hatch rate and clutch size for the entire study area differed significantly from data collected in wild environments, but not data collected in rural environments. These results suggest that the urbanization level in a larger area around a turkey has a bigger effect on its reproduction than the immediate area.

Introduction:

Research on Wild Turkey reproduction in wild environments has been extensive, and in recent decades, studies in urban and suburban areas have increased. Current research shows that the nest success rate (percent of nests producing at least one egg) of Wild Turkeys in urban environments (36%) [1, 2] is higher than in less developed areas (30%) [3, 4, 5]. Clutch size (number of eggs laid by a female in one nesting attempt) in wild regions is about 11.33 eggs per nest [1, 2], compared to 10.4 eggs per nest in human-dominated regions [3, 4, 5]. The hatch rate (percent of eggs that hatch compared to the total in nests producing at least one hatchling) is 86.5% in urban/suburban areas [1, 2] and 89.5% in wild areas [3, 4, 5]. Turkeys in different regions face various challenges and stressors, especially in developed areas where differences in city planning, parkland distribution, or predator presence can lead to more variation. Accurate information for each area is crucial for cities planning conservation efforts and wildlife management strategies.

The encroachment of Eastern Wild Turkeys (*M.g. silvestris*) into urban and suburban areas is a pressing ecological concern. This issue requires further study of their reproductive patterns in these new environments. Various wildlife species have been affected by urban area expansion and natural habitat destruction [6].

Eastern Wild Turkeys (*Meleagris gallopavo silvestris*) have lived in agricultural and forested regions for centuries. With rising urbanization, these birds are now in developed environments. Studying wild turkeys in suburban and urban regions helps us understand the impact of human population expansion on this species and can predict effects on other wildlife. This knowledge is crucial for effective conservation and wildlife management, facilitating strategies to maintain biodiversity amid increasing urbanization.

In our experiment, we aim to determine if wild turkeys in developed areas have different reproductive ecologies than those in wild areas. Our study will be conducted on Staten Island, New York, a highly developed suburban environment. We will search for turkey nests in two locations previously confirmed to have turkey flocks: Staten Island University Hospital North Campus (SIUHNC) and Clove Lakes Park. Clove Lakes Park has a more natural setting compared to Staten Island Hospital's highly developed area. However, both are surrounded by suburban Staten Island. We chose these locations to see if the immediate area's development level significantly affects turkey reproduction. We hypothesize that turkey nests observed in Staten Island University Hospital North Campus will have a lower clutch size and hatch rate but a higher nest success rate compared to nests found in Clove Lakes Park. Moreover, we expect our data to differ significantly from previous studies conducted in wild environments, but not from those conducted in urban areas.

Materials and Methods:

Nest Observation

The nests of *Meleagris gallopavo silvestris* (wild turkey) were studied at two locations, Clove Lakes Park and the Staten Island University Hospital North Campus, where turkeys had been sighted. In the northeastern region where this study was conducted, wild turkeys begin nesting and laying eggs from late April to early May. Starting in mid-April, researchers visited each location once a week to observe turkey flocks, locate nests, and gather data on the nests. Because of time constraints in the paper's creation, we decided not to include any nests we found after May 6th, as we could not gather sufficient data for them.

When a nest was first located, data on the initial clutch size, number of nests, and approximate date of nest creation were recorded in a spreadsheet. Each nesting site was assigned a unique identifier and its coordinates were recorded. Nests were monitored twice a week to check for missing eggs, failed eggs, or signs of predator attacks that might have destroyed the nest.

As wild turkey eggs have an incubation period of 28 days, beginning in late May to early June, the number of hatched eggs and eggshells found in each nest were counted to calculate the final clutch size and overall nest success rate.

Data Analysis

The hatch rate was calculated as the number of hatched eggshells divided by the total number of eggshells found in the nest. The nest success rate was determined by comparing the number of nests that produced at least one hatched egg to the total number of nests observed.

The average hatch rate, nest success rate, and other relevant metrics were calculated for each location and for the entire study area. We compared the values for Clove Lakes Park and the Staten Island University Hospital North Campus/Ocean Breeze Park (SIUHNC) using a two-sample, two-tailed, unpaired T-test, with a desired p-value threshold of $p < 0.05$. The averages for the individual study areas and the entire group were compared with published values from other studies using one sample, two-tailed, unpaired T-tests.

Results:

In total, we monitored 20 nests across two study areas. 11 nests were observed in Staten Island University Hospital North Campus/Ocean Breeze Park (SIUHNC), while 9 nests were observed in Clove Lakes Park. In both study areas combined, we observed a nest success rate,

defined as the proportion of nests that hatched at least one egg compared to the total number of nests in that area, of 40% (8 out of 20 nests). Specifically, the nest success rate was 45.5% for nests found in SIUHNC and 33.3% for nests in Clove Lakes Park (Table 1). Despite these differences, nests in SIUHNC did not exhibit a significantly different nest success rate compared to nests in Clove Lakes Park (2-sample t-test; $p > 0.05$).

Clutch size, or the number of eggs laid at the time of incubation, was determined for all nests. Notably, in both study areas, two nests failed before incubation began. Across both study areas, we noted a mean clutch size of 9.56 (Table 2). The average clutch size was higher for nests in SIUHNC at 10.56, compared to 8.29 in Clove Lakes Park. However, the difference between the mean clutch sizes at the two locations was not statistically significant (2-sample t-test; $p > 0.05$).

Additionally, we calculated the hatch rate, defined as the number of hatched eggs divided by the initial number of eggs in the nest at the time of hatching, across both study areas. We found an overall hatch rate of 0.79%. The average hatch rate in SIUHNC was 0.81%, while the average hatch rate in Clove Lakes Park was 0.76% (Table 1). Our analysis indicated that the location of the turkey nests did not significantly affect their hatch rate (2-sample t-test; $p > 0.05$).

Table 1

Nest Success Rate and Hatch Rate of nests found in Staten Island University Hospital North Campus, Clove Lakes Park, and total study area.

	Nest Success Rate	Mean \pm SD of Hatch Rate	Range of Hatch Rate
SIUHNC	0.455	0.814 ± 0.029	0.78 - 0.86
Clove Lakes Park	0.333	0.759 ± 0.225	0.5 - 0.89

Total Study Area	0.4	0.794 ± 0.125	0.5 - 0.89
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Table 2

Clutch size of nests in Staten Island University Hospital North Campus, Clove Lakes Park, and total study area.

	Number of Nests Measured	Mean \pm SD of Clutch Size	Range
SIUHNC	9	10.56 ± 2.35	6 - 13
Clove Lakes Park	7	8.29 ± 1.6	6 - 11
Total	16	9.56 ± 2.33	6 - 13

Discussion:

Current research suggests that Wild Turkeys in urban environments have a lower clutch size and hatch rate, but a higher nest success rate than those in more natural environments. If this trend were to continue on a smaller scale, turkeys nesting in natural-like environments (parks) in urban areas would likely have higher clutch sizes and hatch rates compared to those nesting in more developed sections of urban areas. However, this was not the case for our study. Nests discovered in Staten Island University Hospital North Campus/Ocean Breeze Park (SIUHNC), a highly urbanized area, displayed larger clutch sizes and higher hatch rates compared to those in Clove Lakes Park, a more natural setting. These results suggest that, at a small scale, the level of development near a nest does not have a large impact on Wild Turkey reproduction. Instead, urbanization level in a larger area around a turkey has a bigger effect on how it reproduces.

The clutch size for both study areas (9.56) was much smaller than that previously recorded in both urban (10.4) [1, 2] and wild (11.33) [3, 4, 5] environments. The average clutch

size in both study areas was not significantly different from that in urban areas (1-sample T-test; $p>0.05$). However, it differed significantly from the average clutch size in wild environments ($p=0.0085$). Clutch size in nests found in Clove Lakes Park differed significantly from those in both urban ($p=0.013$) and wild environments ($p=0.0024$). In SIUNHC, the clutch size did not significantly differ from nests in either category of study ($p>0.05$).

For hatch rate, values previously found in urban areas (0.865) [1, 2] and wild areas (0.895) [3, 4, 5] were larger than the average in our two study areas (0.79). This difference in hatch rate was significant for wild areas (1 sample T-test; $p=0.056$), but not for urban areas ($p>0.05$). The hatch rate for nests in SIUNHC differed significantly from those measured in both urban and wild areas ($p<0.05$). In Clove Lakes Park, on the other hand, the hatch rate was not significantly different from the hatch rate collected in either category of studies.

Our average nest success rate (0.4) did not show a significant difference compared to the nest success rate in urban environments (0.36) [1, 2] and wild environments (0.3) [3, 4, 5] (1 sample T-test). The same was true for the nest success rate in SIUNHC (0.45) ($p>0.05$) and Clove Lakes Park (0.33) ($p<0.05$).

As we predicted, most of our collected data differed significantly from previous research conducted in wild environments, but not from research done in urban areas. For our entire study area, both hatch rate and clutch size differed significantly from data observed in studies done in wild environments. Nest success rate, however, did not differ significantly from data collected in either category of studies.

This means Staten Island's environmental factors are more similar to other urban settings than wild areas. This is consistent with results obtained in past studies in urban areas [1, 2]. Using data collected in a wild environment to inform conservation or wildlife management

efforts in a city would likely lead to a less effective strategy. However, this does not mean that results from any city would apply to any other one. Results from individual areas of our study often differed significantly from both wild and other urban studies. To effectively manage animals affected by urbanization like Wild Turkeys, cities should conduct research within their boundaries or gather data from geographically similar cities.

The significance of the data we collected was limited by the small sample sizes and short timeframe we worked with. Many differences in reproductive metrics could be attributed to yearly changes in weather conditions. Additionally, the scope of the experiment was limited by our inability to capture and track a large number of female Wild Turkeys, as is the preferred methodology for these types of experiments. This meant we couldn't obtain nesting rate, re-nesting rate, habitat range, or mortality rates. To obtain the most accurate data, further research on the subject should cover a larger sample size over a longer period of time to reduce the effect seasonal variation has on the data

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