

Deer Selfies – Analysis of Camera Trap Data to Determine Variations in Visitation Rates to 4-Poster Tick Management Devices under Altered Feeding

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Abstract

Due to a history of high levels of tick-borne disease related cases at Brookhaven National Laboratory the Environmental Protection Division implemented the use of the 4-poster tick management system to reduce the number of ticks on the property. This project has been in place at the lab since 2013. Each year during the summer tick surveys are conducted to determine how effective these devices are in the reduction of ticks at the laboratory. With a more than 90% reduction rate in tick populations in the areas of use the Lab began an experiment, at the request of New York State, in 2018 to determine if an altered feeding rate would result in continued effectiveness. This study includes a determination of visitation rates to 4-Poster devices based on time lapse photography using Moultrie game cameras placed at each 4-Poster location. Photos were downloaded and archived for later sorting into those containing deer and those without deer. This data was then quantified by day, then analyzed using Microsoft Excel to determine variations in visitation rates based on the feedings between weekly and tri-weekly sites. It was determined through paired right-tailed paired t-test that there was a significant difference between the weekly and triweekly feeding. This project will continue for another two years to determine if the altered feeding rate will result in continued effectiveness. Because of this internship, I have gained a better understanding in programming skills through the use Microsoft Excel statistical software.

Introduction

Background

The 4-Poster device have been designed to reduce tick populations on white-tailed deer which are the primary/final host for ticks. Developed by the U.S. Department of Agriculture's - Research Service in 1994, ¹the 4-Poster device consists of an incorporated central bin for holding corn that is connected to feeding troughs and two paint rollers on each side of the bin. The paint rollers absorb and transfer a 10% permethrin acaricide to deer. A plate incompletely covers each feeding trough, which ensures contact between the rollers and the deer as they feed. ²Use of this device has resulted in decreases in tick populations by greater than 90%. Normal use of 4-Poster devices includes charging rollers with permethrin at a minimum of once per week. The New York State Department of Environmental Conservation has requested research into the viability of continued effectiveness with reduced servicing of devices. Reduced servicing also factors in overall costs in time and materials being invested into the operation and maintenance of the 4-poster devices. While NYSDEC would like to place a ban on these devices they haven't. The reduce servicing is to the feeding of wild deer and lessen the congregation of spreading chronic wasting disease among the herds. Chronic wasting disease is caused by a transmissible infectious protein (prion) that results in a neurological disorder influencing deer, elk and moose and typically results in death. This paper will determine if altered servicing results in significant reductions in deer visits at the 4-poster devices by comparing photographic data of deer visits to weekly and tri-weekly serviced devices. The overall objective of this project is to determine the effectiveness of reduced servicing on tick reductions.

Methods & Materials

Deer Selfies

A Moultrie M-50I game camera was placed at each of the 4-Poster locations and set to take photographs on a time lapse every five minutes during a 24 hour period (288 photos/day). Cameras were checked on a monthly basis to see if the memory cards were full or not (which will leave them in if they weren't and had enough battery life to go another week); if full the cards would be removed and replaced with a fresh memory card, batteries replaced, and cameras would be reset back to time lapse for a duration of five minutes. Memory cards were taken back to the lab to be downloaded on to a network drive for archiving by device location and date for future sorting. Archived photos were then sorted into folders named deer or no deer depending on specific deer occurrences or absence within photos. After that the number of photos per day were then categorized and data recorded in an Excel spreadsheet for analysis. This process was continued throughout the 16 weeks of the internship. Which leads to determining whether there is a significant difference in deer visits by day between weekly and tri-weekly treated locations. Some of the cameras either died or failed to start resulting in an inconsistent number of photos. Therefore, data was then entered into the spreadsheet by day to take the average of existing data that was used to fill in missing data in order to conduct statistical analysis. This allowed for statistical analysis for determination of normality ahead of other statistics. A right tailed paired t-test was conducted to determine whether difference between the two treatments was significant.

Results



These graphs show the result of daily deer visits from June-September that were collected from all 4-poster locations on site. Each month had 30-31 days with 288 photos per day (resulting in roughly 10,000 photos from each of 14 sites, or approximately 140,000 photos each month). The grey and orange lines indicated when the 4-posters were service either weekly (grey lines) or all filled (orange lines). The data indicate deer would visit the weekly 4-posters more often than tri-weekly serviced 4-posters, likely due to the almost guaranteed food available at those sites. This indicates that there is a significant difference between the weekly and tri-weekly serviced 4-poster locations; which is also justified by performance of a t-test between the two, where we rejected the null hypothesis; $p\text{-value} < 0.05$, the exact $p\text{-value}$ for both the two-tailed and one-tailed test is 0.000. Results for the first full year indicated weekly treatment is more effective over tri-weekly treatment

Discussion

Camera results indicating that weekly treatments are cost-effective than tri-weekly treatments with a statistical significance in variation of deer visits, despite failure to start or low battery. The hours of appearance to 4-Posters devices observed in the photos were reliable with the average crepuscular conduct of white-tailed deer. The overall goal is to have a reduction in visitation meaning a less likelihood of disease transmission between the deer visiting the 4-poster devices as well. The 4-Poster project is a multi-year project at Brookhaven National Laboratory to reduce tick populations. We are in the second year of a modified tick management project, requested by New York State, to determine continued effectiveness of 4-Poster. In reference to the analysis of camera trap data in determining the variations of visitation rates among the 4-Poster devices under altered feedings. However, in the case of upcoming goals, a more developed analysis on deer visitation will be conducted. In the meantime there is a need for some help from computer science engineers for development of software that can help with sorting photos so that future interns can go through this part of the project more efficiently.

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References

1. Pound, J. M., Miller, J. A., George, J. E., & Fish, D. (2009). The United States Department of Agriculture Northeast Area-Wide Tick Control Project: History and Protocol. *Vector-Borne and Zoonotic Diseases*, 9(4), 365–370. doi: 10.1089/vbz.2008.0182
2. Booth-Binczik-Ph.D., S., & Hurst, J. (2018, December 31). Deer Management in Urban and Suburban New York. Retrieved from https://www.dec.ny.gov/docs/wildlife_pdf/decdeerreport18.pdf.
3. Transmission. (2019, February 25). Retrieved from <https://www.cdc.gov/prions/cwd/transmission.html>

