Analyzing red fox (*Vulpes vulpes*) and coyote (*Canis latrans*) presence at Brookhaven National Lab using camera traps

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Abstract:

Coyotes are a canid species with a wide range, typically found all throughout North America. While they aren't native to Long Island, there have been recent reports of sightings in Queens, Nassau County, and Suffolk County. Because of this, it is important to find out if any are present at Brookhaven National Laboratory (BNL) and how they may impact native wildlife. My project continues previous camera studies of native species with a focus on capturing evidence of canid presence, specifically red foxes and coyotes. Since foxes and coyotes share similar prey, foxes may be affected if coyotes move into the area. To find potential population changes, I used camera trapping to see where foxes are distributed and find possible evidence of coyotes. The collected pictures were analyzed with Timelapse and Ecoassist AI software to identify species and make an excel file of the data. Overall, there was no evidence of coyotes but there were red foxes observed at 5 locations on-site. In the future, cameras should continue to be set out to find how canid populations are changing and document any additional biodiversity changes at BNL. By learning about the arrival of new species early on, we can take steps to document any changes they make to the current ecosystem. As a result of this summer, I learned how to set up camera traps for the first time and got experience working in the field.

Introduction:

Coyotes have increased in range over time due to a decrease in other predators such as wolves and mountain lions (Hody 2018). They have lived in New York City since the 1990's but over the last 10 years, they have been slowly appearing on Long Island. Lone Individuals and mating pairs have been seen in small numbers in Queens, Nassau county, and Suffolk county (Gangemi 2024). Coyotes mostly live in forested areas but also acclimate well to urban environments. They are nocturnal carnivores that primarily eat deer, rabbits, birds, and other small mammals such as white-footed mice or ground squirrels (Hayward 2023). As a forested area on Long Island with a high abundance of prey species, Brookhaven National Lab (BNL) is a possible site for eventual coyote settlement.

Red Foxes are another canid species that have been historically present at BNL in the past. They live in open areas, including woodlands, urban environments, and wetlands. Red foxes are also generalist hunters who eat things like wild berries, small rodents, birds, and insects (Henry 1996). Because coyotes and foxes have similar habitat ranges and dietary overlap, they might interact if they are in close contact. In some cases where coyotes and foxes have been in proximity, coyotes have attacked foxes in their hunting areas (Gese 1996). Because of this, Foxes tend to relocate to avoid areas where coyotes feed. If coyotes become established at BNL it may change local fox distribution on site. **The goal of this project was to find out if coyotes have moved onto BNL and understand the extent of the current fox population**. To analyze canid presence at BNL, we used camera traps to find evidence of species presence. Because trail cams can record many photos at a time without contact, they are a good way to find species such as coyotes or foxes that avoid human activity (Dorning 2019).

Figure 1: Camera trap locations on Brookhaven National Lab property. Cameras were set up every 4 locations and rotated to the next spots when placed back out (For example, cameras 1, 5, 9, etc. were placed first and next was 2, 6, 10, etc.). This allowed the cameras to cover a wide range of areas each time.

Methods:

Moultrie trail cameras were placed in a grid covering the property of Brookhaven National Lab (Figure 1). Each was 0.5 km apart and typically placed near roads or trails. Animals use man made roads often for ease of travel, which makes them a good spot to capture animal activity. 14-17 cameras were placed at a time and rotated to new locations every two weeks to cover a wide area. Some weeks had less cameras than others because there was an odd number of total sites. Some areas were also inaccessible due to construction. Over the course of the study, the cameras were moved three times and a total of 47 sites were completed.

Before being set out, the cameras were set to the following settings:

- High sensitivity
- 30 second delay
- 3 photo burst

The 30 second delay reduced repeat images and the three-photo burst ensured that animals moving through the area quickly were still captured.

Cameras were placed on trees that were close to clearings or roads for maximum visibility (Figure 2). Aim tests were conducted once each camera was secured to make sure they weren't too low or high (Figure 3). Once the camera was set up, a fatty acid bait tab was placed in front of it to attract foxes and coyotes.

Figure 2: Set up process for camera traps. They were placed at a height of 3-4 feet off the ground facing roads or clearings.

Figure 3: A Moultrie camera placed on a tree. The red light indicates motion and was used to ensure the camera was capturing the target area.

Results:

Overall, 20,383 photos were processed using ecoassist. Of these pictures, the software labeled 3,034 as photos including animals. Each animal photo was labeled by hand in timelapse to record species type and number of individuals. About 2/3 of these were false positives or duplicates from the three-photo burst. These were removed from the data set, leaving a total of 943 sightings. Each sighting was labeled by hand in timelapse for species type. No coyotes were found on site but there were 22 total fox sightings, which made up 2.3% of the data (Figure 4).13 of these sightings were near the solar farm in sites 17 and 21 and the rest of the sightings were closer to the outskirts of BNL (Figure 5). There was a pair of foxes spotted at the solar farm and all other sightings were individuals (Figure 6). The most abundant species spotted was white tailed deer, which made up 59.4% of total sightings. Other animals sighted were groundhogs, mice, rabbits, birds, feral cats, turkeys, raccoons, and squirrels (Figure 4).

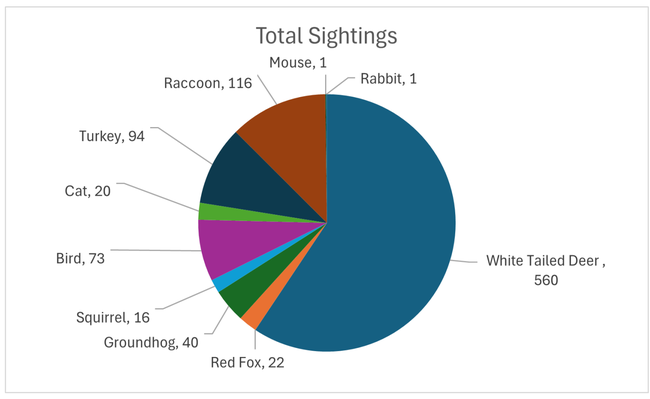

Figure 4: Pie chart showing the total sightings of each species. Deer, raccoons, turkeys, feral cats, mice, rabbits, birds, squirrels, groundhogs, and red foxes were found on site using the trail cameras.

White tailed deer found at site 54.

Figure 5: Marked map with fox sites starred. Because of the proximity of sightings at sites 21, 17, and 10, the same foxes might have been travelling between sites.

Figure 6: Pair of red foxes at site 17. They were the only pair spotted on camera and were found near array 6 of the solar farm.

Figure 7: Red fox spotted at site 59. Showing possible signs of mange due to patchy fur and sparse tail.

Discussion:

Based on the results of this study, coyotes haven't yet been seen at BNL. Red foxes are elusive but still present at the site, specifically near the solar farm and the outskirts of the property. Since sites 21 and 17 had a high number of fox sightings and are in proximity, there is likely a den in the area. Deer were spotted the most due to their large population size and have a large home range at BNL. Raccoons and turkeys often cohabitated in the same areas and had high capture rates. A possible reason for the low capture rate of foxes is reduced population size. Mange has been present at BNL for at least two years and has likely reduced the number of foxes on site. A fox at site 59 appeared to be suffering from the disease due to a thin tail and missing patches of hair (Figure 7). In the future, cameras could continue to be placed out yearly to find early signs of coyote arrival and keep track of mange and population size of the red foxes at BNL.

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