



Photo of radio-collared red fox kit

# Home Range and Population Estimation of Red and Gray Foxes at Brookhaven National Laboratory

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## INTRODUCTION

Red (*Vulpes vulpes*) and gray (*Urocyon cinereoargenteus*) foxes on Long Island

- Long Island lacks large carnivores such as bears, coyotes, and wolves, therefore the fox is a top predator
- Island foxes (*Urocyon littoralis*), are known to disperse over shorter distances than related mainland canids [1]
- Highly fragmented areas such as Long Island can cause more complex and less uniform home ranges compared to undeveloped areas [2]
- In the early 1900s, some speculated that gray fox had gone extinct on Long Island [3]
- Fecal DNA studies in 2006 and 2007 found red and gray foxes living sympatrically at Brookhaven National Laboratory (BNL) [4, 5]

### Home ranges

- Typically, a red fox home range in an urban or suburban landscape is less than 0.4 mi<sup>2</sup> [6]
- Average gray fox home range 0.853 mi<sup>2</sup> according to one study [7]

### Purpose and Hypothesis

- A study was conducted at Brookhaven National Laboratory over 10 weeks in Summer 2008 to study the home ranges of foxes on site through radio tracking
- I hypothesize that the home ranges of radio-tracked individuals are smaller than previously studied home ranges of foxes living on completely undeveloped land
- I also predict that fecal DNA analysis will verify the presence of both red and gray foxes as in 2006 and 2007

## MATERIALS AND METHODS

### Radio Telemetry

- Padded foothold traps were set in areas of high fox activity
- Weight, age, sex, body size, tail length, neck size, hind foot length, canine length, general health, and any other notable information were recorded when a fox was caught, and the animal was ear-tagged
- A collared fox was tracked daily through triangulation using a radio receiver, antennae, and three compass bearings taken within 20 minutes
- Each location was plotted using ArcMAP and ArcGIS software

### Fecal DNA Analysis

- Scat was collected by walking transects in areas of high fox activity
- Scat locations were plotted using Thales MobileMapper and mapped using ArcMAP and ArcGIS software
- Mitochondrial DNA extraction, Polymerase Chain Reaction (PCR) and enzyme restriction were performed according to standard protocol to determine fox species from fecal DNA
- Additionally, a digital automated field camera was set up in several locations over 10 weeks to document the presence of red and gray foxes and determine areas of fox activity

## ABSTRACT

Foxes play an important role in Long Island ecosystems as one of few remaining predatory animals in the area, yet little is known about their natural histories there. Non-invasive genetic studies in 2006 and 2007 identified the presence of red foxes (*Vulpes vulpes*) and gray foxes (*Urocyon cinereoargenteus*) at Brookhaven National Laboratory (BNL). A study performed in Summer 2008 built upon this initial research by investigating the individual home ranges of these foxes and again testing for the presence of red and gray foxes. Two red fox kits were trapped, one of which was successfully collared and tracked. Additionally, scat was collected for DNA analysis over an eight-week period with a focus on areas of historic gray fox activity. The collared fox maintained a home range of 0.05 mi<sup>2</sup> but was only tracked for one week before he could no longer be found. It is likely that competition forced him out of his parents' home range. Fecal DNA was extracted at a 17% success rate and analyzed using mitochondrial DNA markers. All successful enzyme restrictions were determined to be red foxes. Furthermore, no gray foxes were seen on an automated field camera, implying that there may no longer be a gray fox population at BNL. Trapping and radio collaring will resume next winter in order to track adult foxes with permanent home ranges at BNL, and continued fecal DNA analysis will verify the status of the gray fox population there.



Photo of the first trapped red fox kit

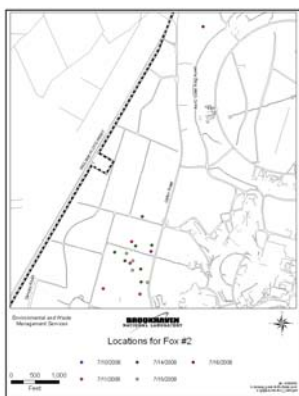


Figure 1. All fox locations recorded between July 10 and July 16, 2008.

## RESULTS

### Home Range

- In 351 trap nights, two red fox kits were caught
- One fox was large enough to safely collar without risk of out-growing the collar
- The home range of the red fox kit was 0.05 mi<sup>2</sup> (Figure 1), but he was only tracked for one week until he could no longer be found
- Last recorded location was 0.76 mi north of the fox's previous locations
- The fox was not found in the 45 mi<sup>2</sup> area on and around BNL that was checked for a collar signal (Figure 2)

### DNA Analysis

- Out of 56 samples, DNA was successfully extracted from 10 (17% success rate)
- Out of the 10 successful extractions, 4 had successful enzyme restriction
- 2 samples were determined to be red fox, and species could not be accurately identified on 2 samples

### Camera

- Three red foxes and no grays were caught on camera

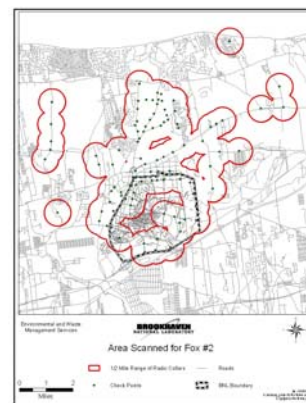


Figure 2. Areas checked for radio collar signal within and outside BNL

## DISCUSSION

### Radio Telemetry

- The red fox kit home range is small compared to various other home range studies [6, 8]
- The fox's disappearance has several possible explanations:
  - Young foxes generally do not disperse from their parents' home range until September or October [9], but it is possible that the collared fox was subordinate to the other fox caught in the area who may have forced him out of the territory
  - One red fox study determined that dispersal distance ranged from 0-187 mi [10], so if the fox did disperse, it is not surprising that he was not found
  - Another possibility is that the fox could have been hit by a car and removed from the area, as his last recorded location was less than a mile away from two major roadways
- Trapping difficulties were experienced during this study largely because trapper's scent is more easily deposited in summer due to perspiration in hot temperatures, and baits and lures may be less attractive to foxes in the summer when food is abundant

### DNA Analysis

- The lack of gray fox fecal DNA conflicts with studies from the past two years that found both red and gray foxes on BNL property [4, 5]
- The DNA extraction and enzyme restriction success rates were much lower compared to studies from 2006 and 2007, resulting in a smaller sample size. However, the lack of gray fox DNA combined with the lack of photo documentation from the field camera suggests that the gray fox population at BNL has declined. Additionally, two adult gray foxes were caught in winter 2008 by a trapper just south of BNL, and it is possible that these included the only two known resident adults seen on camera at BNL in 2007 [5]

### Future Research

- Trapping will resume in winter 2008 with hopes of radio-collaring adult foxes rather than transient kits
- DNA analysis with a higher success rate is needed to verify the status of the gray fox population at BNL
- This study demonstrates the fragility of the gray fox population and the need for widespread research throughout Long Island to protect this species

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