WILDLIFE RESTORATION GRANT—INDIANA
Examining Urban and Rural White-tailed Deer: Mortality, Dispersal, and Relatedness

Urban deer will often bed down just a few feet from road edges and sidewalks. (Photo by Garrett Clevinger)

CURRENT STATUS

Third year of a three-year project

FUNDING SOURCES AND PARTNERS

Wildlife Restoration Grant Program (W48R1)
Ball State University
Western Michigan University

PROJECT PERSONNEL

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BACKGROUND AND OBJECTIVES

State management agencies face challenges in managing growing white-tailed deer *(Odocoileus virginianus)* populations in suburban and urban areas. Hereafter such areas will be referred to as urban. These areas may serve as sanctuaries for deer because of hunting restrictions, limited access, and land ownership.

The increasing deer populations in urban landscapes can lead to elevated levels of human-deer conflicts. Similar experiences rarely happen in rural and exurban areas, hereafter referred to as rural, where hunter access and hunting are more prevalent.

Previous studies have found deer in suburban landscapes have smaller home ranges and higher survival rates than deer in rural areas. However, little is known of the potential relationship(s) between deer that occupy adjacent urban and rural environments and their resulting influence on population dynamics. It is unknown if urban deer disperse into adjacent rural areas or remain near their natal range. Likewise, it is not known if rural deer move into urban areas where hunting is greatly reduced. Therefore, it's important for managers to compare deer in urban and rural areas within the same general area at the same time. Knowledge of simultaneous movement patterns and survival of deer in both environments could allow managers to make policy recommendations to resolve conflicts and better understand population growth in both rural and urban settings.

A collared doe in suburban Bloomington. (Photo by Garrett Clevinger)

Deer often frequent apartment complexes in suburban Bloomington because of their lush ornamental gardens and shrubberies. (Photo by Garrett Clevinger)

As urban deer conflicts become more common, knowledge of potential population growth and dispersal in both urban and rural areas will help establish management priorities and actions in each human development area.

The objectives of this project are to:

1. Determine mortality rates and causes of mortality of adult urban and rural deer;
2. Determine dispersal rates and distances traveled of adult urban and rural deer,
3. Determine daily movements, home range size, and habitat selection of adult urban and rural deer,
4. Evaluate genetic relatedness in urban and rural deer to help understand long-term movement patterns.

METHODS

We used a wide variety of techniques to capture deer to fit them with either a global positioning system (GPS) or very high frequency (VHF) radio collar. These collars allowed us to monitor the movements and survival of each collared deer. We used a drop net, dart projectors in conjunction with a VHF transmitter dart, netted cage traps, and a suspended net-launcher to capture deer. We anesthetized deer with a compound of butorphanol, azaperone and medetomidine, and used naltrexone and atipamezole to reverse the anesthetic effects once processing was completed. While the deer were anesthetized, heart rate, respiratory rate and body temperature were recorded every five minutes from the time full anesthesia was reached. Age was estimated based on dental characteristics. Small tissue samples were collected from each deer before reversal.

During the 2015 field season, fawns were located using foot searches and contact from the public. Fawns in rural areas were equipped with an expandable VHF collar, but only male fawns in urban areas were equipped with collars. Fawn collars were also used to increase searcher efficiency of adult male deer during the 2016 field season.

Movements and space use were determined using location data collected from the GPS and VHF collars. The GPS collars recorded three to four locations daily. Movements of deer equipped with VHF collars were monitored using radio telemetry to estimate locations two to four times a week for two years. When possible, locations were collected by "homing-in" on VHF-collared deer using a vehicle-mounted antenna and telemetry receiver. When a collared deer was sighted, its location was recorded using a handheld GPS unit.

If we were unable to confirm a visual location, we estimated the deer's location using standard radio-tracking triangulation procedures.

Each VHF collar was equipped with a four-hour movement sensor to determine if a deer was active. If a collar emitted an inactive (mortality) signal, the deer was located to determine the cause of death or to recover the collar, if dropped. The GPS collars were set to eight-hour movement sensors and monitored continuously for mortality signals. VHF deer were monitored two to four times a week. Fawns were monitored for survival once every two weeks until January 2016 or until the collar battery died and no longer emitted a signal.

Tissue samples were collected from captured deer and hunter-harvested deer across Indiana to determine relatedness. Genetic markers will be analyzed in each sample to determine how related deer are within the city of Bloomington and surrounding rural areas. This will add another source of information about the movement and breeding patterns of deer across the urban-rural gradient. This will help determine how open or closed a population may be.

PROGRESS TO DATE

A total of 88 adult deer were captured and anesthetized, and 85 were collared between April 2015 and July 2016. Methods of capture were a dart projector (27 in urban; 22 in rural), drop nets (18 urban; 6 rural), netted cage traps (11 rural), and suspended net launchers (4 rural). Forty-five adult deer (25 males; 20 females) in urban areas and 40 (20 males; 20 females) in rural areas were collared. Additionally, 28 fawns were equipped with expandable VHF collars between May 20, 2015, and June 15, 2015.

Results indicate a fair amount of home range overlap between deer in adjacent urban and rural areas. Home ranges of both urban and rural adult deer have shown to differ among sexes, with males occupying larger home ranges than females. Preliminary results also suggest a difference in home range size based on development type. Females used smaller areas in urban areas than rural areas. This indicates females responded greater to development class than males in southern Indiana both seasonally and annually. While dispersal was a rare behavior of both urban and rural deer, all eight dispersal events that we documented were made by males. However, our data also suggest that urban deer were less likely to undergo temporary excursions outside seasonal home ranges than their rural counterparts.

As of July 2017, 32 mortalities of radio-collared deer had occurred. Causes of mortality include 10 deer struck by vehicles, nine from hunter-related incidents, four accidents, three from post-capture myopathy (muscle damage from extreme exertion, struggle or stress), and two from predation. The cause of death for four deer was not known. As expected, the highest form of mortality in urban areas was vehicle collisions, and rural deer were primarily harvested by hunters. Survival rates were not influenced by urbanization, but rather by sex. Males, from both environment types, had lower survival than females, regardless of season. An additional 12 collars were either dropped shortly after capture (3), or components of the collar failed, resulting in the failed collar retention (9). The fate of these 12 deer is unknown.

Monitoring of collared deer ended in July 2017. GPS collars were detached remotely, whereas VHF collars were left in place because recapture of deer is more traumatic than leaving the collars on. Analysis of survival and space-use data is ongoing, and we expect to complete it in early 2018.

Tissue samples were taken from 84 deer during processing, and 46 samples were collected remotely using a biopsy dart. During the opening weekend of the 2015 and 2016 Indiana firearms seasons, an additional 1,051 tissue samples were collected from hunter-harvested deer. We have analyzed 357 samples collected in and around Bloomington to address the question of whether the urban population is open or closed. We have sequenced all samples at a mitochondrial DNA marker and genotyped all individuals at 16 highly variable microsatellite markers. We are currently analyzing these data to assess levels of gene flow between rural and urban deer.

COST: $873,293 FOR THE COMPLETE THREE-YEAR PROJECT