

CAMERA TRAPPING IN THE E. S. GEORGE: WHO'S OUT THERE, AND HOW MANY ARE DEER

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ABSTRACT

Camera trap use has become increasingly common in field observations of wild animals, and game cameras have been utilized for studies on animal population size, range, habitat use, and activity patterns. This study used camera traps to survey the medium and large terrestrial vertebrates in the E. S. George Reserve. Cameras were placed along roadways and game trails for four to six days. Data from traps were used to estimate the white-tailed deer population using established un-hunted deer population sex ratios. The population of white-tailed deer on the reserve was estimated to be between 30-40 individuals. Maximum estimates using ratios from hunted populations were between 42-56, and 78-104.

INTRODUCTION

Over recent years the use of camera trapping as a sampling method in ecological studies has greatly increased. Game cameras have been used in estimating animal populations and range sizes, and gathering activity data and habitat use (O'Connell et al., 2011). Camera traps are particularly useful for gathering data on shy or rare species, and the low level of disturbance allows for observation that would have previously required countless hours hidden away in a blind or looking through a spotting scope, if it would have been possible at all. Additionally, camera traps are relatively quick and easy to set up and can collect data for months at a time, depending on the chosen settings. They are also versatile in the types of data that can be collected with single shot, burst, and video options, and are fully functional both day and night.

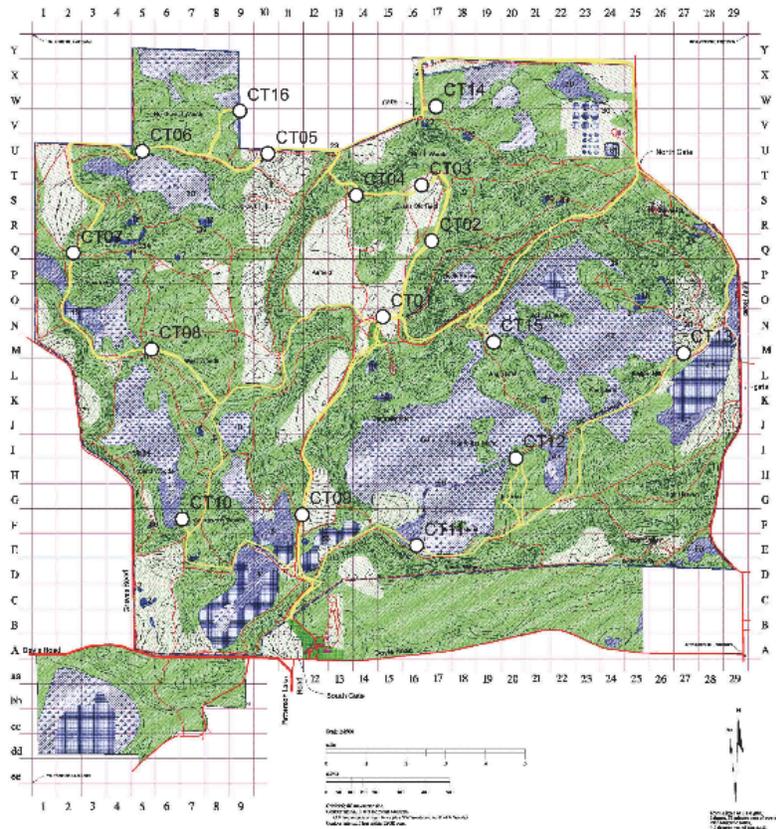
In this study, camera traps were used to survey the medium and large vertebrates found in the E.S. George Reserve (ESGR) and collect data on the white-tailed deer, coyote, and wild turkey populations on the property. Though there is abundant evidence in the form of scat and tracks of all three of these species, only the wild turkeys are seen with any regularity.

In 1927 the George Reserve was fenced and in 1928 four does and two bucks were released inside. From those first six deer, the herd grew to 160 animals by 1933. After substantial damage to the vegetation within ESGR a deer cull was instituted in 1942 and has continued since, with heavy culling over the last 3-4 years (Chris Dick, Alex Wenner, personal communication). Currently the size of the herd is unknown, and while there has been speculation as to its number, there have been no population surveys in recent years.

METHODS

Fifteen cameras were deployed along roads and well-traveled game trails throughout the E.S. George Reserve in Livingston County, Michigan. Locations were chosen to optimize likelihood of capturing the three target species: white-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans*), wild turkey (*Meleagris gallopavo*). Criteria for site selection included road intersections, road and trail convergences, and natural chokepoints created by bodies of water or other barriers. Nine cameras were deployed on the initial set date, with an additional six deployed two days later. Batteries were replaced on the original nine while placing the second round of cameras since multiple cameras showed 10% battery life or less after placement. The initial nine cameras were collected six days after being set. The second group of cameras was collected after four days. One of the cameras in the second group had a battery malfunction and turned off without taking any pictures. A second camera in that group died after only 11 hours. Both cameras showed better than 75% battery remaining at the time they were placed.

Map 1. Camera trap locations within the reserve.



Photos were indexed with location, time, date, species, number of individuals, and sex, though sex was only recorded for white-tailed deer and wild turkeys, as they are the only species

with sexually dimorphic characteristics that are discernable from photos. Male white-tailed deer were individually identified by the size and shape of antlers and given unique IDs.

Population size was estimated for white-tailed deer using a sex ratio for un-hunted populations of white-tailed deer (O'Connell et al., 2011). Fawn to adult ratios were calculated using demographic data from DeNicola, Etter, & Almendinger (2008). An ANOVA GLM with Poisson distribution was used to test for correlation of co-occurrence of the target species.

RESULTS

In total, the cameras took 5,502 photos over a total of 1,714 trapping hours. 2,522 photos taken contained vertebrates, including wild turkey (*Meleagris gallopavo*), eastern fox squirrel (*Sciurus niger*), cottontail (*Sylvilagus sp.*), Virginia opossum (*Didelphis virginiana*), common raccoon (*Procyon lotor*), white-tailed deer (*Odocoileus virginiana*), red fox (*Vulpes vulpes*), and coyote (*C. latrans*) (Table 1).

Table 1. Captures by camera and species.

Camera	C. latrans	D. virginiana	O. virginianus	P. lotor	S. niger	Sylvilagus sp	V. vulpes	M. gallopavo	Total
1	12	-	65	-	3	-	-	29	109
2	-	34	-	10	114	10	-	-	168
3	-	-	40	-	-	-	-	15	55
4	13	-	141	10	-	-	-	-	164
5	75	-	300	-	-	-	-	11	386
6	79	-	81	10	66	-	-	-	236
7	77	-	123	-	30	-	-	-	230
8	5	-	140	10	21	-	-	30	206
9	4	1	47	20	-	-	-	2	74
10	-	-	52	29	48	-	3	-	132
11	-	-	136	-	3	-	-	9	148
13	3	-	24	3	-	3	-	75	108
14	-	-	21	-	-	-	-	-	21
15	-	-	409	-	-	-	-	75	484
Total:	268	35	1579	92	285	13	3	246	2521

A minimum count of six individual bucks was identified from photos, with two additional male individuals whose identity were harder to distinguish in photos, possible. The minimum population using an un-hunted sex ratio of two does to every buck yielded an estimate of between 30-40 individuals. If the demography of the population in the reserve were to more closely resemble a higher ratio for hunted populations at 3:1, the population estimate range would increase to between 42-56 individuals. On the high end of sex ratios, with six does to each

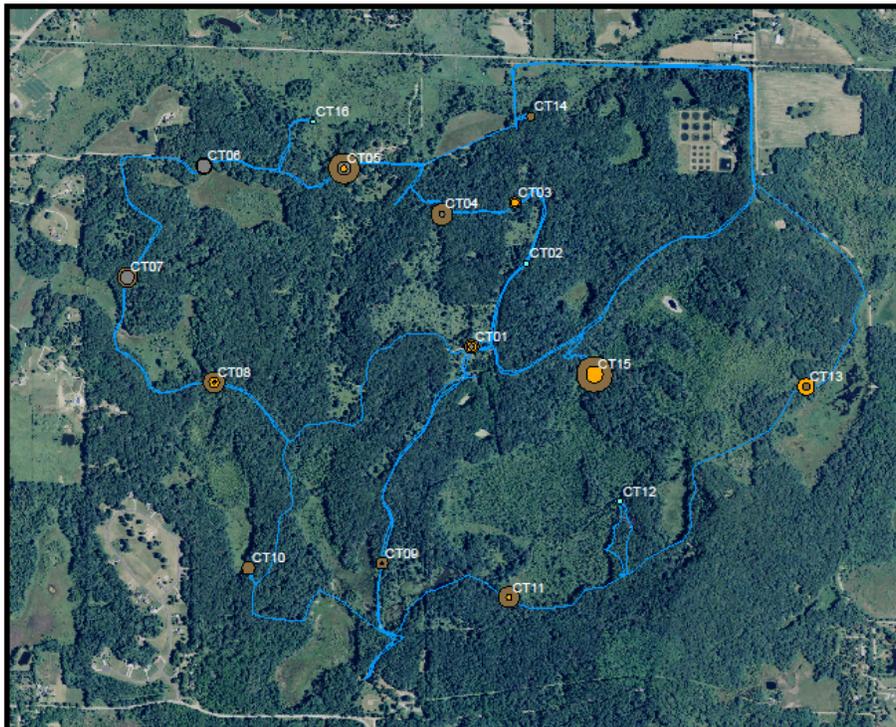
buck experienced in heavily hunted populations, the estimate would be from 78-104 deer (Table 1). All sex ratios are from DeNicola et al. (2008).

Table 2. Population estimates using demography of un-hunted deer populations. Low estimates are based on a count of 6 unique bucks in the George Reserve. High is based on a count of 8 bucks.

2:1 Low				2:1 High			
Does	Bucks	Fawns	Total	Does	Bucks	Fawns	Total
12	6	12	30	16	8	16	40
3:1 Low				3:1 High			
Does	Bucks	Fawns	Total	Does	Bucks	Fawns	Total
18	6	18	42	24	8	24	56
6:1 Low				6:1 High			
Does	Bucks	Fawns	Total	Does	Bucks	Fawns	Total
36	6	36	78	48	8	48	104

The GLM showed buck presence correlated with does ($p\text{-val} < 0.01$, effect size 0.005), and coyote presence was also correlated with deer presence ($p\text{-val} < 0.01$, effect size 0.004). There was not an apparent correlation between deer and turkey or coyote and turkey.

Map 2. Deer (brown), wild turkey (orange), and coyote (grey) photo locations. Circle size corresponds with number of photos taken, with higher numbers represented by larger circles.



DISCUSSION

The estimate of 30 to 40 deer in the ESGR puts the deer herd below or at the bottom end of the target herd size of 40 to 60 animals, which suggests that culling efforts have been overzealous in the number of animals harvested. Estimates using sex ratios of 3:1 and 6:1 are unlikely and almost certainly unrealistic since those ratios are derived from hunted populations, in which there is stronger selection pressure on bucks, creating an artificially skewed demography. As culling was sex-neutral, and sport hunting has not taken place on the reserve in years, these artificial conditions would not exist. The USFS lists the deer population density in the eastern US at the time of European settlement as ranging between 8 and 20 deer per square mile (Rains & Nisley, 2012). With 1300 acres on the property the ESGR might have been expected to be home to 16 to 40 deer at that time, which puts the estimate of 30 to 40 deer at close to a natural population size, or just above.

There are more complex methods of population estimation that are available using camera traps, including methods that allow for estimations without the use of marked animals (which is often required). These methods, however, call for additional data beyond what was collected in this study, including animal speed and the radius and angle of the area captured by the camera (Rowcliffe et al., 2008). Collecting the additional data needed would allow for more sophisticated, though not necessarily more accurate estimation in future studies.

Another direction for analysis that also proved impossible with current data was considering habitat characteristics in the detection and occurrence of species at trapping locations. Initial direction for the study had included using land cover satellite image data to analyzing the distance to and from forest types, and density of oak in particular, however I was unable to locate layers with sufficiently fine resolution to be useful.

Other points of interest from the data are the presence of the red fox, which has not been recorded on the property beyond the presence of a single cranium, a single photo of a coyote which appears to be carrying a woodchuck, and the number of photos of both deer and coyote that were taken within 30 minutes of less after recording a person at that location. Along similar lines is the photo of a coyote less than 40 meters from the houses and tents while field ecology was on site. This suggests that while there are few to no observations of deer or coyote by members of the class or faculty, the animals are never far away and are obviously much more adept at avoiding detection than we are at detecting them.

The data collected in this study can lay a foundation for future camera surveys within the reserve, and can potentially serve to inform management decisions regarding the deer herd in the ESGR. Combining trapping data with habitat surveys could also elucidate habitat preference for the species observed, and longer duration studies could look for seasonal shifts in habitat preference or site use. Longevity studies could also be carried out through annual recapture of easily identified bucks, and population trends of various species could be seen if the number of photos of each species varies annually.

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