# Ecology Lab: Deer Drive Census

## Background

A basic parameter of population biology is the density of a population: how many individuals of a species are there per unit area. Population ecologists have long been interested in how the environment affects density and how the density of one population affects populations of other species (competitors, predators, etc.). Wildlife managers use population ecology theory to manage populations of wild animals for the benefit of humans. Locally, white-tailed deer (*Odocoileus virginianus*) are of interest as game animals, potential crop pests, and as a tourist attraction. The Sequoyah State Park (SSP) near Hulbert on Lake Ft. Gibson has a large population of white-tailed deer. These deer are an important reason why visitors come to the park. As they have not been hunted in many years they are somewhat habituated to humans, permitting close observation. Unfortunately, the high density of deer at SSP has impacted the vegetation of the park. It has also contributed to an abundance of ticks, which affect humans and other animals at the park. (See readings on the course Bb site.) For these reasons, former SSP naturalist (and NSU alum) Les Pulliam asked the NSU biology department to estimate the density of deer in the park for comparison with past estimates of deer density. The current park naturalist has permitted us to continue this study. For this lab, we will estimate the density of deer in SSP and compare that estimate to previous estimates of deer density and look for multi-year trends in the population. We will share our data with the park naturalist for use in management decisions.

## Procedure

We will meet at the north end of the abandoned airstrip of the SSP at the time specified by Blackboard announcement. The entrance to SSP is off of State Highway 51 18 miles west of Tahlequah and 8 miles east of Wagoner. Plan on driving at least 30 minutes from Tahlequah and an hour from Broken Arrow. See Figure 1. From the park entrance, head south on the entrance road about two miles. Turn left (East) onto the road to the Cherokee Campground. The road passes onto an abandoned airstrip in about a half mile. Turn left and park at the north end of the airstrip. See figures 3 and 4.

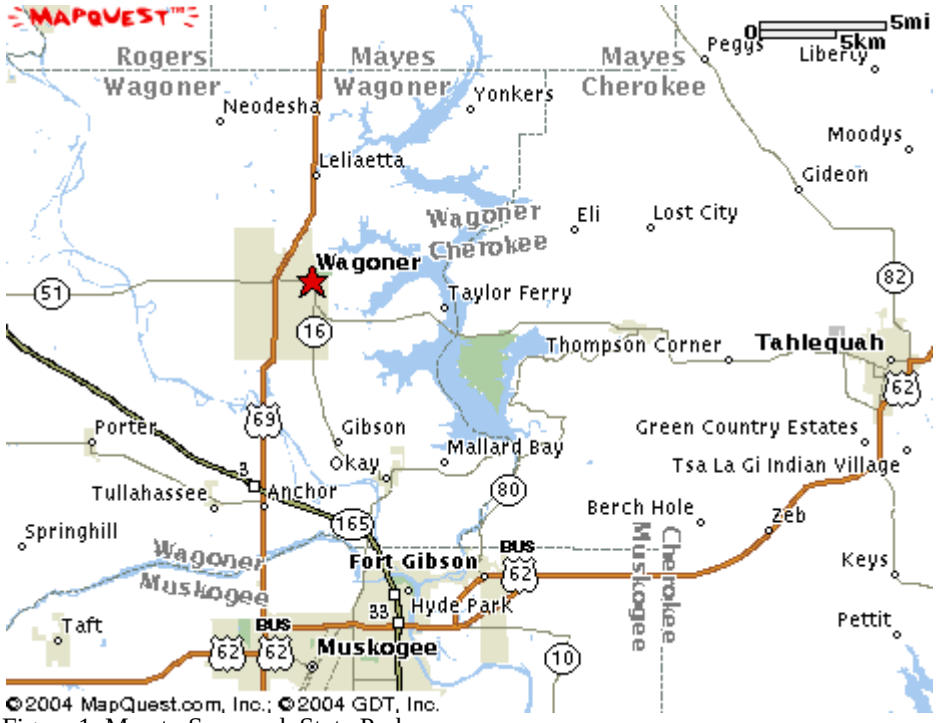

Figure 1. Map to Sequoyah State Park.

*Drive Procedure:*
Once we are assembled, we will form into two teams: drivers and counters. Counters will be stationed along the road to count deer crossing the road between them and the next counter to the right. Drivers will walk in parallel lines through the drive area while counting deer that run between them and the driver to the right. It is very important that the drivers walk in a line. Bring a compass if you have one (I will provide some as well) as the drivers will be walking exactly magnetic east. At all times the drivers should stay even with the drivers to the left and right of them. To make this as easy as possible everyone should dress in the brightest colors they can. You should also dress warmly and to protect yourself from scratches and twisted ankles as you push through some dense vegetation and cross rough terrain. You should also plan to make as much noise as possible while driving deer—whistle, clap, shout, etc. Also, a slow walk by all the drivers prevents some drivers from falling behind when they encounter rough patches of terrain. The drivers must also maintain an even distance between themselves and the drivers to their left and right. Resist the temptation to find and follow paths: stay on a straight line, deviating only briefly to get around obstacles, and then quickly resuming your previous heading. See Figure 2.

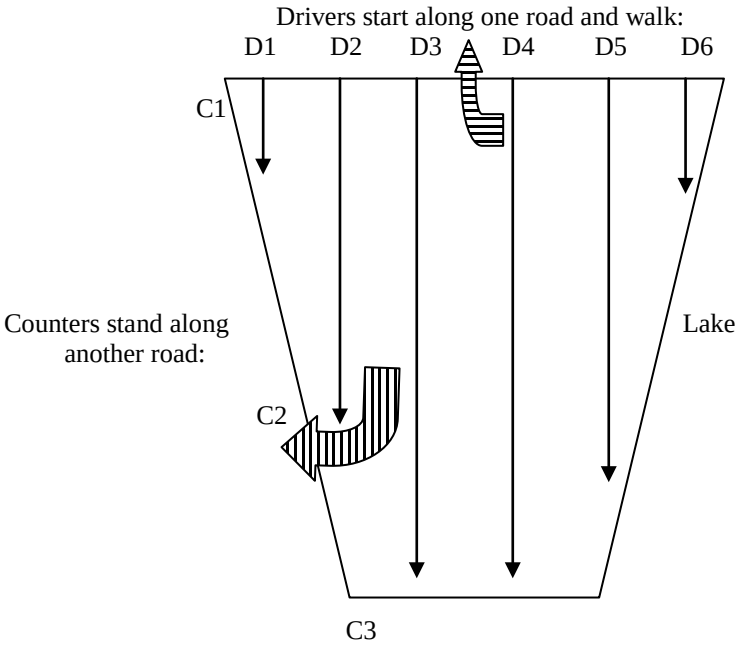


Figure 2. Hypothetical deer drive. Six drivers (D1 to D6) walk south through an area bounded by roads on the north, west and south and by a lake on the east. Three counters (C1 to C3) stand along the west and south roads (the drivers started on the northern road). Two deer are seen by drivers. The first deer (horizontal stripes) was flushed by D4 and was counted by D4, as it ran to the right of D4 (and the left of D3). The second deer (vertical stripes) was flushed simultaneously by drivers D2 and D3, but neither could count it as it ran forward and then across the west road. Instead, it was counted by C2 as it run to C2's right (the left of C3). As it ran across the road, C2 noticed that the deer was accompanied by a smaller deer, presumably last year's fawn. Finally, D6 saw another group of deer ahead of him when the drive ended, but they did not pass to his right and so he could not officially count them. No one else saw them. Thus, by the end of this drive, three deer were officially counted. If the area sampled was 5 acres, the density estimate is 3/5 = 0.6 deer/acre (or 1.7 acre/deer).

Ideally, we would do one huge drive covering the whole park. That is not practical, as it would require a thousand people. The next best approach would be to perform several drives over randomly chosen plots on the park. We would then take the average density over all of the samples as our park-wide density estimate. That would require fewer people, but much more time. Instead, we will do one drive in one part of the park and assume that the density in that part of the park is the same as the density in the park as a whole. Do you think that that assumption is justified? How could you find out, without a lot of work? Feel free to start a new discussion thread on this topic on the "Deer Drive' forum.

When the drive is completed, everyone will need to meet by the parked cars at the end of the drive area to turn in his or her numbers of deer and any other mammal seen (e.g., armadillo, coyote, rabbit, skunk) to park management. We will also count the number of participants (see below). This year's data can then be compared to data from previous years on the table below.

## Data Analysis

Add the current data to the data from previous years. Calculate deer density for each drive. Calculate an estimate for the deer population size (number of deer in the entire park) for each drive. Make a neatly organized scientifically formatted table of all these data and calculations (i.e., one table). Make neatly organized and scientifically formatted plots of both deer density over time and total park deer population over time. Examine the plots. Would linear regression be an appropriate method to produce a best-fit line to these data? (Why or why not?) If it is, perform a regression analysis on these data to determine how deer density is changing over time. The units for slope will be in (deer/acre)/year (or deer/year for total population size) added to or reduced from the park. If linear regression is not appropriate for these data, can you think of another way to analyze these data to determine if there have been changes over time?

Finally, determine the effect of varying numbers of participants on density estimates. This can be done using least-squares regression, where participant number is the X variable and density is the Y variable. The null hypothesis is that the slope is 0, the alternate is that the slope is not 0.

Table 1. Raw data from Spring drive censuses of white-tailed deer in Sequoyah State Park (Cherokee Co., Oklahoma, USA) conducted from 1989 to 2007. Total park area is approximately 2500 acres (~1000 ha).

| Year | # participants | Acres covered | # deer counted |
|---|---|---|---|
| 1989 | 114 | 616 | 199 |
| 1990 | 12 | 338 | 99 |
| 1991 | 37 | 382 | 60 |
| 1992 | 63 | 382 | 63 |
| 1993 | 44 | 382 | 64 |
| 1996 | 85 | 382 | 116 |
| 1999 | 108 | 382 | 129 |
| 2000 (Feb.) | 67 | 208 | 24 |
| 2000 (Dec.) | 38 | 107 | 23 |
| 2001 (Feb.) | 33 | 107 | 32 |
| 2001 (Nov.) | 51 | 107 | 53 |
| 2002 (Feb.) | 50 | 107 | 51 |
| 2002 (Nov.) | 65 | 107 | 40 |
| 2003 (Feb.) | 45 | 107 | 23 |
| 2003 (Nov.) | 50 | 107 | 35 |
| 2004 (Feb.) | 75 | 107 | 24 |
| 2004 (Nov.) | 59 | 107 | 44 |
| 2005 (Feb.) | 64 | 208 | 98 |
| 2005 (Nov.) | 53 | 208 | 15 |
| 2006 (Feb.) | 49 | 107 | 55 |
| 2006 (Nov.) | 40 | 107 | 33 |
| 2007 (Feb.) | 51 | 208 | 47 |
| 2007 (Nov.) | 49 | 107 | 26 |
| (additional rows of data will be provided, plus you will help update this data for park management!) | | | |

## Report

1) Participation
2) Calculations
    a. Calculations of deer density using the pellet method (show work)
3) Formal Table (as above, but with current data row(s) added, plus new columns for density (deer/acre) and total park population based on the drive method
4) Graphs
    A) density over time (with linear regression); mark pellet estimate on the graph.
    B) total park population (with linear regression); mark pellet estimate on the graph
    C) effect of participant number on density estimate (with linear regression)
5) Narrative – write a 500 word abstract summarizing in ~100 words each:
    a) Why it is important to estimate the density of deer at SSP
    b) How the two density estimates were obtained
    c) What results were obtained from the two methods
    d) How you interpret the results
    e) What recommendations you have for the management of deer at SSP

    NOTE: your lab report may be given to park management unless you request that it not be. In any event, data you help generate <u>will</u> be made available to park management.

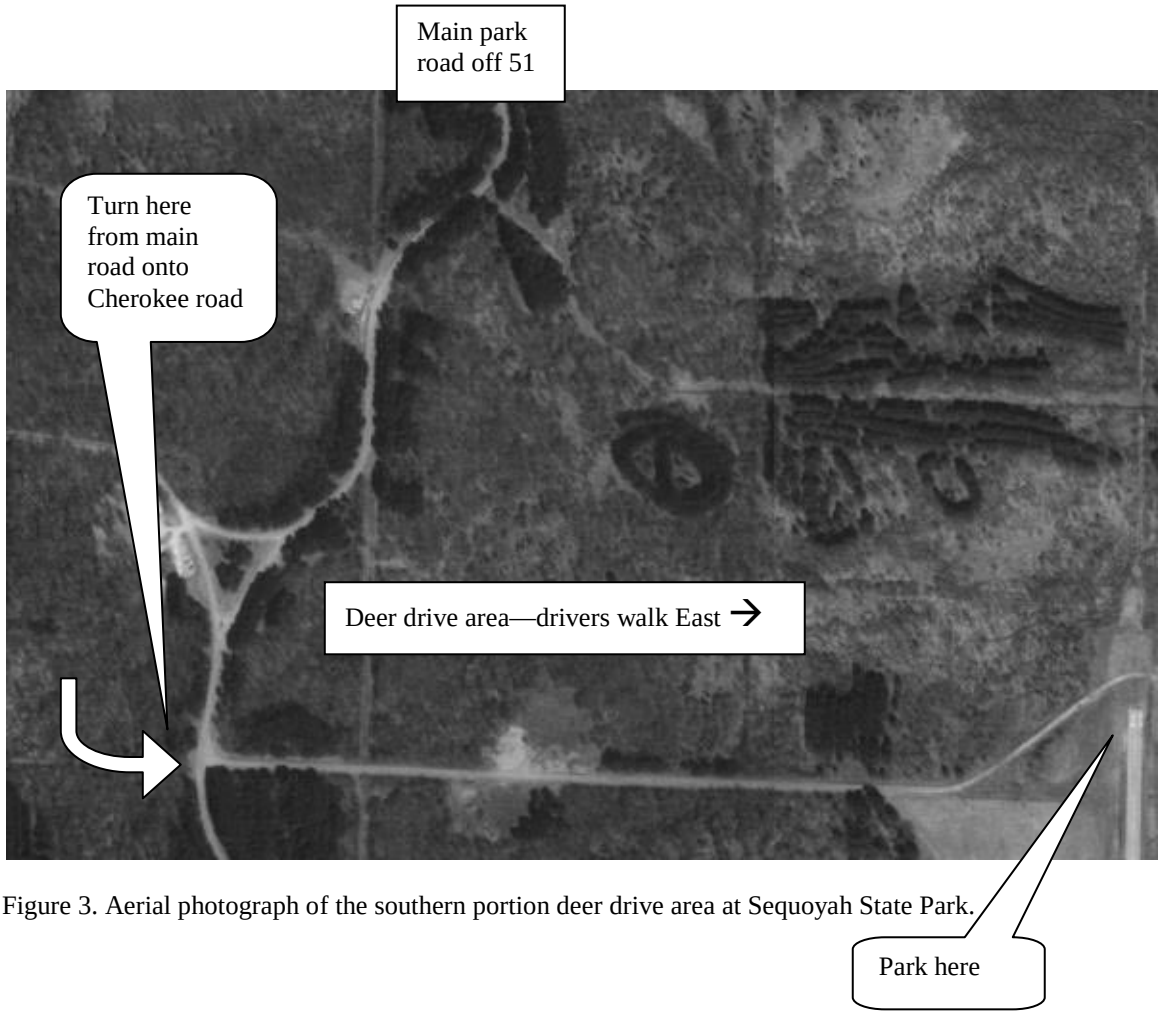


Figure 3. Aerial photograph of the southern portion deer drive area at Sequoyah State Park.

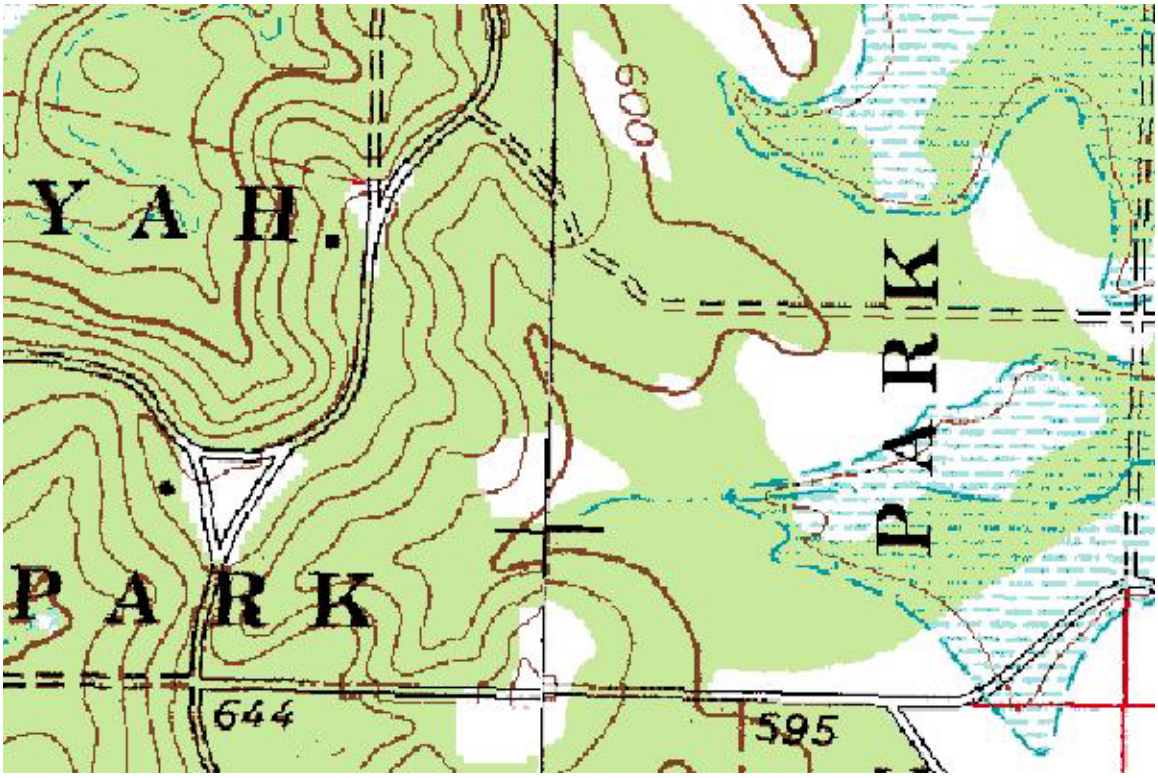


Figure 4. Topographical map of the southern portion of deer drive area at Sequoyah State Park.