ESTIMATING WHITE-TAILED DEER DENSITY USING TRAIL CAMERAS AT ITASCA STATE PARK IN NORTHWESTERN MINNESOTA

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SUMMARY OF FINDINGS

White-tailed deer (*Odocoileus virginianus*) densities in the farmland zone of Minnesota are estimated using simulation modeling and aerial surveys. Simulation modeling is not well suited for modeling population dynamics in small areas, such as Itasca State Park (Permit Area 287). In 2005, Itasca State Park was chosen as a study area to test alternative deer hunting regulations. Deer density estimates were needed to evaluate the effect of antler-point restriction regulations (>3-points-on-a-side) on the deer population in the park. A trail camera study was initiated in 2006 to monitor the population. Forty-two cameras were systematically placed at a density of 1 camera/130 ha. The ratio of legal bucks to sub-legal bucks (fork and spike bucks), and buck:antlerless deer ratios were calculated for 2, 3-week sampling periods before and after the hunting season. A change-in-ratio formula was used to estimate number of antlered deer. Total number of deer was estimated using sex and age ratio data. During 2006, cameras captured 12,484 images of deer over the 6-week sampling period. The pre-hunt deer density at the park was estimated at 85 deer/km^2 (33 deer/mile^2). This estimate was comparable to deer densities estimated by simulation modeling in adjacent permit areas (PAs). We conclude that the camera technique did provide a reasonable population estimate in 2006. The study was continued in 2007, but data entry is not complete.

INTRODUCTION

In 2005, Itasca State Park was chosen as a study area to test a 3-points-to-a-side antler-point restriction regulation for deer hunting. Deer density estimates were needed to evaluate the effect of the antler-point restriction on the density and demographics of the deer population.

Deer densities in the farmland zone of Minnesota have traditionally been estimated using simulation modeling and aerial surveys. Simulation modeling has been used throughout the farmland zone to estimate deer densities in individual PAs. Aerial surveys have been used in some PAs to recalibrate deer density estimates (Haroldson and Giudice 2006). However, due to errors caused by demographic stochasticity and seasonal movement patterns, simulation modeling is not recommended for small areas (Grund 2001). The small size of this park (approximately 130 km^2) made population modeling impractical. Also, aerial surveys were not feasible due to dense coniferous cover that existed in parts of the park. While deer density estimates were not available for the park, the simulated deer density immediately north of the park was estimated at 65 deer/km^2 (25 deer/mi^2) in spring 2007 (Lenarz 2007).

Infrared-triggered cameras have been used to estimate deer populations in a variety of habitat types and study area sizes (Moore 1995, Jacobson et al. 1997, Koerth et al. 1997, Warlock et al. 1997, and Roberts et al. 2006). Jacobson et al. (1997) developed a camera technique to estimate deer density using known numbers of individually identifiable mature bucks and associated age and sex ratios from the deer herd. In Texas, Koerth et al. (1997) compared camera population estimates to helicopter counts and concluded that both techniques provided reliable deer density estimates.

In Fall 2005, a pilot camera study initiated at Itasca State Park determined that a greater sampling effort, systematic sampling design, and pre-baiting of sites was needed. In 2006, the study was adjusted to accommodate the pilot study findings and provide a population estimate. The study was continued in 2007 and data are in the process of being entered. The study is planned to continue in 2008.

OBJECTIVE

- To estimate density and demographics of the deer herd at Itasca State Park.

METHODS

The trail camera study was conducted at Itasca State Park, located in northwestern Minnesota in 2006 from September to December. The park is approximately 130 km^2. The study area we used was approximately 6,400 ha located in the center of the park in order to minimize effects that movement patterns would have on deer observations along the perimeter of the park. Following the protocol developed by Jacobson et al. (1997), 42 trail cameras were placed at a density of 1 camera/130 ha systematically throughout the study area using the Systematic Point Sample tool in ArcView 3.3. Minor adjustments were needed to avoid wetland areas (Figure 1).

Each site was located in the field using a global positioning system unit and flagged. Sites were baited with 23 kg (50 lbs) of shelled corn 3 weeks prior to placing the cameras in the field. An additional 11 kg (25 lbs) of corn was added to each site 1 week before camera sampling began. A Bushnell TrailScout Pro 2.1 Mega Pixel (MP) or 3.0 MP trail camera was used at each site. Cameras were attached at a height of 1.5 m to a nearby tree using a cable. Each camera faced north and was 4-6 m from the established bait pile. Cameras were angled slightly downward to aim the infrared beam to a height approximately 1 m above the bait pile. Cameras were programmed to take pictures day and night with a 1-minute delay between pictures to minimize multiple pictures of the same deer. Cameras were in the field for 3 weeks both before and after the regular firearms season. Batteries and memory cards were replaced and corn (11 kg) was added to the baited area on a weekly basis.

Each image was examined using Adobe Photoshop 3.0, and images of species other than deer were deleted. We classified each deer as legal buck (3 points to a side), sub-legal buck, or antlerless deer. We excluded images if we were unable to classify a deer to an appropriate category.

Using harvest data for the PA and number of legal bucks in each sampling period, a standard change-in-ratio formula (Paulik and Robson 1969) was used to calculate the number of legal bucks:

$N = (R_X - RP_2)/(P_1 - P_2)$

where R_X = number of legal bucks harvested in PA 287
R = total number of all bucks harvested in PA 287
P_1 = proportion of legal bucks in preseason buck population
P_2 = proportion of legal bucks in postseason buck population

The density of bucks (D_B) was then calculated, and the density of antlerless deer (D_{AL}) was estimated by the following formula;

$D_{AL} = D_B$ (1/ % of bucks in preseason population)

RESULTS AND DISCUSSION

Trail cameras captured 16,708 images during the 2, 3-week sampling periods. More images were captured during the postseason (9,349) than during the preseason period (7,359). Approximately 75% of the images contained a photo of a deer. Other species we observed included black bear (*Ursus americanus*), raccoon (*Procyon lotor*), bobcat (*Lynx rufus*), snowshoe hare (*Lepus americanus*), a variety of avian species, gray wolf (*Canis lupus*), mice (*Peromyscus* spp.), squirrels (*Sciurus* spp. and *Tamiasciurus hudsonicus*), chipmunks (*Tamias striatus*), and humans. Some images (16%) contained no visible animal, and distortion of the

image also caused some deer to be unidentifiable (8%). Thus, 11,368 images were useable for project purposes.

During the preseason period, we observed 1,505 legal bucks, 800 sub-legal bucks, and 3,420 antlerless deer images. During the postseason period, we observed 1,773 legal bucks, 1,509 sub-legal bucks, and 5,080 antlerless deer images. These camera and associated harvest data produced a preseason estimate of 85 deer/km^2 (33 deer/mile^2) using the change-in-ratio model. This prehunt density estimate agreed with simulated estimates produced by Lenarz (2007) when factored with harvest and winter mortality. We acknowledge that correlation between 2 estimates does not validate or invalidate either technique. However, the Lenarz (2007) model has been effective throughout the forested region of Minnesota to monitor deer population dynamics for >10 years. Thus, we were encouraged by the general agreement between the 2 estimates. Data collected in subsequent years will help assess the repeatability of the camera technique across years.

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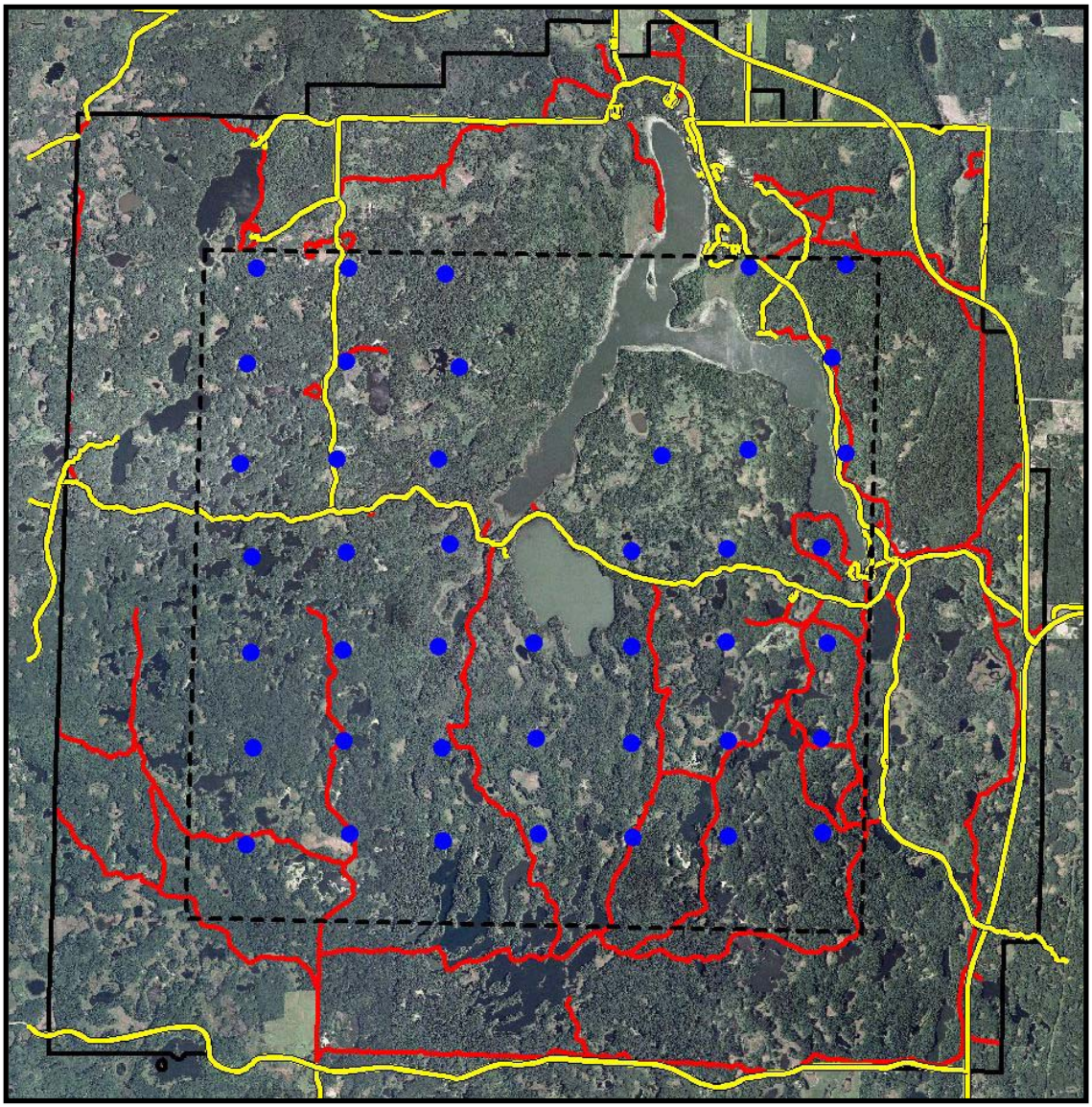

Figure 1. Locations of trail cameras (dots) in the study area (dashed line) at Itasca State Park, Minnesota in 2006.