White Buffalo Inc.
Conserving Native Species and Ecosystems

Iowa City
White-Tailed Deer Population Estimate
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INTRODUCTION

Deer overabundance and the associated conflicts are pervasive throughout much of the US. Alternative management techniques (i.e., controlled hunting, sharpshooting, trap and relocation, fertility control research) have been explored from Georgia to Texas to Minnesota and back through Maine and nearly all the states contained therein. Throughout this large geographic region, deer are creating both social and ecological conflicts in suburban, corporate, and park environments. Many federal, state and local agencies are struggling to address this ever-increasing problem.

Critical to any management decision and research assessment is an understanding of the abundance and distribution of deer, yet it is often difficult to obtain accurate estimates. There are a variety of estimation methods available to decision makers, and each method has its advantages and disadvantages. The techniques typically used to estimate the abundance of white-tailed deer include: spotlight surveys, aerial infrared-scanning or snow counts, mark-recapture/resight, and population reconstruction (Downing 1980). Mark-resight with infrared triggered camera-traps has successfully been used to estimate population size for free-ranging deer with a portion of the population tagged (Curtis et al. 2009). Jacobson et al. (1997) established that individual antler patterns could be used as a unique mark to identify the approximate number of individual antlered males using the survey area. This unique mark and photo ratios could then be used to successfully estimate population size, assuming all sex and age classes are equally susceptible to the camera-trap (Jacobson et al. 1997). Curtis et al. (2009) documented that using IRCs with the Jacobson method provided a reliable method for estimating the abundance of suburban white-tailed deer herds.

STUDY AREA

Iowa City contains a matrix of suburban/commercial development, agricultural fields, parks and open grasslands. As a result of no legal hunting opportunities and fertile soils, the deer population had increased to a level incompatible with some land uses and human activities in the late 1990s. Although deer physical condition was not an issue, there was concern regarding deer/vehicle collisions and damage to garden and landscape plantings. In 2000, a sharpshooting program was initiated that resulted in a significant deer population reduction, and associated deer-vehicle collisions, over a nearly 10 year period. The population reduction program was implemented through 2009 when it was concluded as deer-human conflicts were no longer of concern. This population estimate was requested given the deer population had not been actively managed for 8+ years and appeared to be increasing.

METHODS

Camera Survey

The camera survey was conducted in a ~3-mile^2 population estimation area (Figure 1). We divided the sampling area into 15 sections by overlaying a grid of approximately 130-acre blocks. We adjusted the grid for the best fit to deer habitat in each block. We deployed one camera per 130-acre block. The infrared-triggered digital cameras (Moultrie D-80 White Flash camera, Moultrie Feeders, Alabaster, AL, USA) were deployed over bait piles of shelled corn on properties with a high probability of deer activity. Camera sites were baited daily for several days prior to, and during camera deployment, starting on 5 December 2017 until the cameras were removed on 16 December 2017. Each camera was elevated approximately 2 ft off the ground, oriented north to control exposure issues, and placed approximately 12 ft from the center of bait. The cameras were set to run continuously for 24 hours per day, with a preset delay of 5 minutes between pictures. Every other day during the survey the memory cards in the cameras were changed to confirm the cameras were functioning properly. On 16 December, the photo survey was completed, and cameras were removed.

Figure 1. Population estimation area and camera locations.

After the cameras were removed from the field, all of the pictures containing deer were sorted by site. Each picture was closely studied, and we recorded the total number of deer, the number of antlered males, the number of non-branched antlered males that could not be uniquely identified, the number of adult females, and the number of fawns. The number of unique males observed at each site was determined using unique antler patterns.

Population Estimate: Jacobson's BDR Method

With the camera data we used the Jacobson buck:doe ratio (BDR) population estimator. As outlined in Jacobson (1997), "individual branch-antlered males were identified from photographs using antler configuration (# of points, relative length of points, angle of projection of points, and relative location of points on the antler beam), antler mass, pelage characteristics and body traits. We then assigned an identifying number to each antlered male. Branch-antlered males were any antlered males with greater than or equal to 1 branched antler. Photographs were excluded from analysis when identification of an animal was uncertain."

Spike-antlered males can be difficult to distinguish individually; therefore, spike:branch-antlered ratios were determined and the estimated total antlered male population was calculated using this ratio:

$P_s = N_{sa}/N_{ba}$,

where

P_s = ratio of spike:branch-antlered bucks (antlered males),

N_{sa} = total number of spike-antlered deer occurrences in photographs,

N_{ba} = total number of branch-antlered deer occurrences in photographs,

and

$E_b = (B \times P_s) + B$,

where

E_b = estimated total buck (antlered male) population,

B = number of individually identified branch-antlered bucks (antlered males)."

The estimated **adult female** population was calculated using the estimated antlered male population and the antlered male:adult female ratio (calculated from the photographs):

$P_d = N_d/N_b$,

where

P_d = ratio of does (adult female) : bucks (antlered male),

N_d = total number of antlerless adult deer occurrences in photographs,

N_b = total number of antlered adult deer occurrences in photographs,

and

$E_d = E_b \times P_d$,

where

E_d = estimated total doe (adult female) population.

Fawn abundance was calculated in the same manner:

$P_f = N_f/N_d$,

where

P_f = ratio fawns: does (adult female),

N_f = total number of fawn occurrences in photographs,

and

$$E_f = E_d \times P_f,$$

where

E_f = estimated total fawn population.

Total population size was estimated by summing each segment of the population. The sex ratio was determined using the ratio of antlered males to adult females in photo observations, where sex ratio = N_d/N_b. The recruitment rate was determined using the ratio of fawns to adult does in photo observations, where recruitment rate = N_f/N_d.

RESULTS/DISCUSSION

Photo summary

We obtained a total of 7,874 usable pictures from the 15 baited camera sites from 5-16 December 2017, which included 10,324 photographic observations of individual deer (Table 1). The total number of branched antlered male images that were identifiable in the pictures was 4,010, the total number of spike antlered male images was 317, the total number of females was 3,050, and the total number of fawns was 2,947 (Table 1).

TABLE 1. Summary of photos observations in Iowa City, IA December 2017.

	Photo Observations				
	# Observations of Deer	# Branched Antlered Males	# Spike Antlered Males*	# Females	# Fawns
Total	10,324	4,010	317	3,050	2,947

*Animal cannot be identified as unique based on antler pattern.

Density Estimate and Recruitment Rate

We estimated the total population in the survey area at 172 (Table 2), and given the area was ~3 mi^2, the minimum estimated density was 57.5 deer/mile^2. We estimated the total adult female population at 51 and the total fawn population at 49. This results in a fawn recruitment rate of 1.0.

TABLE 2. Estimated population in sample area using Jacobson BDR method based on photo observation data in Table 1).[1]

	A: # Individual Branched Antlered Males[2]	B: # Spike Antlered Males[1,3]	C: Total Antlered Males	D: Estimated # Adult Females[4]	E: Estimated # Fawns[5]	F: Minimum Estimated Total Population
Total	67	5	72	51	49	172

1. If a number is less than 1, we round up to 1, given there is likely a deer in the area. Rounding calculated in separate spreadsheet and numbers may vary slightly due to when rounding is applied.
2. The number of branched antlered males is based on photo capture of these males in camera survey and identification based on unique antler pattern.
3. # Spike Antlered Males (B) = (# Spike Antlered Male Photo Observations (Table 1)/# Branched Antlered Male Photo Observations (Table 1)) * # of Branched Antlered Males (A)
4. # Adult Females (D) = ((# Adult Female Photo Observations (Table 1))/# Antlered Male Photo Observations (Table 1))) * Total Antlered Males (A)
5. # Fawns (E) = (# Fawn Photo Observations (Table 1)/# Adult Female Photo Observations (Table 1)) * Total Adult Females (D)

Camera Survey Bias Adjustments and Sex/Age Class Ratio Ranges

There are potential sex and seasonal biases in attracting deer to bait relative to their occurrence in the population (Koerth and Kroll 2000, McCoy et al. 2011, Chitwood et al. 2017). The type of bias varies for any number of reasons, including food availability, breeding season, fawning period, and ratio of males to females. Given the unlikely ratio of antlered males:adult females:fawns in photos (~1.4:1:1), we believe the population estimate is an absolute minimum. In other words, females and fawns may be underrepresented as antlered males can dominate baited locations (especially after the breeding season while males still have their antlers) limiting the number of photos of females and fawns comparatively.

Typical suburban deer populations have been documented to be 20% antlered males (DeNicola et al. 2008). We believe the percentage of males in Iowa City is higher than the DeNicola et al. (2008) study, but likely not as high as the 42% observed in photos. We have documented approximately 30% antlered males in local populations at other project locations with male mortality rates that may be similar to those in Iowa City (e.g., our research site in Cincinnati, OH had 31.4% antlered males and San Jose, CA had 30% antlered males). **If we adjust the ratio of antlered males to 30% this would increase the population estimate to 80 deer/mile^2, or 240 deer in the area surveyed.**

The Iowa DNR counted 69 deer in 2008 in the same area of Iowa City. They used helicopter counts over snow. Therefore, there are likely 3 times as many deer now in the survey area as there were ~10 years ago. This reflects a density similar to what was present when we initiated the sharpshooting program in 2000.

LITERATURE CITED

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