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White-tailed Deer Monitoring at Arkansas Post National Memorial, Arkansas: 2008 Status Report

Natural Resource Technical Report NPS/HTLN/NRTR—2008/103

ON THE COVER
White-tailed deer (*Odocoileus virginianus*)
Photo from The Heartland Inventory and Monitoring Network and Prairie Cluster Prototype Monitoring Program files.

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Executive Summary

White-tailed deer were monitored on Arkansas Post National Memorial, Arkansas (ARPO) using methods developed between 2005 and 2007. The index of deer density increased to 72.48 deer/km^2 this year. A substantial increase compared to 2006 and 2007 monitoring. Overall the estimated index of deer density is still lower than when our monitoring began in 2005 (a decline of 12.65 %), but our survey indicates the population is increasing. Outside hunting pressures and practices along the northern boundary of ARPO have subsided. Deer feeders once occupied an area along the parks' north-east border during 2006-07, but have since been removed by the landowner. During 2007 no disease outbreaks were reported in deer populations in or around Arkansas County, Arkansas (Roger Milligan, 2008)

Introduction

Since European settlement, white-tailed deer (*Odocoileus virginianus*) populations in North America have experienced enormous changes in size and distribution. Once abundant, deer numbers declined to near extinction by the early 1900s. Clearing of forested lands and unrestricted hunting contributed heavily to the decline of this species (Stoll and Donohoe 1973, Dennis 1983). Declines in deer numbers were especially prevalent in the East and Midwest sections of the country where much of the land was converted for row-crop farming.

Regulated white-tailed deer hunting and extermination of most of their natural predators has led to unprecedented population growth throughout their range. With natural deer habitat severely reduced, row-crop agriculture and other agriculture practices provide artificial food sources that deer utilize. The ability of white-tailed deer to adapt to human disturbance has also aided in the recovery of this species. Urban sprawl benefits deer by fragmenting continuous blocks of forested lands into small sections with increased edge habitat, which is favored by deer and rarely available for hunting. Therefore, deer experience high rates of population growth as long as food is available in these small blocks of patchy habitat. Grass and forb production is greater in these areas as is mast production by oaks, hickories and other trees when compared to larger blocks of forested land (Peitz et al. 2001). Urban sprawl also redistributes deer by eliminating habitat in one area, thereby concentrating deer in available habitat in another (Shafer-Nolan 1997).

Deer become vulnerable to overpopulation, disease and starvation in the absence of natural predators and hunting. When deer occur in high densities, diseases are transmitted more readily. In years when forage or mast production is restricted due to climatic conditions, starvation or poor herd health can occur. Deer browsing from high-density herds also has a negative affect on vegetation of an area. Research has shown that high deer populations contribute to over-browsing of vegetation, which leads to plant mortality, decreased plant reproduction and may tend to favor less preferred exotic species (McShea and Rappole 1997). This shift in species assemblages can reduce plant diversity at a local level and cause changes in the functioning of prairie and woodland communities. Deer foraging may influence rare and sensitive plant species negatively. However, the influence of deer on the status of most rare and sensitive plant species is largely unknown. Many studies have shown that deer can have a negative effect on developing forestland (Crouch and Paulson 1968, Horsely and Marquis 1983, Marquis 1981). Browsing on young tree seedlings causes stunted growth as well as mortality (Michael 1992, Mladenoff and Stearns 1993). Research has shown that in some situations damage from deer as well as mice and rabbits may be a key impediment to forest restoration projects (Crouch and Paulson 1968, Strole and Anderson 1992).

White-tailed deer are often viewed as an important component of park ecosystems. Deer have a tremendous following among the public and many parks provide information on the status of deer through their interpretive programs. However, this information is generally anecdotal in nature. White-tailed deer can present a safety hazard to motorist and park visitors when populations are high. High deer numbers increase the number of vehicle-deer collisions and the resulting property damage and personal injuries. In some cases, vehicle-deer collisions can result in the loss of human life. Deer also disperse ticks, which may carry Lyme disease (Connelly et al. 1987). Lyme disease is a debilitating immune system disease transmitted to humans by the bite of ticks. Ticks carrying other human transmittable diseases such as Rocky Mountain Spotted Fever and Ehrlichiosis may be spread by deer as well. Information on the status and trends in deer population size helps park managers determine if control measures are necessary in order to protect other park resources and improve visitor safety.

It is against a backdrop of urban sprawl, altered ecosystems and concerns over visitor safety on Park Service lands that we proposed monitoring white-tailed deer populations to assess their status and trends. Long-term trends in deer abundance provide one measure for assessing their potential as a problem for a park. Documenting long-term patterns in deer numbers allows one to evaluate correlations with changes in vegetation (e.g., through restoration of the cultural landscape). With this information, resource managers can more effectively identify and potentially mitigate damage caused to vegetation communities and endangered plant populations by deer. Monitoring data also helps managers assess safety risks from collisions and disease transmission. Long-term monitoring of deer numbers is critical in evaluating any population control measures a park may implement.

Objectives

The primary objectives for monitoring white-tailed deer populations at Arkansas Post National Memorial, Arkansas are:

- Determine annual changes in white-tailed deer numbers.
  Justification. *Significant annual changes in deer numbers may signal the presence of illegal deer harvest, disease or other acute factors of concern for park management.*
- Determine long-term trends in white-tailed deer numbers.
  Justification. *Understanding decadal trends in deer number will help park management determine if measures need to be taken to maintain herd health, minimize vegetation damage within a park or damage to surrounding private properties.*

This report summarizes survey results for the fourth year of monitoring.

Methods

Study Area
Deer surveys were limited to the area visible at night with spotlights along 3.42 km of the main tour road of the memorial. This permanent sampling route was chosen from all existing roads and trails within the memorial, including service roads because it is easily traversed and passes through all major habitats found on the memorial. It is also important for long-term monitoring that the survey route is an all-weather route so that it will be passable shortly following inclement weather. Counting deer along this road corridor will yield an index of relative deer abundance, which correlates with the absolute abundance of deer on the memorial. Our index of relative deer abundance will allow detection of general increases or decreases in the actual population over time.

White-tailed Deer Survey Methods
Sampling was limited to winter months, before spring vegetation emerged (January through mid March). Therefore, the target population includes all deer within the boundaries of the main unit of the memorial at the time surveys were conducted (although the sample frame was limited to the road corridor). These are the deer that most impact herd size and memorial resources throughout the following year.

Surveys were conducted from a survey vehicle moving no more then 16 km / hr, using two 1,000,000 candlepower spotlights. All deer seen along the survey route were counted and their location recorded using GPS. Deer observations were made by two observers seated on the left and on the right side of the vehicle. Distances from the stopped survey vehicle to all deer were determined by a rangefinder or, for deer < 10 m from the vehicle, by visual estimates. Deer were usually observed in groups, in which case distance was taken or estimated to the center most deer in the group. In order to map locations of deer, the direction and angle of all deer or deer groups from the survey vehicle were recorded as well.

Survey nights were January 7th, 14th, 28th and February 4th. Initially, six survey nights were scheduled but due to inclement weather, two survey nights were cancelled (Jan. 21 and Feb. 11). Three spotlight counts were conducted each night. The first survey of each night started approximately one hour after official sunset with succeeding surveys occurring each hour thereafter.

Visibility Estimates
At every 10th mile along the survey route we recorded perpendicular distances from the survey vehicle to the point beyond which deer would not be visible. The perpendicular measures were marked using GPS. Following methods outlined in Peitz et al. (2007), visibility estimates were taken once following deer surveys on January 7. In a GIS, perpendicular distances were plotted on a map, along with any outlying deer locations (deer observed outside the estimated distance), to create a map of the survey area.

Data Analysis
Using nightly maximum count data and the survey area determined from visibility estimates (Figure 1), indexes of relative deer densities were calculated. Nightly results were used to

estimate the average ($\pm$SD) annual deer population density index. The percent change in the annual index value was calculated and reported.

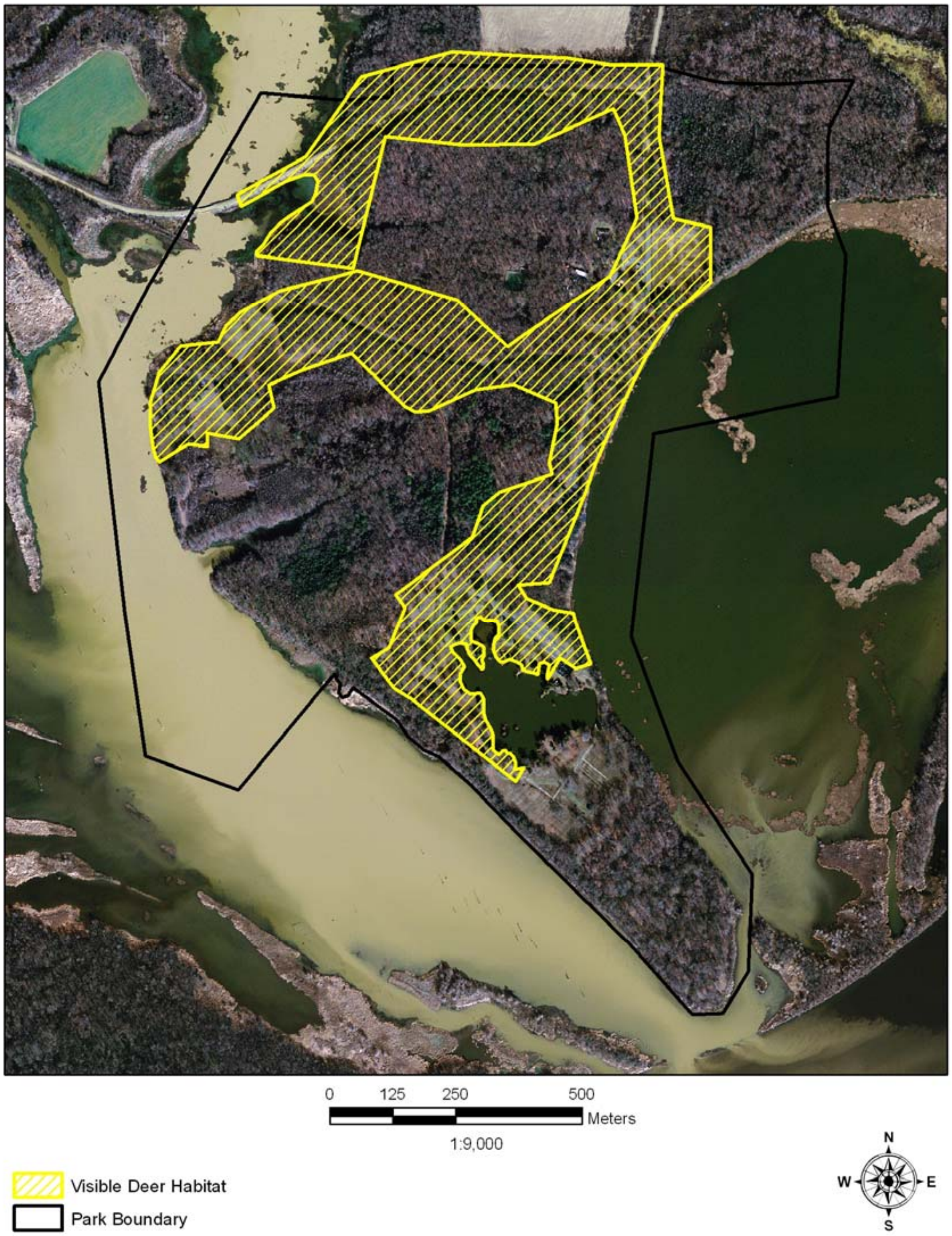

Figure 1. Route showing the area visible during white-tailed deer surveys on Arkansas Post National Memorial, Arkansas during 2008 survey.

Results

The index of relative white-tailed deer density averaged 72.48 (std. dev. ± 18.11) individuals / km^2 for the survey area of Arkansas Post National Memorial in 2008 (Figure 2). Values ranged from 47.29 to 90.47 individuals / km^2. This represents a significant increase in the mean index value. During the survey nights, a high of 37, 23, 37 and 44 deer were seen respectively. The area visible from the survey route increased 21.45 % to 48.63 ha (Figure 3), or 40.1 % of the park (Figure 3).

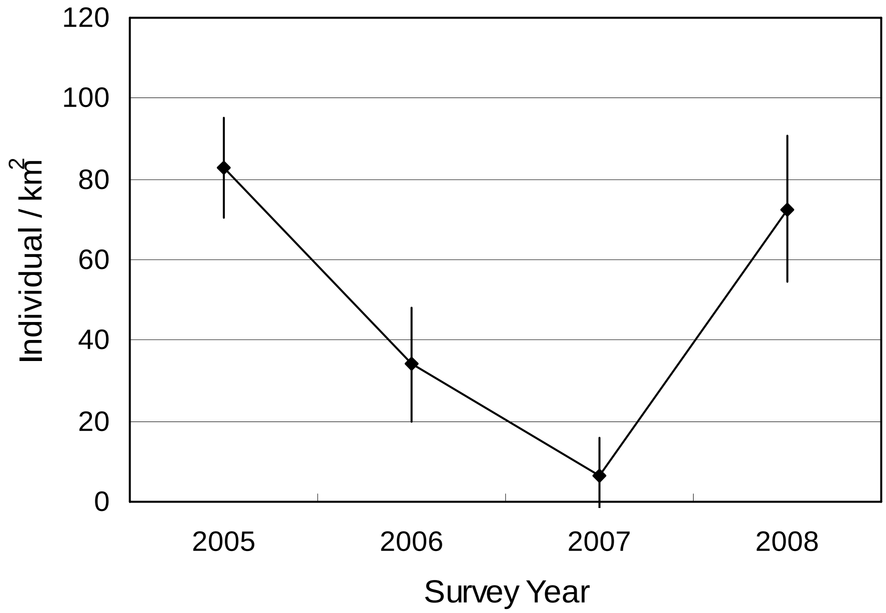

Figure 2. Average density index (± std. dev.) of white-tailed deer in the survey area of Arkansas Post National Memorial, Arkansas, 2005 – 2008.

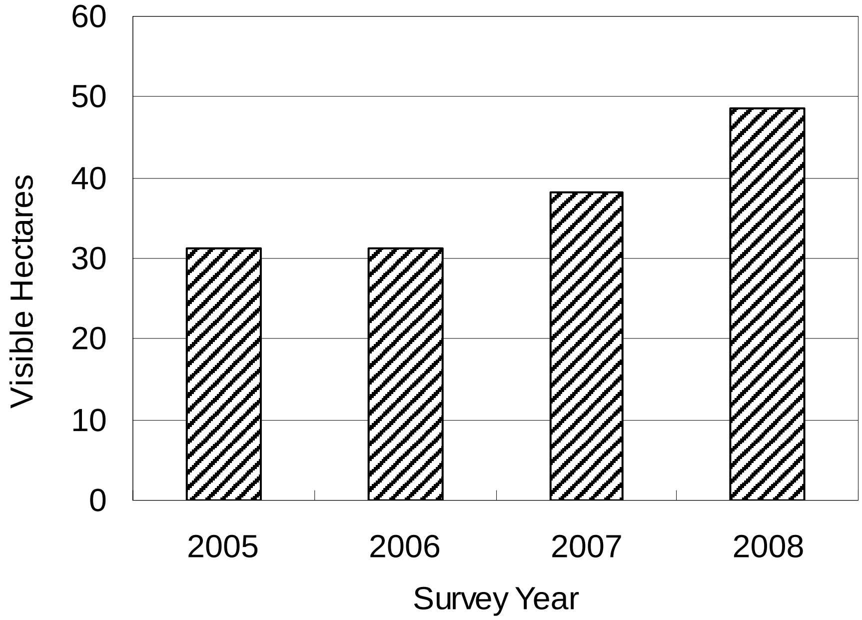

Figure 3. Area visible during white-tailed deer spotlight surveys (survey area) on Arkansas Post National Memorial, Arkansas, 2005 – 2008.

Discussion

The index of deer density for the survey area in 2008 has increased significantly compared to last year. After speaking with the local state biologist (Andy Vanhorn, Arkansas Game and Fish Commission) it was determined that the use of deer feeders north of the park has ended. Deer densities at Arkansas Post National Memorial are most likely increasing due to the change in hunting practices or pressures outside of the park boundary. Due to the significant increase of deer observed it is suspected that deer are no longer moving off the preserve in the direction of deer feeders during the evening period. Also, with the lack of hunting pressure, more does survive to produce young. Given the lack of hunting pressure, it appears the deer population on the park is increasing and returning to levels observed when monitoring began.

The area visible during deer survey counts continue to increase. Removal of brush along park roadways has increased visibility by 21.45 % this year allowing 40.1 % of the main unit's terrestrial area to be surveyed. Visibility in the woodland region of the park has increased the most. As visibility increases, more of the park can be surveyed, improving the precision of our spotlight counts.

Climatic conditions during 2007 varied from the 30 year average. The average yearly precipitation for 2007 was significantly less than the 30 year average, 29.3 cm lower. This was the third consecutive year that precipitation was less than the 30 year average. Even though precipitation was reduced compared to the 30 year average, forage production was not substantially impacted. High and low average temperatures for 2007 were slightly elevated. However, these variations were minute (0.47º C for average daily temperature) compared to the 30 year average. (http://ag3.agebb.missouri.edu/npsdata/, 2008)

White-tailed deer are extremely adaptable to human disturbance, which has aided the species in recovering from near extirpation in Arkansas to today's herd, which exceeds 1,000,000 individuals during most years. As far back as 1988, deer densities were already averaging over 12 individuals / km^2 in the southeastern part of the state (http://www.uga.edu/scwds/, 2006). Today, higher deer densities in areas of suitable habitat or in areas where populations grow without the pressures of predators and hunting are expected.

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The NPS has organized its parks with significant natural resources into 32 networks linked by geography and shared natural resource characteristics. HTLN is composed of 15 National Park Service (NPS) units in eight Midwestern states. These parks contain a wide variety of natural and cultural resources including sites focused on commemorating civil war battlefields, Native American heritage, westward expansion, and our U.S. Presidents. The Network is charged with creating inventories of its species and natural features as well as monitoring trends and issues in order to make sound management decisions. Critical inventories help park managers understand the natural resources in their care while monitoring programs help them understand meaningful change in natural systems and to respond accordingly. The Heartland Network helps to link natural and cultural resources by protecting the habitat of our history.

The I&M program bridges the gap between science and management with a third of its efforts aimed at making information accessible. Each network of parks, such as Heartland, has its own multi-disciplinary team of scientists, support personnel, and seasonal field technicians whose system of online databases and reports make information and research results available to all. Greater efficiency is achieved through shared staff and funding as these core groups of professionals augment work done by individual park staff. Through this type of integration and partnership, network parks are able to accomplish more than a single park could on its own.

The mission of the Heartland Network is to collaboratively develop and conduct scientifically credible inventories and long-term monitoring of park "vital signs" and to distribute this information for use by park staff, partners, and the public, thus enhancing understanding which leads to sound decision making in the preservation of natural resources and cultural history held in trust by the National Park Service.

www.nature.nps.gov/im/units/htln/

Heartland Network

Natural Resource Monitoring

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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