

2011

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Recommended Citation

Deffendall, R.; Storie, A.; Weimer, J.; and Belin, C. W. (2011) "Whitetail Deer Carrying Capacity at a Georgia Barrier Island," *Georgia Journal of Science*, Vol. 69, No. 2, Article 5.

Available at: <https://digitalcommons.gaacademy.org/gjs/vol69/iss2/5>

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WHITETAIL DEER CARRYING CAPACITY AT A GEORGIA BARRIER ISLAND

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ABSTRACT

Whitetail deer (*Odocoileus virginianus*) populations of several islands along the Georgia coast have appeared to be in declining health for the past 10 years. Several explanations for this phenomenon have been proposed; however, several researchers have alluded to the over-population of the species. We calculated the carrying capacity of the Skidaway Island State Park (SISP), a portion of Skidaway Island located near the coastal City of Savannah. By determining the amount of biomass produced by several habitats located within the park, and knowing the hectares of these habitats, the total amount of biomass was calculated. Using the caloric requirements of the whitetail deer found at various regions of the continental United States, we determined the sustainable carrying capacity of a healthy deer population within the park. We calculated that approximately 11.5 deer can be annually sustained on the vegetative biomass produced by the Skidaway Island State Park (SISP).

Key Words: whitetail deer, carrying capacity, barrier islands, Georgia, southeastern US, *Odocoileus virginianus*

INTRODUCTION

The population of whitetail deer on Skidaway Island has increased over the past several decades since the initial development of the island in 1973 (1, pers comm.). Prior to that year, sustainable populations of deer were maintained due to the presence of predators. Now, with the development of a large, up-scale community on the island, as well as a reduction in the number of predators, the population of whitetail deer has increased remarkably as shown by annual censuses conducted by the Georgia Department of Natural Resources (1, pers comm.). The deer are found throughout the island, especially in SISP.

Many studies have been conducted to determine the carrying capacity of a particular area for the whitetail deer (2). These include studies by Campbell and Cassidy (3) as well as Harlow (2). In all cases these carrying capacities

have pertained to populations of whitetail deer that are found further north than coastal Georgia.

Several techniques have been used for determining the carrying capacity for this species. This study used a technique of harvesting plant biomass on a quarterly basis from a selection of stations while excluding the primary herbivore, deer.

Caloric requirements for the whitetail deer have been determined by information supplied by not only the Georgia Department of Natural Resources, Fish and Game Division (1, pers comm.) but also The Landing Association (4, 5, 6, 7), a private interest group located on Skidaway Island.

The populations of *Odocoileus virginianus* found on Georgia barrier islands are far smaller in stature than those found in other more northern states. Typical adult individuals weigh approximately 36 kg (80 lbs.) for females and 51 kg (112 lbs.) for males.

This study was designed to determine the carrying capacity of deer habitat on Skidaway Island.

METHODS AND MATERIALS

In an effort to manage the deer herd for optimal health, inquiries were made of the environmental personnel on the island for the current number of deer per hectare. In addition, several internet inquiries were made to determine the carrying capacity of whitetail deer in the southeastern United States in general and, more specifically, for Georgia coastal barrier islands. No data could be found for the whitetail deer carrying capacity for the Georgia barrier islands.

The carrying capacity of many species was determined using various techniques in the past. Several have been summarized by Odum (8); in particular, Harlow (2) evaluated these techniques and showed that a method in which vegetation of known sites are clipped as described by Campbell and Cassidy (3) allows for a flexible mechanism for estimating the carrying capacity. This mechanism was used in this study and measures the primary productivity of an area over time (2). By restricting the herbivores from a defined area, the amount of biomass produced by that area correlates to the number of species and individuals that would normally be consuming the biomass.

A 3-year study was initiated in the autumn of 2007, to determine the carrying capacity for SISP. Using exclosures to discourage deer from foraging within the boundaries, the annual biomass of enclosed vegetation was calculated. These exclosures were strategically placed to represent the habitats most frequented by the deer. Initially a total of 15 stations with exclosures were located throughout the three habitat types (5 exclosures at each major habitat type). The biomass was harvested at specific intervals and presented as a mean for each habitat type.

Site selection was made in conjunction with SISP park personnel. The sites were selected based on a number of criteria, including the ease of monitor-

ing, availability of vegetative species preferred by the deer, seclusion from all but the most curious park visitors, and representation of island habitat types.

Station #1 was chosen because it is situated in a high-traffic area for pedestrians, near the main gate of SISP. It was an oak forest area. Station #2 was located in an area generally restricted from access by the general public and park visitors. It was located near a tidal creek away from normal human traffic patterns and was characterized with various grasses and a wax myrtle shrub overstory. Station #3 was placed in a wooded portion of the park, and was considered a moderate traffic area for pedestrians. It was vegetated with an oak overstory and several shrubs including wax myrtle.

The three sites are representative of the three major habitat types found on the park as depicted by satellite imagery provided by the US Army Corps of Engineers, Savannah District (9) and described by Cowardin *et al.* (10). The three primary habitats surveyed included edaphic oak forest community, mixed oak – pine forest community and an ecotone habitat including grasses and shrubs between the salt marsh and the upland mixed forest.

At each of the three sites, exclosures were erected, enclosing 1.8 m² of vegetation and eliminating browsing by herbivores. Large plastic latticed dog fence exclosures, approximately 1 meter tall, were used which were anchored into the substrate using 20 cm long staples. The protective fence allowed for accurate data collection of the plant materials involved in the trials (4).

Following site selection, the areas were raked clean of debris and the vegetation was removed to 2 cm above the ground level, taking care not to pull up the roots of vegetation during the process. After the initial visit, the three sites were monitored for growth on a monthly basis to ensure that the exclosures were functioning properly and were not being adversely impacted by humans.

The vegetation from each of the exclosures was harvested quarterly and was transported to the laboratory in large paper bags and air dried for approximately 4 days. Individual weights of the bags were taken each day and, when there was no further drop in weight, the summed values at each station per year were then extrapolated for the amount of similar habitat found within the SISP. The number of hectares for each type of habitat was determined from analyses of satellite imagery established by the National Wetlands Inventory system developed by Cowardin *et al.* (9). Data were collected quarterly for 3 years. A value for the entire park was generated which represented the total amount of vegetation available to the whitetail deer.

RESULTS

The vegetation at the sampling stations that were selected at SISP represents 88% of the surface area of the park. Using 1.8 m² exclosures various locations were sampled for the three major habitats of the Skidaway Island Park; disturbed oak forest, mixed forest and marsh / grassed edge. The total available biomass for each habitat was found to be:

Oak forest	=	709.2 hectares
Mixed forest	=	467.2 hectares
Edge	=	186.2 hectares

As shown on Table I, at Station #1 a total of 83.9 g of biomass was produced within the enclosure per year. This equals a biomass of 46.6 g/m². With 709.8 hectares of similar habitat at the SISP, the scaled production is 9.77 x 10⁶ g/year. Similar calculations were completed for the production harvested at stations #2 and #3 yielding values of 6.5 x 10⁶ g/year for Station #2 and 1.2 x 10⁶ for Station #3.

Table I. Skidaway Island State Park Carrying Capacity for Whitetail Deer; 2008 - 2010.

	Station #1	Station #2	Station #3
Average Enclosure Annual Production (g)	83.9	249.9	124.8
Average Enclosure Annual Production (g)/m ²	46.6	138.8	69.3
Hectares of similar Habitat	709.2	467.2	186.2
Average Annual Habitat Type Production (g)	9776680	6484736	1290366
Approximate usable calories/g biomass	5.0	5.0	5.0
Total SISP g Production/year	1955336	12969472	3571752
Average WTD caloric need per year	1569500.0	1569500.0	2580732
# sustainable deer at SISP at habitat type	1.9	8.3	1.4
Summation of stations	11.5		

This production was then converted to approximate useable calories using the conversions of Goldman (12) in which 5 dietary calories can be recovered for each gram of biomass consumed by deer. Thus, the annual biomass production equates to approximately 1.9 deer for the habitat type at Station #1, 8.3 deer for the habitat found at Station #2, and 1.4 deer for the habitat type found at Station #3 or a total of 11.5 deer for SISP per year.

Thus, the carrying capacity of the Skidaway Island State Park is determined to be approximately 11.5 deer able to be sustained by the available biomass.

DISCUSSION

Many of Georgia's coastal islands have been severely impacted by humans resulting in impacts to the deer population. The deer have favorably acclimated to the presence of humans, but often this relationship results in significantly increased herds and the population becomes emaciated, and diseased.

Annual census counts (usually performed each November and April by the Georgia Department of Natural Resources) have estimated the number of deer on many of the coastal islands; however, no data exist for the coastal whitetail deer carrying capacity either within SISP, the entire Island or for other Georgia barrier islands.

The data in this study provide carrying capacity information for the park. Our efforts show that a carrying capacity of 11.4 deer can be supported by the biomass produced at the park per year. This equates to 0.008 deer per hectare.

While the herd is dynamic, the resources available to it are finite. Thus, as more individuals are born, the resources become divided further. This was evident between 8 and 12 years ago when the herd was visibly diseased, malnourished, and susceptible to parasites (4, 5, 6, 7). As a result, hunting throughout Skidaway Island had been banned.

Annual census data of Skidaway Island and SISP completed by personnel of the Georgia Department of Natural Resources (1, pers comm.) and the US Department of the Interior (11) revealed approximately 0.2 - 0.3 deer/hectare in 1990 - 1996. Since then, efforts have been made to reduce the population. However, an alternate, reasonable conclusion is that the current deer herd found at SISP is leaving the Park and seeking other food resources nearby. While the Park is fenced throughout its perimeter, gaps are periodically found. In addition, the deer have been reported swimming in the nearby creeks and streams (1, pers comm.) ostensibly to graze elsewhere.

Annual census data revealed the estimate of deer in the population, however, no data existed that showed the optimal carrying capacity of the park. Estimates from other parks within the Georgia Department of Natural Resources system have been alluded to; however, they also fail to reveal an optimal carrying capacity.

The historic populations of the Whitetail deer of 4-5 deer per hectare between 1950 and 1980 (11, pers comm.) have been reported via the annual census of the island and the data collected suggest that these numbers are far too high to be sustainable for more than a few years. Higher numbers of deer result in the grazing of less desirable plant species, the grazing of plants with less caloric content and a stressed herd.

Our data demonstrate that habitat found within the Skidaway Island State Park can support approximately 11.5 deer annually or 0.008 deer per hectare.

ACKNOWLEDGEMENTS

The authors wish to thank the following individuals for their guidance, recommendations, critical judgment and suggestions in the preparation of this article;

1. Mr. Jon Smith, 2008. Personal Communication, US Department of Agriculture, Animal Plant Health Inspection Service, Animal Damage Control, USDA-APHIS-ADC, 600 Landings Way South, Savannah, GA 31411.
2. Ms. Holly Holdsworth, Park Manager, Skidaway Island State Park.

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