

Ungulate Surveys at Saguaro National Park: Past, Present, and Future

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January 2008

Prepared for:

Saguaro National Park
and
Western National Parks Association (Grant #06-06)

Deer and javelina are important to Saguaro National Park, not only to the functioning of its ecosystems, but because they are “charismatic megafauna” that people enjoy seeing. Maintaining populations of deer in particular has always been an important management issue in the park, as evidenced by the number of studies, surveys and reports on deer populations that have occurred at Saguaro in the past (Bucci 2007). Unfortunately, almost all previous attempts to estimate deer numbers and to determine the status of deer populations in the Park have been disjunct and qualitative. The result is that despite considerable effort throughout the years, we know little about the history and status of deer populations in the Park. It is difficult to know whether current concerns about declining mule deer populations in the Park are simply an artifact of recent drought conditions, or if the population, particularly in the Rincon Mountain District, is in danger of becoming locally extinct. Clearly, Saguaro National Park needs to implement systematic, long-term surveys that provide the information needed to effectively manage deer, if not to ensure mule deer remain a part of the park fauna! Such surveys will be most beneficial if they are comparable to the best survey efforts of the past.

The purpose of this WNPA funded project was to assist the Park in developing an effective long-term monitoring program for deer and other ungulates at the park. Major goals were to: conduct helicopter surveys in both districts of the park in 2006; evaluate changes in ungulate populations over time; review the literature and interview local experts on ungulate survey techniques; make specific recommendations for future long-term monitoring of game species in the Park; develop a Visitor Center display (subsequently changed to a Park “site bulletin” per discussions with the Rincon Mountain District Interpreter); and present a Powerpoint talk to educate Park staff and the public on this interesting management issue.

Deer Ecology

Mule deer (*Odocoileus hemionus*; Figure 1) and white-tailed deer (*Odocoileus virginianus*; Figure 2) are the only two species of deer occurring in the southwestern U.S.

(Hoffmeister 1962). Ten subspecies of mule deer are recognized throughout the species' range, which includes most of western North America down to southern Mexico (Anderson and Wallmos 1984). The subspecies occurring in southeastern Arizona is the desert mule deer (*Odocoileus hemionus eremicus*). White-tailed deer occur from southern Canada throughout most of the contiguous United States, except Utah, south to northern South America (Smith 1991). The Coues white-tailed deer (*Odocoileus virginianus couesi*) is the subspecies occurring in southeastern Arizona.

In the southwestern U.S., mule deer are found from 200' to 7,300' elevation, most being found below 4,500' (Heffelfinger 2006). They inhabit a number of vegetation associations, including palo verde (*Cercidium spp.*)-saguaro (*Carnegiea gigantea*) desert communities, grasslands, pinyon (*Pinus spp.*)-juniper (*Juniperus spp.*) woodlands, dense chapparral, and oak (*Quercus spp.*) woodlands in southern Arizona (Heffelfinger 2006). Mesquite (*Prosopis spp.*) bordered washes are important for forage and cover in the Sonoran desert (Heffelfinger 2006). White-tailed deer are usually found above 4,000' elevation in the southwest (Heffelfinger 2006). They mainly inhabit woodland communities but can be found in desertscrub, and ponderosa pine (*Pinus ponderosa*) and deciduous forests (Hoffmeister 1986).

Mule deer and white-tailed deer have similar diets in areas where they coexist (Anthony and Smith 1977, Heffelfinger 2006), so at lower elevations where mule deer and white-tailed deer overlap, there may be competition between the species for forage, especially when resources are scarce (Anthony and Smith 1977). Both species depend heavily on browse (i.e., woody plants and shrubs) throughout much of the year; but after seasonal rains, forbs (i.e., broad-leaved weeds) make up an important component of the diet of both species (Heffelfinger 2006). Since rainfall affects the amount and quality of forage available, it can be an important influence on deer populations.

Basic information on the natural history of deer at Saguaro National Park is provided in the form of a site bulletin that includes a guide to distinguishing these two species.

Deer Survey Techniques

Deer populations are usually measured as density (i.e., deer/sq. mile). In the southwest, deer densities do not usually exceed 15 deer per square mile; however, deer densities, as well as home range, can fluctuate due to resource availability, time of year, and age and sex of animals (Heffelfinger 2006). Males tend to have larger home ranges than females, which tend to travel in groups; and home ranges are generally larger in areas that are less productive, such as southwestern deserts (Heffelfinger 2006).

Estimating deer density can be prohibitive because of the time and expense involved, and is usually done only on a small scale (Heffelfinger 2006). Indices of abundance (number of deer/unit effort) using standardized methods over time can be performed more frequently and cost less than calculating density. The advantages and disadvantages of various survey techniques for deer are evaluated in many papers (Aldous 1956, Eberhardt and Van Etten 1956, Progulske and Duerre 1964, Van Etten and Bennett 1965, Lewis 1970, Mooty et al. 1984, DeYoung 1985, Pollock and Kendall 1987). Ultimately, the best technique is determined by the information managers think is most important. Regardless of survey type, it is important for observers to be able to accurately distinguish between mule and white-tailed deer.

Foot or horseback surveys are conducted on predetermined routes in deer habitat using binoculars or spotting scopes to record the number of deer observed. On the ground researchers are better able to count and classify all animals, as well assess field conditions (i.e., forage, water availability, deer sign, and behavior). *Driving surveys* are conducted along roadways in a similar manner to walking/horseback surveys. Density can potentially be estimated with line transects using spotlights during driving surveys at night. The disadvantage to both walking/horseback and driving surveys is that they are very time intensive. *Aerial surveys* (i.e., helicopter and fixed-wing aircraft) have the advantage of being able to cover large areas in a relatively short amount of time and are particular good in rough terrain. However, they can be dangerous, expensive, and make deer classification difficult. In addition, low-flying aircraft may be controversial or even

prohibited over Wilderness areas, such as Saguaro National Park. *Pellet plots* are a relatively inexpensive method for determining deer abundance but because of the variability in defecation rates for deer and the inability to distinguish pellets from different individuals, they may not yield accurate indices. *Remote camera set-ups* can give good information on deer presence and distribution, but not overall abundance. *Harvest data* (statistics on age, sex, health, etc.) are very important in the management of deer populations, but only in areas open to hunting.

Deer at Saguaro National Park

Park managers have been concerned that the number of mule deer at Saguaro National Park may be declining, and are interested in understanding the relationship of mule and white-tailed deer in the lower elevations of the Rincon Mountain District (RMD). A major goal of this WNPA funded study was to assess past survey efforts in the park, as well as the status of deer, and recommend future monitoring techniques. To this end we conducted an extensive search of Saguaro records in the NPS Western Archeological Conservation Center archives for recent and historic data, and anecdotal information about deer and javelina in the park (summarized in Bucci 2007). We located and assessed four studies conducted in the RMD (Sumner 1951, Day 1977, Duncan 1986, Bellantoni 1991, and Bellantoni and Krausman 1991), three studies in the Tucson Mountain District (TMD; Clark 1953, Elder 1953 and Kline et al. 1998), and various in-house reports, memos, and interviews with park staff. Bucci (2007) also compiled results from helicopter surveys that park staff had flown in conjunction with the Arizona Game and Fish Department (AGFD) in both districts of the Park (1989, 2000 to 2006; Table 1; Figure 3).

The results of this work substantiated the Park's continued interest in deer, but confirmed the lack of any consistent monitoring strategy. Thus, although data from helicopter surveys in the past 20 years (Table 1) indicate a fairly dramatic downward trend for mule deer in the Rincon Mountain District of the Park, it is difficult to make inferences about long-term trends for deer overall. However, we were able to relocate data from a 15-year study of deer and javelina (Figure 4) conducted in the Park's Rincon Mountain District (Day 1977), and to interview the

Principle Investigator, Dr Gerald Day. Day enabled us to map his survey routes, and gave us essential input on surveys techniques so they could be repeated in the future.

Based on all of these data, Bucci (2007) made the following recommendations for future long-term monitoring of deer at Saguaro National Park:

1) Continue helicopter surveys with/per AGFD personnel/protocols, in a manner that is cost effective for the park (e.g., if annual surveys in both districts are not feasible, alternate annual surveys at RMD and TMD, or extend the time period between surveys to every two to three years/district, etc.). These surveys have provided useful trend data on deer populations and their distributions in the Park, and they allow for some comparison to deer populations outside the Park (Game Management Unit 33).

2) In addition to the helicopter surveys, repeat past ground (walking) surveys for ungulates (NPS files, Day 1977) to the best of the park's ability. Reestablishing Day's routes would make his 15 years of data comparable to future data, and would be particularly important for mule deer.

These methods, especially when used together, will provide trend data on number, distribution, and relative abundance of both species of deer in the Park, thereby addressing our most salient issues. As there is some question as to the effectiveness of surveying mule deer by helicopter (Heffelfinger 2006), using both survey methods could help clarify the status of their populations in the park. Given the concern that mule deer populations are on the decline, it would be prudent to rule out a survey bias before making conclusions about the overall status of the population. The ground surveys will also provide a useful index against the helicopter surveys in general.

In 2008, Saguaro National Park began implementation of Recommendation 2, above. Based on data and recommendations from this study we are in the process of re-locating and mapping Day's (1977) routes (Figure 5), and establishing written protocols so that these surveys can be repeated annually.

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Table 1. Number of mule deer (*Odocoileus hemionus*) counted during helicopter surveys in 1989 and from 2000 to 2006 in the Rincon Mountain District of Saguaro National Park.

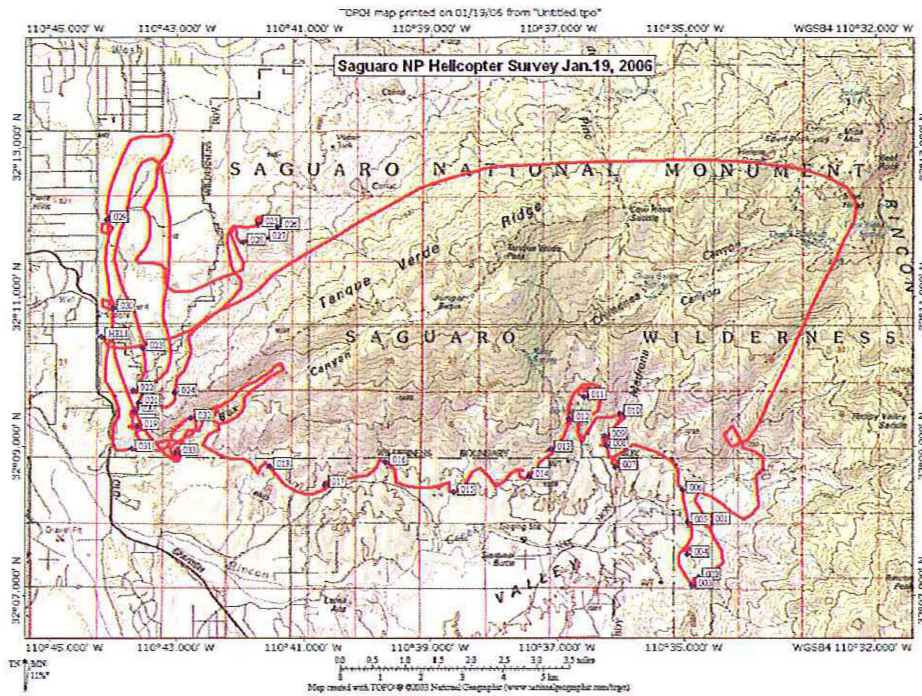
Date	Bucks	Does	Fawns	Unknown	Total	Buck:Doe
6 February 1989	20	48	26	0	94	0.42
26 January 2000	0	0	0	0	0	
6 January 2001	1	2	0	0	3	0.50
5 January 2002	2	5	5	0	12	0.40
4 January 2003	0	6	0	0	6	0.00
4 January 2004	3	3	1	0	7	1.00
20 January 2005	1	1	0	0	2	1.00
19 January 2006	4	6	0	0	10	0.67



Figure 1. Desert mule deer (buck) photographed by an infrared-triggered camera at Dobe Catchment in the Tucson Mountain District of Saguaro National Park on October 11, 2007.



Figure 2. White-tailed deer (doe) photographed by an infrared-triggered camera at the Rincon Mountain District Visitor Center in Saguaro National Park on May 20, 2007.



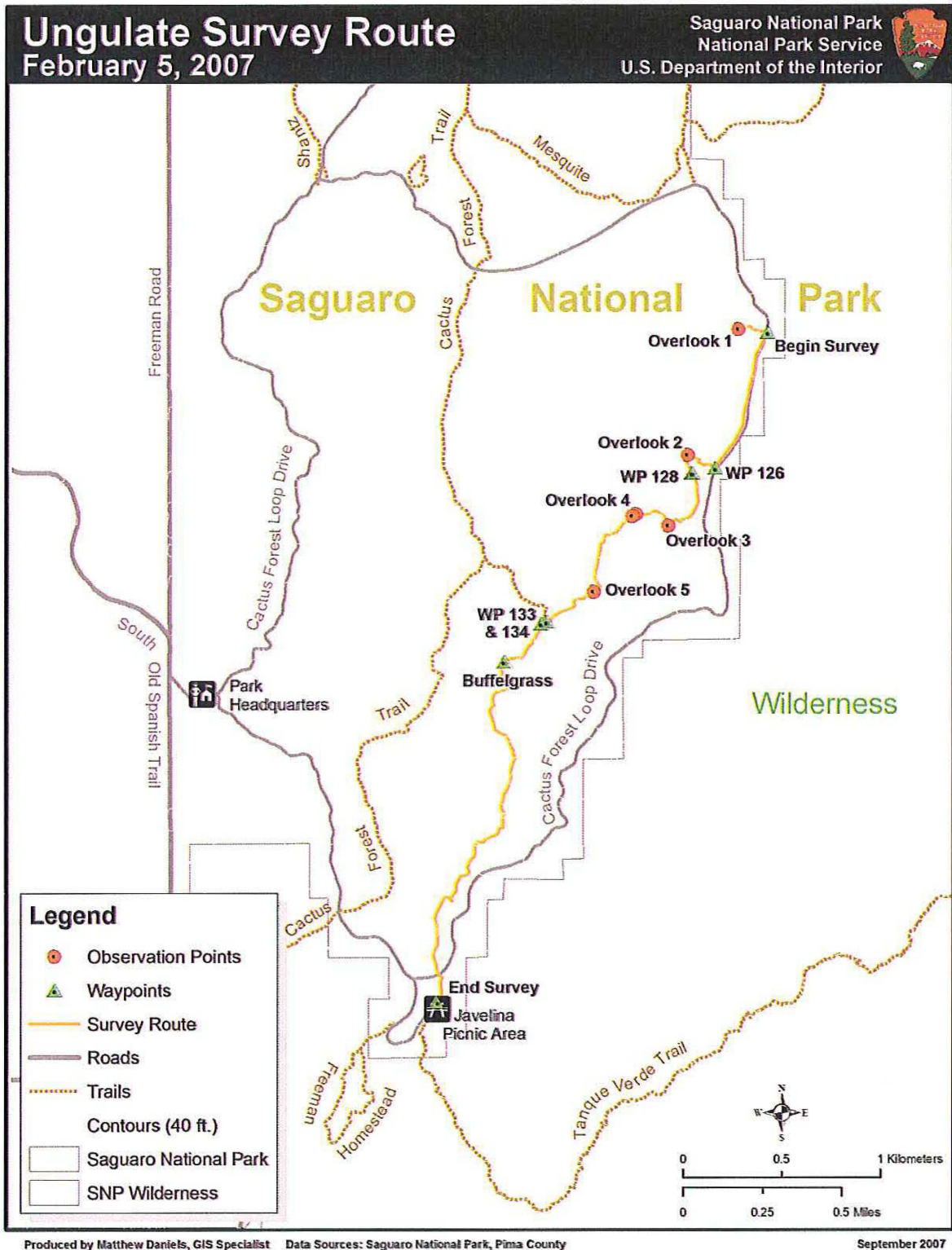


Figure 5. Map of survey route and overlook points for deer Survey Route #2 in the Rincon Mountain District of Saguaro National Park, based on Day (1977).