

OBSERVATIONS OF A WHITE-TAILED DEER DIE-OFF IN THE GREAT SMOKY MOUNTAINS NATIONAL PARK¹

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ABSTRACT

Nightlight counts and daytime observations were utilized in the Great Smoky Mountains National Park to measure the effects of hemorrhagic disease on a high density white-tailed deer (*Odocoileus virginianus*) population. Deer utilization of 1,846 acres of pasture in the Cades Cove area appeared to be greatest during February, 1971. Following the availability of spring browse, the number of deer utilizing the pastures stabilized at approximately one deer per ten acres until the die-off. During the period of mortality (August through October) utilization of pastures by deer decreased by 84 percent. This decrease in utilization closely corresponds with percent mortality observed under experimental infection with the epizootic hemorrhagic disease virus in deer. Utilization of pastures nine, twelve and twenty-four months post-dieoff was similar to pre-dieoff use. The above and other data indicate that the disease was probably restricted to the Cades Cove area, that vacant niches were filled by animals from peripheral areas and that decreased utilization of pastures during the die-off was due to mortality caused by a hemorrhagic disease. A total of eleven cattle were reported to have died prior to and during the deer die-off period and exhibited gross lesions similar to those of the deer. The possibility of resistance by cattle to the disease and interspecific transmission of the disease are cited.

INTRODUCTION

Seldom does the opportunity arise to accurately document the effects of an infectious disease on the density of a wild animal population. During the period August through October, 1971 a die-off of major proportions of a white-tailed deer (*Odocoileus virginianus*) population occurred within the Cades Cove area of the Great Smoky Mountains National Park in Tennessee. This paper does not elaborate on the etiology of the hemorrhagic disease complex causing the die-off but attempts to document the effects of this disease on a protected, high-density white-tailed deer population under ideal observational conditions.

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AREA DESCRIPTION AND MANAGEMENT HISTORY

The Cades Cove area is a four square mile area of the Great Smoky Mountains National Park in Blount County, Tennessee. It can best be described as a gently rolling, pastoral setting isolated by high mountains.

Cades Cove, unlike other portions of the Park, is managed as an historical site. For this reason, some cultural practices, not found within the remainder of the Park, are practiced in order to perpetuate aspects of early pioneer life. Within the area, there are 2,413 acres devoted to this type of management.

Land management is carried out by three permittee operations under the supervision of the National Park Service. Of the 2,413 acres under management 1,846 acres (76.5 percent) are devoted to pasture and hay. Small woodlots comprise the remaining 576 (23.5 percent). Habitat management consists of mowing, periodic plowing, fertilization, and seeding of the pastured areas; no row cropping is undertaken. Approximately 1,300 domestic animals, mainly cattle, and a few horses are allowed to graze throughout the year. Some sheep are allowed to graze during the summer months.

There are fifteen miles of roads on the area. A major portion of these roads are devoted to a one way, paved, motor nature trail of eleven miles where Park visitors may visit historic sites and observe wildlife. These roads are open to traffic during the daylight hours only. Gates are locked at sundown and all visitors excluded.

The National Park Service provides total protection for deer and other wildlife species. Only natural mortality and occasional poaching account for deer herd reduction. Due to the protected nature of the deer herd's environment, animals within the Cades Cove area assume an almost semi-tame nature and can be observed by Park visitors at unusually close ranges - compared to deer outside the protected area of the Park.

Past observations by Park service personnel indicated an increasing population of deer within the Cove. In a 1969 report to the resource manager of the Park (Anon. 1969), the district ranger in Cades Cove expressed concern for the increasing population and urged research and/or possible initiation of control measures. Control measures consist of removal by live-trapping in event of overpopulation, and direct reduction as a last resort (Anon. 1969). No control was practiced prior to or during this study.

PROCEDURES

Surveys of the deer population of Cades Cove were begun in late February, 1971 and continued through September, 1973. By following the road system within the area, practically all fields could be sampled. A light capable of distinguishing deer up to 500 feet was utilized. This visibility range was used in calculation of acreages surveyed. All counts were deleted when factors such as rain or fog affected visibility. Surveys were comparable to a simplified strip census since deer apparently did not react adversely to the presence of lights or vehicles. Emphasis is placed on the fact that population densities expressed in this paper reflect only those deer utilizing pastures and not wooded areas of Cades Cove. However, few deer were observed at night utilizing the open and heavily grazed and browsed patches of woods.

Surveys were conducted on a minimum of two occasions each month. Road sections were surveyed only once during each census. Repetition of surveys following the initial nights' counts revealed little variance in the number of deer observed and the location. Size of groups of deer could usually be predicted on repeat counts of the same area during any given nightly count.

Detailed records of deer observations were also maintained during an average of 15 to 20 days each month within the Cades Cove area.

RESULTS AND DISCUSSION

At the first of this study, it became apparent that a high number of deer were present in Cades Cove. Browse lines were evident. Deer were observed rearing on their hind legs to reach vegetation above established browse lines.

The first count in February, 1971 revealed one deer per 2.65 acres utilizing the pastured environment (Table 1). High numbers of deer observed in the pastures at the beginning of the study are attributed to a lack of available food within the surrounding mountains. Sparrowe and Springer (1970) and Heezen and Tester (1967) noted a definite restriction of the range of white-tailed deer during the late winter and early spring months. With the advent of spring thaw, there was general dispersal from these areas of concentration. Utilization of pastures apparently dropped from 723 to 196 animals during the period between late February and mid April, 1971. Following the decline in pasture utilization, the number of deer within the study area appeared to stabilize at approximately one deer per 10 acres of pasture (Table 1).

Table 1. Population estimates for the Cades Cove deer herd utilizing pastures during the period February, 1971 through September, 1973.

Month	Acreage Surveyed	Number of Deer Observed	Deer/acre	Acres/deer	Total Deer Utilizing Pastures
1971					
February	756.28	285	0.377	2.65	723
March					
April	756.28	116	0.154	6.49	296
May	1110.81	163	0.147	6.80	282
June	1828.02	165	0.090	11.11	173
July	756.28	96	0.111	9.01	213
August	1347.34	162	0.120	8.33	230
September	1163.57	42	0.036	27.77	69
October	1158.98	22	0.019	52.63	36
November	1142.88	20	0.017	58.82	33
December	2536.61	64	0.025	40.00	48
1972					
January	1050.40	32	0.030	33.33	58
February	2219.84	165	0.074	13.51	142
March	756.28	81	0.107	9.35	205
April ^a					
May	2268.84	87	0.038	26.32	73
June	1512.56	62	0.041	24.39	79
July	756.28	53	0.070	14.29	134
August	1512.56	113	0.075	13.33	144
September	756.28	88	0.116	8.62	223
1973					
August and September	2156.04	176	0.081	12.27	152

The first deer were found dead or dying during the last week of August, 1971. During this period, it became apparent that a disease of major proportions was affecting the deer of the area. Personnel from the Southeastern Cooperative

Wildlife Disease Study, College of Veterinary Medicine, The University of Georgia, Athens, arrived in Cades Cove on September 1, 1971. Several animals were necropsied. The tentative diagnosis was epizootic hemorrhagic disease (EHD) but it was not confirmed by virus isolation. Known incidences of deer dying continued until late October, 1971.

Eleven cattle died immediately prior to, and during the initial outbreak of this disease. It is uncertain whether the death of these cattle were related to the die-off of deer. However, gross lesions in cattle were similar to those observed in deer. Abnormally high cattle mortality during the die-off period may indicate the possibility of some interspecific transmission of the disease. The fact that only eleven of the cattle died during the die-off suggests that cattle were more resistant to the disease than were deer.

During October 1971, following the apparent peak of the die-off, many vultures were observed within the area. Black vultures (*Coragyps atratus*), a rare species in the Park (Stupka 1963), were seen in almost equal numbers to the turkey vulture (*Cathartes aura*). From one location during October, a total of 158 scavengers were observed circling in various locations throughout the Cove. The odor of decaying carcasses was evident during the day with an almost constant odor being present during night counts.

Fifty-two deer were found dead during the die-off. Fifty of these fifty-two were found within the area covered by census surveys. Although 15 to 20 days were spent each month walking and driving outside Cades Cove proper, only two deer were found dead and these were only three miles away in a drainage leading into Cades Cove. There are at least two major factors which may have influenced the above phenomenon. First, all surrounding drainages lead directly into this area. In this case, the effects of topography may have influenced sick and dying deer to wander into the area before dying. Second, this area is heavily utilized by visitors who reported many of the deer found. A concerted effort was not made to locate dead or dying animals away from the road system within the Cove.

Decreases in pasture utilization during the die-off period indicated that many more deer died than were found. Percent decrease in pasture utilization based on population estimates from the last survey in August, 1971, to the last known mortality (late October 1971) was 84 percent. Two surveys were conducted each month during August, September, and October. Acreages surveyed differed very little in each survey. Deer actually observed during this period dropped from 162 animals during the pre-dieoff period to 22 animals at the apparent conclusion of the die-off, a decrease in actual number of deer observed of 86 percent. Experimental infections with EHD have been found to result in greater than 90 percent mortality (Fay et al. 1956, Shope et al. 1960, Karstad et al. 1961).

The number of deer utilizing pastures 9 months post-dieoff were similar to pre-dieoff estimates. The above data imply that the disease was probably restricted to the Cades Cove area and that vacant niches were filled by animals from peripheral areas (lack of finding dead or dying deer in areas surrounding the Cove support these data).

The question arises as to whether some other factors may have caused a decreased utilization of pastures during the period of the die-off. However, the number of deer utilizing pastures 12 and 24 months post-dieoff (August and September of 1972 and 1973) were also similar to pre-dieoff estimates.

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ABNORMALITIES OF MANDIBLES AND OF LIMBS IN WHITE TAILED DEER FROM VIRGINIA¹

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Five white-tailed deer (*Odocoileus virginianus*) with abnormally short mandibles (Brachygnathia inferior, "Parrot-mouth") were recovered during 1972-1973 from the deer herds on the Radford Army Ammunition Plants (RAAP) at Dublin and Radford, Virginia. Three of those animals also had limb deformities. Several reports of mandibular abnormalities in white-tailed deer are available (see Free et al. *New York Fish Game J.* 19(1):32-46, 1972, for references). Brachygnathia inferior has been reported in domestic ruminants (cattle and sheep) and is considered to be a genetically inherited defect. Recently, Dunn and Johnson (*J. Dairy Sci* 55(4):524-526, 1972) have shown that an abnormal chromosome number in a calf was associated with brachygnathia inferior. Reports are not available associating limb deformities with brachygnathia. Should these two conditions be associated and should they be inherited defects such information is of interest as the prospects of dually afflicted animals for survival are probably slim. Descriptions of the abnormal animals recovered are given below:

No. 1. This male animal was captured by tranquilizer injection. Shortening of the mandibles was such that the incisors made contact with the back rather than the front of the dental pad. The entire pad was exposed (2 cm) when the animals mouth was closed. At capture this animal weighed 41 kg and was 3 years old. It looked emaciated and has persisted in such a condition in captivity. There were no apparent limb deformities.

No. 2. This male fawn was captured within a short period of birth. Mandibles were severely shortened and incisors did not reach the dental pad. The extent of shortening of the mandibles was such that the ability to suckle was probably drastically curtailed. Both front legs were deformed producing a pronounced bow-legged stance and difficulty of locomotion.

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