DEER RESPONSE TO A DRIVE CENSUS
DETERMINED BY RADIO TRACKING

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Censuses of animal populations are usually predicated upon a knowledge of the animal’s behavior. In many cases the assumptions underlying the census method have not been tested because data on behavior under natural conditions were not available. The technique of radio tracking provides an excellent opportunity for adding to our knowledge of animal behavior and for observing the natural responses of individual animals to census methods. This article reports on the use of the Cedar Creek automatic radio tracking system to monitor the responses of two radio-tagged white-tailed deer to a drive census conducted in January, 1964.

The site for this study was the Cedar Creek Natural History Area, a 4,500 acre tract administered by the University of Minnesota, about 30 miles north of Minneapolis. General characteristics of the area were discussed by Cochran, et al. (1). Both upland deciduous forest and a white cedar (Thuya occidentalis) bog were covered by the drive. Pierce (2) described these and other vegetational types in detail.

Methods

Three deer were captured in live traps on the study area in early January, 1964. Radio transmitters similar to those described by Tester, Cochran, and Warner (3) operating in the 53 megacycle range were placed on these animals prior to release. After release the movements of each were monitored continually by the automatic tracking system (1) which recorded on 16 mm film the locations of each animal every 45 seconds. These data were then analyzed and the movements plotted on large-scale habitat maps.

A drive census covering approximately 500 acres of upland forest and cedar bog was conducted on January 25. A total of 58 people participated in the drive, and 45 deer were observed in, or leaving, the census area. The movements of six drivers carrying radio transmitters were monitored by the automatic tracking system to determine the position of the line during the census. The movements of the two radio-tagged deer present in the cedar bog were also automatically monitored. These were both adult does whose movement patterns had been studied for several weeks prior to the drive.

Weather data were obtained from the weather station at the Cedar Creek Laboratory and from several nearby U.S. Weather Bureau Stations.

Deer No. 502 was a 3.5-year-old female captured on January 2, and Deer No. 503 a 2.5-year-old female trapped on January 3. Both were released at the capture site. Although data are available for each day since radio-tagging, this report is based only on movements from January 23 through January 27: 2 days before the drive and the day of the drive for both deer, 2 days following the drive for Deer No. 502, and 1 day following for Deer No. 503. Data for Drive Day +2 for Deer No. 503 are unsatisfactory because of improperly tuned receivers. The movement patterns of each deer are discussed separately.

Movements of Deer No. 502

Movements before drive. Movements of this deer during the 2 days preceding the drive were similar to those during other cold periods of midwinter,
when the animal frequented the cedar bog and immediately adjacent upland (Fig. 1). From 0935 to 1145 January 23, she apparently moved at random within the cedar bog. At 1145 she entered the adjacent fields and wooded uplands where she remained until 0245 January 24. Then she returned to the cedar bog and, except for two short trips to the upland, remained there until the drive started.

Deer drive. At 1400 January 25, the participants in the deer drive began taking their places around the census area and at 1435 the southward drive began. Dashed lines in Fig. 2 represent the line at various times during the drive.

At 1410 Deer No. 502 began to move slowly westward (Fig. 3) and at 1443 approached the drive line. She turned back, and was observed by several drivers who noted the radio collar. After encountering the drive line a second time, at 1446, she again turned back; she was not seen this time. At 1448 she ran the line and proceeded rapidly northward. Within 10 minutes she was nearly one mile away from the drive line. She slowed her flight at 1501 and began circling slowly toward the area which she had occupied the 2 preceding days.

Movements following drive. These movements are essentially similar to those for the 2 days preceding the drive. Her activity was confined primarily to the cedar bog, with short trips to the adjacent wooded upland and fields (Fig. 3).

Movements of Deer No. 503

Movements before drive. Two days before the drive, Deer No. 503 moved in an area approximately 1.0 mile long and 0.3 mile wide along the northern edge of the cedar bog and adjacent fields and wooded upland (Fig. 4). The next day she confined her movements to the eastern part of the bog with one trip to a wooded area across the highway to the south. Prior to the drive on January 25, her movements were confined to a very small area of the cedar bog.

Deer drive. When the drive started, at 1435, the deer was southeast of Cedar Bog Lake (Fig. 5). She was not moving, i.e., either resting or sleeping, during mid-day and was not "disturbed" by the sounds of the drive. As the line approached, she moved directly toward and through it, continuing north about

Fig. 1. Movements of Deer No. 502 from 0935 January 23 to 0930 January 24, 1964, at Cedar Creek Natural History Area, Minnesota. (Locations plotted at approximately 15-minute intervals in Figs. 1, 3, and 4; and approximately every minute in Figs. 2 and 5.) All times are expressed in terms of a 24-hour clock on Central Standard Time. Lines joining consecutive points show probable route traveled.

Fig. 2. Movements of Deer No. 502 from 1235 January 25 to 1002 January 26 and position of drive census line (dashed line) from 1435 to 1515 January 25, 1964, at Cedar Creek Natural History Area, Minnesota (see Fig. 1 legend for explanation).
Fig. 3. Movements of Deer No. 502 from 1020 January 26 to 1000 January 27, 1964, at Cedar Creek Natural History Area, Minnesota (see Fig. 1 legend for explanation).

Fig. 4. Movements of Deer No. 503 from 1014 January 23 to 0938 January 24, 1964, at Cedar Creek Natural History Area, Minnesota (see Fig. 1 legend for explanation).
0.3 mile, where she remained for the rest of the afternoon.

**Movements following drive.** Movement by Deer No. 503 on January 25 and 26 were similar to those during the 2 days before the drive. In general, she spent this period along the northern edge of the cedar bog and made occasional trips into the adjacent wooded upland (Fig. 5).

**Discussion of results**

Both does occupied essentially the same habitat and exhibited similar movement and activity patterns from the time of tagging in early January through the period covered by this report. Their daily range varied with weather conditions. Temperatures in the Cedar Creek area from January 23 through 27 varied from 30°F to -13°F. The sky was mostly clear and winds were moderate from the northwest. In mild weather the range of movements was considerably larger than during periods of extreme cold.

The sizes of the daily ranges of both deer were similar for the 5 days, except for the time of the drive. The largest area used by Deer No. 502 was approximately 0.8 by 0.5 miles or 0.4 mile². The largest daily range of Deer No. 503 was 1.0 by 0.3 miles, or 0.3 mile². Detailed analyses of the movements of these and other radio-tagged deer from January through April, 1964, will be reported separately. In general, these data indicate that the deer on the Cedar Creek Natural History Area concentrated in the cedar bog during cold weather and that they ranged several miles from the bog onto the upland fields and wooded areas during warm periods.

Little is known about the specific reaction of deer to disturbances such as a drive census. Hickie (4), in a popular account, gives a vivid description of deer behavior during a drive. He states, "At times deer appeared to bound from every clump of trees or bushy thicket while sometimes they seemed to spring magically from nowhere. Some of them ran ahead of the line while many were entirely confused and dashed back through the noisy driving line... At the finish... all the deer that had been moving ahead of the drive line broke cover by the dozens and streaked between the counters. . . ."

The behavior of Deer No. 502 during the drive appears to be similar to that described above. This doe approached the drive line twice and turned back each time. On the third attempt she ran between the drivers and then raced northward for nearly a mile before slowing. We believe that this extensive movement outside her normal range was caused by panic or fright due to the noise made by the drivers. This animal's radio was noticed by a driver as the deer approached the drive line. The driver shouted to the others, and the doe "spooked" away from the line.

Deer No. 503 was apparently "surprised" by the drivers and made a short dash through the line, probably with several other deer, and then stopped its flight, without moving outside of its normal range. Its radio was not noticed.

Both deer were within their regular ranges by late evening. The disturbing effects of the drive appear to have been very short-lived since we could not detect any difference in the range of movements or the activity patterns of the deer immediately following the census. Probably deer react similarly to hunting, and we hope that the radio-tracking system can be used to evaluate responses to hunting in the future.

**Bibliography**


