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# PRELIMINARY REPORT OF TELEMETRIC STUDY OF DEER MOVEMENTS AND BEHAVIOR ON THE EGLIN FIELD RESERVATION IN NORTHWESTERN FLORIDA

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## INTRODUCTION

A fundamental concept of ecology and animal behavior is that most species of animals have characteristic patterns of movement and activity. In general, it is to an animal's advantage in the evolutionary process of natural selection, to establish a movement pattern which is repetitious enough to provide familiarity with a particular unit of habitat. As a result, it is able to obtain the basic necessities of life such as food, water, and protection with efficiency and minimum energy expenditure.

Knowledge of home range and daily movement is extremely important for good deer herd management. One of the most commonly used deer population census methods in Florida is the track count technique developed by Tyson (1952). The reliability of this method is based on an accurate estimate of the daily movement of deer in the area in which the census is made. There has been doubt as to whether the estimate of one-mile daily movement, which Tyson originally proposed for the Eglin Field, can be generally applied to other areas. A negligible amount of information is presently available regarding the variability of deer movement in different habitats and under different conditions. It is suspected that such factors as climatic conditions, habitat type, deer population densities, and availability of food affect deer mobility.

The primary purpose of this study is to determine the diel[1] movements, activity cycles, and other behavioral aspects of a population of Florida coastal white-tailed deer *(Odocoileus virginianus osceola,* Bangs).[2] The present paper relates only to the summer season and to a "longleaf-pine/turkey-oak" habitat type, but subsequent study will consider other seasons of the year, as well as other habitats. Another objective is to develop a workable radio-tracking system, in as much as interdisciplinary research techniques such as this are felt to be essential for the continued rapid advancement of wildlife science.

## STUDY AREA AND DEER POPULATION

The Eglin Air Force Reservation is located in the panhandle of northwestern Florida and covers 461,117 acres in Santa Rosa, Okaloosa, and Walton Counties. The study was performed in Walton County in the general vicinity of Range 52. Due to military activities, this Range is normally closed to hunting with firearms and as a result is one of the areas most densely populated with deer. It is also equipped with an extensive road system and most locations can be approached within one-half mile or less by road. This, and a system of military observation towers, provided excellent conditions for the study.

### *Habitat*

According to Tyson (1955), most of the large expanses of forest have very light, well-drained soil in the Lakewood series. The U. S. Soil Conservation Service considers this type to be too poor for agriculture except where the climate is suitable for citrus fruits. Much of the area consists of remnants of ancient sand dunes which may be 150 feet deep in places. Elevation for the entire reservation ranges from sea level to 296 feet. The terrain on which actual deer-tracking was conducted is only slightly rolling and varies from about 60 to 110 feet above sea level.[1]

Vegetation around the cleared bombing range is principally of the Longleaf-pine/Turkey-oak Association or "sandhill vegetation type" described by Laessle (1942). As the name implies, the predominant overstory species are longleaf pine *(Pinus palustris*[2]*)* and turkey oak *(Quercus laevis).* Since the advent of fire protection, however, sand pine *(Pinus clausa)* has become increasingly common (Tyson, 1955). As a result, some of the habitat is now apparently in a stage of intergradation between the previously mentioned "sandhill" association and the "sandpine-scrub-oak" type also described by Laessle,*(op. cit.).* A few small, cool, spring-fed creeks meander through the tracking area. Following a narrow path along the edges of these streams are dense hydric plant associations comprised of such species as bigleaf gallberry *(Ilex coriacea),* black titi *(Cliftonia monophylla),* red maple *(Acer rubrum),* black gum *(Nyssa aquatica),* and sweet bay *(Magnolia virginiana).* Much of the actual tracking was done on Range 52 proper, a cleared area involving several square miles. The more recently cleared

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[1] Refers to the entire 24-hour period including a complete day and night.
[2] Scientific names of mammals from Miller and Kellogg, 1955.
[1] Elevation data taken from United States Geological Survey maps.

portions have a variety of herbaceous annuals and grasses. Older sections of the cleared range also have considerable quantities of turkey oak regeneration in the one-inch DBH size class.

It is recognized, of course, that deer movement patterns and other behavior may vary between locations and habitat types. Consideration must also be given to possible variation related to subspecific physical characteristics and population conditions. For this reason, a brief discussion of these aspects as related to the deer on the study area seems pertinent.

White-tailed deer on Eglin Field are classified as *Odocoileus virginianus osceola,* (Bangs). Kellogg (1956) describes this subspecies as "closely resembling typical *virginianus,* but averaging somewhat smaller; skull narrower; pelage shorter; color usually somewhat paler." When compared to most other deer herds in the southeastern United States, the Eglin deer are rather small. Legal bucks average about 100 pounds and stand approximately 34 inches high at the shoulder, while does average 65 pounds and 30 inches.

Like most herds in mild climates, the Eglin deer have a long period of time during which fawns are dropped. Fawning reaches a peak about September or October with most fawns being born sometime between June and December. The information reported in this paper was obtained prior to the main fawning period. One of the deer whose movements were monitored was pregnant when captured on June 24. At the time of writing this report, there were no indications that parturition had occurred.

The rutting season, as would be expected, begins in late December and continues into early April. Tyson (1955) states that deer have been seen mating as early as December 25 and as late as April 10. Rutting activity was not a factor directly affecting deer activities at this stage of the study.

While overpopulation is not a problem over most of the reservation, the unhunted area around Range 52 may be the exception. Physical examination of deer in this area indicated that some were emaciated and carried heavy loads of ectoparasites. Track counts on the range indicated a population density of approximately one deer per 12 acres.

## INSTRUMENTATION

The system used in this study provides a lightweight tracking capability with an operating range of 1.5 miles and a life expectancy of six months. The equipment operates in the frequency spectrum between 26 and 27 mc as authorized by the Federal Communications Commission. Directional data with an accuracy of plus or minus five degrees at one mile may be obtained by the use of a loop antenna. The transmitters can be located within 150 feet of their actual position when readings are taken at distances under one-half mile.

The transmitter has an input power of approximately 180 milliwatts and a duty cycle ratio of one to seven. It was attached to the top of a large dog harness and the complete package weighed 1.8 pounds. Two type 2n706 transistors were used in this unit. The first stage is a crystal-controlled, self-quenched oscillator, the second stage a buffer-power amplifier. Operating frequency is controlled in the first stage by a third-overtone crystal and tripling. The quenching frequency is approximately 100 pulses per minute. This pulse rate becomes slower as the batteries weaken and can be used as an indicator of battery condition (See Figure 1). Duration of the pulse is approximately 170 milliseconds. The antenna for the transmitter consists of a single-turn loop approximately 10 inches in diameter. The trans-

[2] Scientific names of plants in accordance with Small (1933).

mitter will operate on DC input voltage varing from 2 to 12 volts; however, the optimum input voltage is 9 volts. Four mercury cell 4.2 volt batteries provide the power supply. The transmitter in good operat-

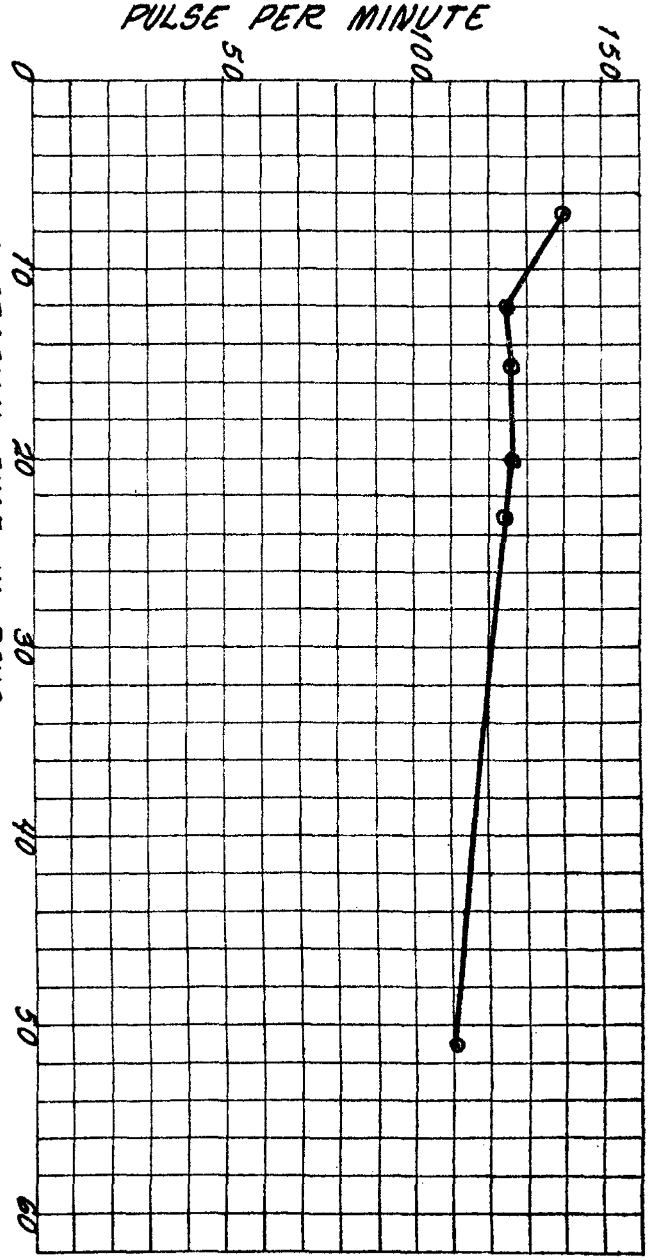



Figure 1. Relationship of pulse rate to operation time for the transmitter mounted on Deer No. 1. It is anticipated that this curve can be used to indicate the time when the transmitter will cease operation.

ing condition has a frequency stability better than plus or minus 20 cycles per megacycle and all spurious radiation attenuated by more than 50 db. A schematic diagram of the transmitter is shown in Figure 2. This unit should be considered a custom-made device because the components must be hand-picked.

The receiver is a dual-conversion superheterodyne unit which operates in the 26 to 27 mc band. Receiver sensitivity is 0.2 micro-volt for minimum discernible signal (MDS). This unit consists of a transistorized MONARCH automobile receiver mounted in a metal carrying case with the following modifications:

1. A three-transistor crystal-controlled converter was added. (Fig. 3).
2. A beat-frequency oscillator (BFO) and switch were added (Figure 4).
3. The receiver gain circuit was modified to pemit constant gain or automatic volume control (AVC).
4. The audio output circuit was modified to permit headset operation.
5. The RF input was redesigned to permit operation with a loop antenna approximately 20 inches in diameter. The antenna is connected to the receiver by a lead-in wire with a BNC connector.
6. A vehicle was equipped with a 104 inch citizen-band antenna. This antenna can also be connected to the portable receiver with a BNC connector. This addition to the receiving system greatly facilitated locating the general area of the transmitter.

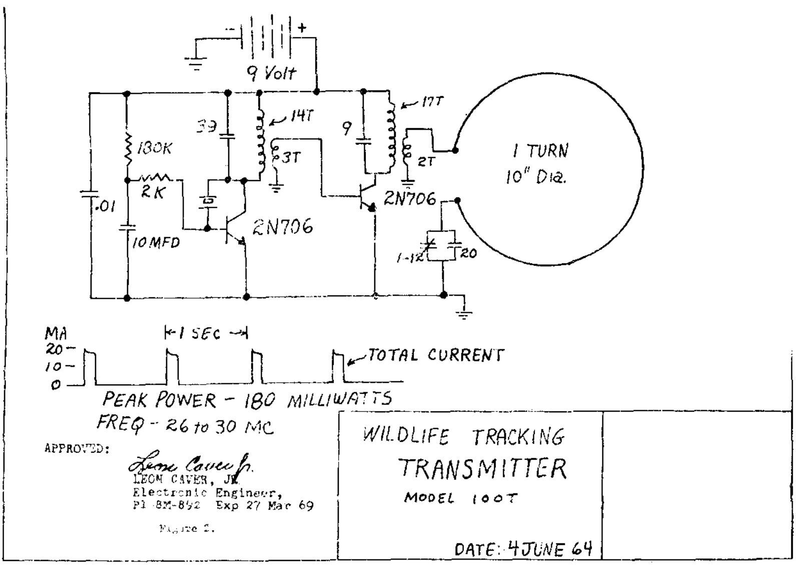



Figure 2.

## PROCEDURE

Deer were captured by means of a modified version of the Cap-Chur-Gun technique described by Green (1963), utilizing a 240 mg dosage of nicotine alkaloids (Cap-Chur-Sol[1]). Artificial respiration was administered by the hunter immediately after the deer had been shot

[1] Palmer Chemical and Equipment Co., Inc., 1391 Spring Street, N.W., Atlanta, Georgia. 30309

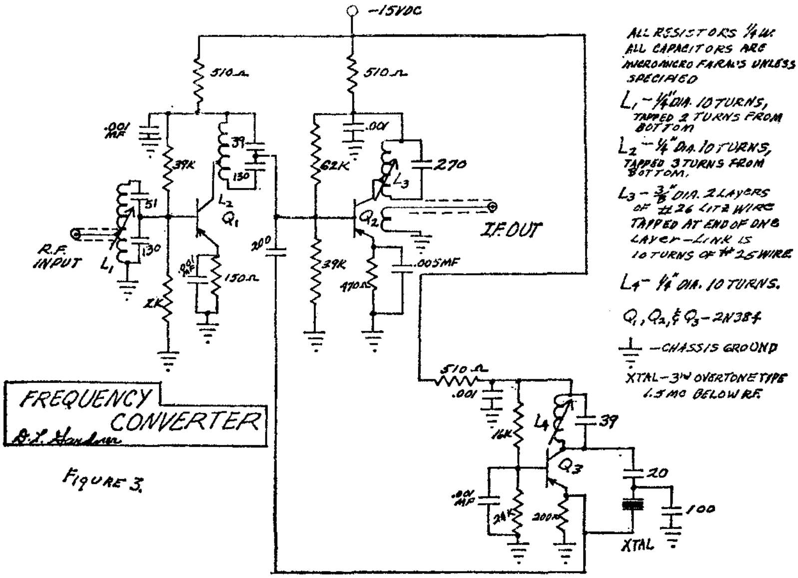
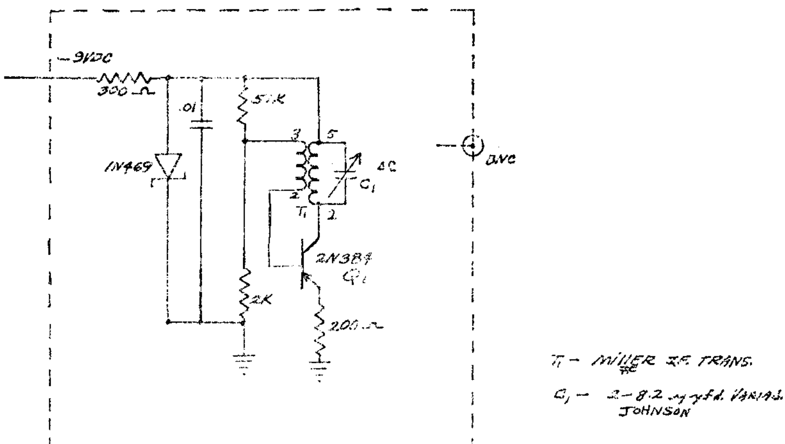



Figure 3.




455 KC BEAT FREQUENCY OSCILLATOR

Figure 4.

and had fallen to the ground. When other members of the group arrived, about one cc of adrenalin chloride was injected into the animal's neck. The deer's head was elevated and artificial respiration continued until normal breathing resumed.

After it appeared that the deer would survive the drug, the dog harness with the transmitter was attached. Foam rubber was taped around the harness to help provide a custom fit. The transmitter was then tuned to maximum output by turning the adjustment knob and reading the changes on a meter indicator. When transmitting and receiving systems had been thoroughly tested, the animal was released in the capture area. Usually about two hours elapsed from the time the deer was shot until its release.

The actual tracking procedure began by connecting the vehicle's citizen-band antenna to the receiver and driving into the general area where the deer was expected to be found. The area was canvassed until a strong signal was received on the mobile receiving unit. The vehicle was then stopped at the nearest fixed station at which point the citizen-band antenna was disconnected and replaced by a loop antenna. A directional reading or "fix" on the transmitter was obtained by rotating the loop antenna until a null or "no-signal" was received. This null was obtained when the loop antenna was exactly perpendicular to the direction from which the transmitter signal was radiating. (A receiving system designed to operate on the null is superior to one utilizing maximum signal strength because the "no-signal" zone is very narrow whereas an audible signal can be detected over most of 360 degrees.) After the null was located, a compass reading was taken and recorded along with the station number and meteorological data on a radio-tracking sheet (Fig. 5). This operation was repeated at a second station.

The fixed stations were set up 0.2 mile apart and new ones added when the animal moved out of range of those already established. A total of fourteen stations were established in the field and plotted on a map of the area. The directional readings were applied at the appropriate points on the map and the deer's location established at intersecting directional lines. Sometimes three readings were obtained as a means of checking location accuracy. On other occasions after the readings were taken, the animal was tracked to its location and observed. Through this technique it was ascertained that radio-locations of the deer were not more than 150 feet from the animals' actual positions.

While in general the equipment and procedure functioned extremely well, a few technical problems did arise. One of these was that when taking directional readings near telephone or electrical wires, false

RADIO TRACKING DATA SHEET

FREQUENCY __________ MC.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | | | | | | | | | | | | | | | | | |
| Time | | | | | | | | | | | | | | | | | |
| Direction Reading (1) | | | | | | | | | | | | | | | | | |
| Station Location (1) | | | | | | | | | | | | | | | | | |
| Direction Reading (2) | | | | | | | | | | | | | | | | | |
| Station Location (2) | | | | | | | | | | | | | | | | | |
| Temperature | | | | | | | | | | | | | | | | | |
| Wind | | | | | | | | | | | | | | | | | |
| Cloud Cover | | | | | | | | | | | | | | | | | |
| Weather Conditions | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |

Figure 5. Model of data sheet used in recording radio location.

nulls were sometimes obtained which could result in tracking errors. This was easily eliminated by moving away from the wires. Difficulty was also encountered in finding a null when the transmitter was too close. This problem occurred at ranges of less than 0.1 mile and was usually eliminated by lowering the loop antenna to about waist height. Little signal "bending or bounce" attributed to vegetation or terrain was encountered.

## RESULTS AND DISCUSSION

At the writing of this paper, a total of four deer had been equipped with transmitting equipment.

Deer No. 1—On June 19, 1964, a doe at least eight years old and weighing about 60 pounds was captured and a transmitter operating on 26.75 mc was attached. This animal was in an extremely emaciated condition and carried a heavy load of ectoparasites. She was captured on the edge of a small titi bottom and upon release moved into a dense section of vegetation. Periodic radio-locations made during the following 48 hours indicated no movement. On June 21 the animal was approached by radio-tracking and found to be dead and floating in a small creek. (Although only the top of the transmitter case was above water, a signal readable at about ⅛ mile was being transmitted.) It is assumed that the shock of drugging and handling was too much for the animal's weakened system.

Deer No. 2—A second doe was captured on June 24. This animal was about 2½ years old, was in good physical condition, weighed 85 pounds, and was noticeably pregnant. The transmitter and harness that had been used on Deer No. 1 was placed on her. At the time of writing this report, the unit had transmitted for nearly two months and was still operating quite satisfactorily. It is this animal from which the most valuable data have been obtained.

Deer No. 3—The third deer was a 1½ year old buck taken on July 5. At the time of capture, it had velvet-covered spike antlers about one inch in length and it weighed 75 pounds. Physical condition was fair with a heavy load of ectoparasites present. A transmitter operating on 26.70 mc and a harness similar to the one on Deer No. 1 and 2 was mounted on this animal. Tracking proceeded until July 16 when Deer No. 3 was killed by a car. The transmitter continued functioning after the blow.

Deer No. 4—Another young buck was radio-equipped on June 30. It weighed 45 pounds and was estimated to be 10 months old. Antlers were velvet nubs about one-half inch long. A belt-type mounting was used for attachment of the transmitter. This particular type of mounting proved unsuccessful as the transmitter and belt were recovered on August 4 where the deer had slipped out of them.

An analysis of the telemetric information obtained from these animals indicated that deer require a period of time to adjust to the inconvenience of carrying a transmitter. This adjustment period may vary in length with the transmitter weight, type of mounting, and individual deer. With the type of equipment used in the present study, indications were that about 10 days to two weeks are required. Although four deer had been radio-tagged, only Deer No. 2 was studied sufficiently after the adjustment period so that conclusions could be made concerning normal activity. The following information was ascertained from the telemetric analysis of this single deer's activities and, of course, does not necessarily reflect a population norm or average.

### *Daily Movement*

The daily movements of Deer No. 2 were quite variable as shown in Figures 6, 7, 8, and 9. Maximum distance between locations during each of these 24-hour tracking periods varied from 1600 feet to 7400 feet. The arithmetic mean, however, was 4800 feet or 0.91 mile. This average, although based on a small sample, tends to support Tyson's (1952) hypothesis that deer on Eglin Field have a daily range of slightly under one mile. It should be pointed out, however, that in many instances the animal returned to a location only a short distance from where it was at the beginning of the tracking period, and that the daily movement pattern was often long and narrow rather than circular as Tyson (*op. cit.*) assumed. This resulted in an actual distance traveled which was usually greater than twice the distance between extreme location points.

Although the behavior of Deer No. 2 varied considerably, a common pattern involved bedding and feeding in the wooded portion of the range during the daylight hours and moving onto the open range during the night. Often the middle and latter parts of the night were spent bedding out on the open range. Some daytime bedding occurred on the open range also, but this was usually in a section of habitat where turkey oak reproduction offered shelter.

### *Home Range*

The home range of Deer No. 2 was ascertained from a total of 131 radio-location points (See Fig. 10). As can be seen from Figure 11, it was surprisingly elongated with the major axis of 1.8 miles running in a northeast-southwest direction. The minimum area included within the range was approximately 200 acres or 0.33 square mile. This acreage was obtained by connecting the outermost location points on a map and determining the area with a planimeter. In a similar manner, Marchinton (1964) obtained a minimum area of 230 acres based on the results of radio-tracking a doe in the central Florida sandhills. Another study (Progulske, 1956) indirated an average minimum of 210 acres for does and fawns in Missouri.

According to Kaufmann (1962), it has been generally assumed that some area within the home range of each animal or social group is used more frequently than any other, and that this area probably contains the principal home sites, refuges, and most dependable food sources. In reporting a study of the coati (*Nasua narica*), Kaufmann (*op. cit.*) suggests the use of "core area" as a term designating this section of the home range. In relation to this, locations at which Deer No. 2 was recorded were concentrated in certain areas rather than being randomly distributed over the home range. Figures 10 and 11 illustrate that about 65 per cent of the feeding and bedding activities were conducted in a portion of the wooded area which comprised less than thirty per cent of the total range. This concentration of activities seems to correspond to the "core area" concept.

The home range and "core area" as indicated at this stage in the study are not necessarily the total annual range covered by this individual. The possibility that the animal may shift range with seasonal changes or other environmental variables is recognized. However, although minor changes in the "core area" are considered probable, the relative homogeneity of the climate and habitat as well as a tendency for female deer to be more sedentary than males (Olson, 1938; Progulske, 1956; Carlsen, *et al.*, 1957) seems to reduce the likelihood of any major shift in the home range. As the radio-monitoring of Deer No. 2 is continued, more definite information in relation to this question is anticipated.

### *Evaluation of Technique*

Radio telemetry in wildlife work is a relatively new development; however, it is difficult to say too much about its potential as a wildlife conservation tool. The results of this study indicated that radio equipment can yield unique and valuable information. With an adequate tracking system, a deer carrying a transmitter for a few weeks can provide information about some aspects of deer life history and ecology that could not be obtained even in years of study by other methods. The value of such data becomes obvious when the time expenditure required by more conventional methods to gather similar information is considered.

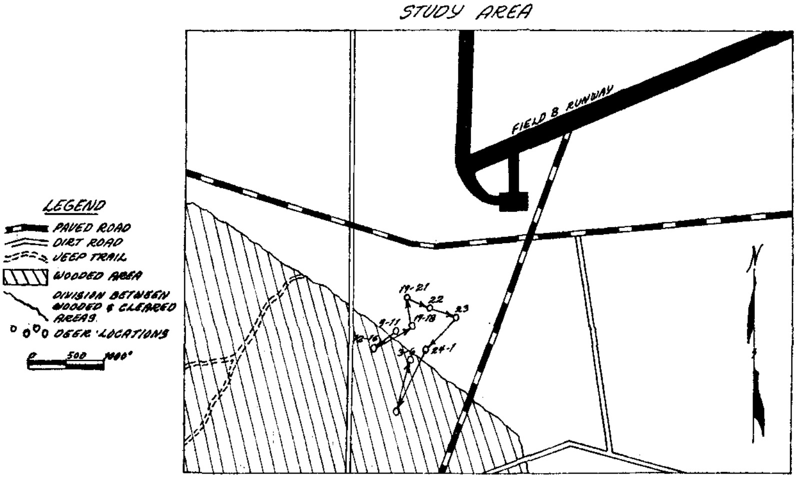



Figure 6. Map showing 24-hour movement of Deer No. 2 on June 29-30, 1964. Numbers refer to the time, based on the 24-hour clock, during which deer was radio-located at the position indicated by the circle.

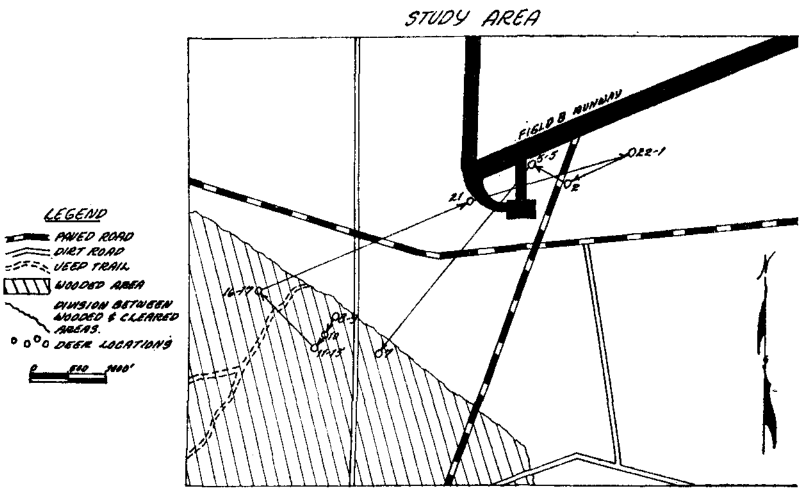



Figure 7. Map showing 24-hour movement of Deer No. 2 on July 8-9, 1964. Numbers refer to the time, based on the 24-hour clock, during which deer was radio-located at the position indicated by the circle.

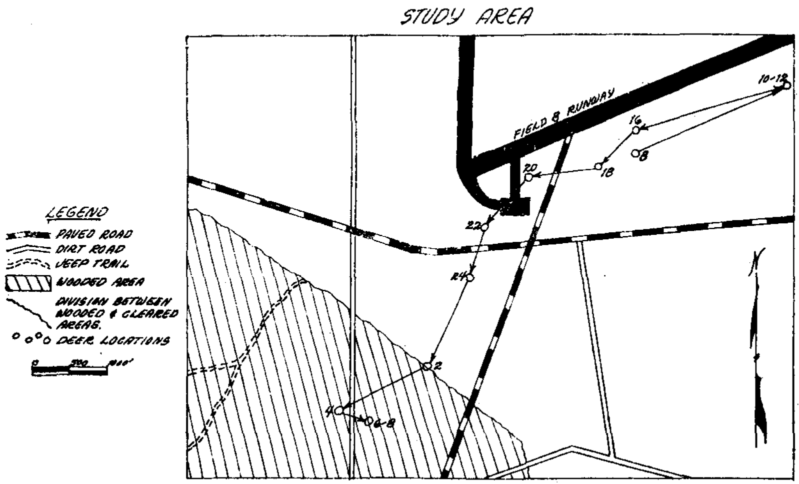



Figure 8. Map showing 24-hour movement of Deer No. 2 on July 18-19, 1964. Numbers refer to the time, based on the 24-hour clock, during which deer was radio-located at the position indicated by the circle.

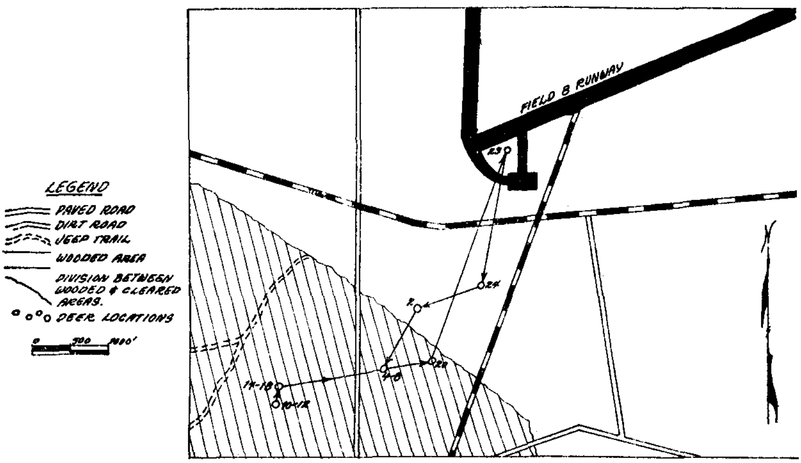



Figure 9. Map showing 24-hour movement of Deer No. 2 on August 3-4, 1964. Numbers refer to the time, based on the 24-hour clock, during which deer was radio-located at the position indicated by the circle.

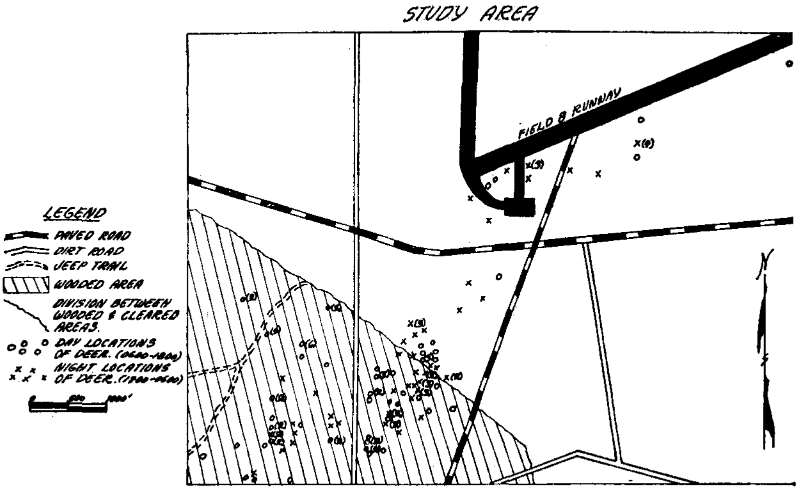



Figure 10. Map showing total radio locations of Deer No. 2 from June 24 to August 11, 1964. A number after O or X indicates fixes in same location.

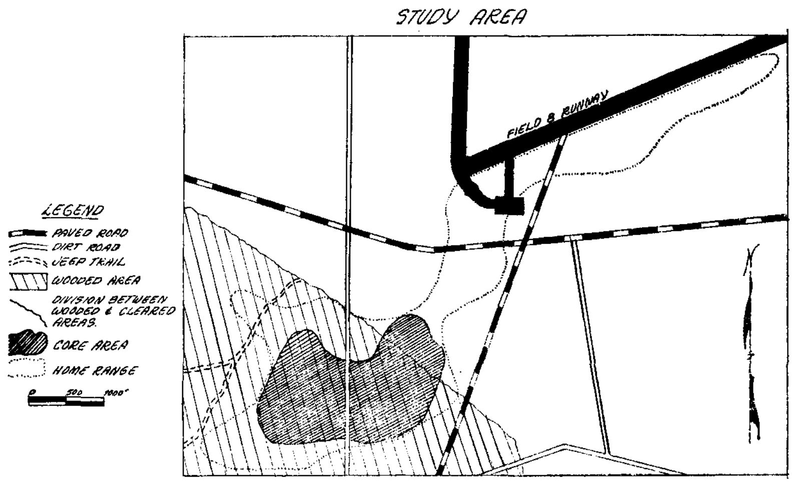



Figure 11. Home range and "core area" of Deer No. 2 from June 24 to August 11, 1964.

## SUMMARY AND CONCLUSIONS

1. This paper reports the progress of a study utilizing telemetric instrumentation to obtain movement and other life history data on white-tailed deer. The study is being conducted on the Eglin Air Force Base of northwestern Florida in a longleaf-pine/turkey-oak type habitat.

2. Radio equipment has been developed which enables monitoring of individual deer at ranges of three-fourths to one and one-half miles. The radio transmitters with power source weigh approximately 1.8 pounds, and although maximum life of the units has not yet been established, a period of six months is anticipated. Radio-locations of the deer are determined with receiving equipment by the intersection or triangulation method and are usually within 150 feet of the animal's actual position. A certain amount of data can also be obtained concerning the animal's activities as a result of variations in the tone and intensity of the transmitter signal.

3. Four deer have been equipped with radio transmitters. A discussion of the movements of one of these, an adult doe, is reported in this paper. This animal was tracked for nearly two months during which time its home range was 1.8 miles long and averaged about 0.2 mile wide (i.e., about nine times longer than wide) and included a mimimum area of 200 acres. A majority of this deer's bedding and other activity occurred within a relatively small section of the home range referred to as the "core area." Daily movement as indicated by the maximum distance between locations during 24-hour periods varied from 1600 feet to 7400 feet but averaged about 4800 feet or 0.9 mile. A common pattern of movement involved feeding and bedding on the open range during the night and returning to the "core area" during the day. This resulted in an actual distance traveled of at least twice the distance between extreme locations.

4. Indications are that valuable information can be obtained in short periods of time with this system of telemetric instrumentation.

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