tails are easily observed from the air during January and February due to the very low, thin surface vegetation. One-third of the existing population is taken each year, an amount equal to the annual reproduction of the herd. Removal of a substantial number of deer from this herd during the late winter period of critically low food supply prevented die-offs since hunting is not permitted on the refuge.

Six years of capturing whitetail deer in the marshes of Louisiana have resulted in the capture of 832 animals. Accurate cost figures are difficult to obtain, since many of the people assisting with the operations were university students, often attending on their own time to observe the technique, but assuming a direct cost on each man and machine used, it is cheaper than the average deer taken in Louisiana with box traps. The operation is not without its costs but it is fast, efficient and so far a mortality rate of approximately two percent has been experienced.

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MOVEMENT RESPONSES OF WHITE-TAILED DEER TO CHANGING FOOD SUPPLIES [1]

By JAMES L. BYFORD [2]

ABSTRACT

While studying deer movements and ecology in a logged, floodplain habitat in southwestern Alabama, the investigator noted certain consistent responses by deer to food changes.

One radio-instrumented deer shifted her range three times in response to changing food supplies (food plot to ear corn to spring greenery and back to food plot). The shifts were not great in magnitude, but they were distinct and were spread over a nine-month period. Diel movements were very concentrated when food was concentrated, but dispersed when the food supply was dispersed.

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1 A contribution of the Alabama Cooperative Wildlife Research Unit, Auburn University, Game and Fish Division of the Alabama Department of Conservation, the U. S. Fish and Wildlife Service and the Wildlife Management Institute, cooperating. Presented at the 23rd Annual Conference of the Southeastern Association of Game and Fish Commissioners.

2 Completed this study while Graduate Research Assistant, Alabama Cooperative Wildlife Research Unit, Auburn University. Currently Wildlife Extension Specialist, University of Georgia.

Two deer were radio-tracked on the clear-cut area during cutting activities. One that was tracked during the summer when food was abundant on the cut area had a limited range and diel movements. The other was tracked during the late fall when food was becoming scarce, and her range was nearly three times as large and diel movements were more dispersed.

A deer-activity index was derived by counting the numbers of deer seen at night per mile of travel through the clear-cut and uncut areas. By comparing the seasonal change in index values for the two areas, it was found that deer activity became much more concentrated on the clear-cut area as the food (sprouts, herbs, and woody vines) became more abundant.

INTRODUCTION

Until the recent advent of radio telemetry, home range studies of deer were restricted to home range sizes and distances traveled between tagging and observation sites. Deer movements, however, are dynamic—from day to day, from season to season. They are stimulated and affected by all facets of the environment such as food, cover, predators, and weather as well as by internal motivations such as mating behavior. By monitoring a deer frequently during complete 24 hour periods and by carefully observing simultaneous changes in the habitat, it is often possible to measure the reactions of an animal to these changes.

While radio-tracking deer in the vicinity of a bottomland clear-cut area, the investigator noted certain movement response patterns related to food.

The Study Area

The study area is a tract of bottomland hardwoods being clear-cut by International Paper Company in order to study, among other things, the compatibility between deer and this type of timber management. It is located in southwestern Alabama in Baldwin County and is approximately 2 3/4 miles east of the junction of the Tombigbee and Alabama Rivers. Consisting of 1,000 acres and divided into two logging compartments, it was to be injected, commercially clear-cut, and allowed to regenerate by natural succession. The first logging compartment of 435 acres is considered to be the study area for this report. Data were also obtained for several miles in all directions from the study area.

The floodplain, which varies in topography between 0 and 10 feet, is about 250 square miles in size. The area floods annually, usually in winter or early spring, and remains under water for varying periods of time ranging usually from two to four months. Sometimes water rises and recedes several times during one year. The depth of water varies from year to year, and thus the extent of deer migration from the bottomland varies.

The area is characterized by mature trees, and consequently there is little available browse due to shading out of understory by the closed crown canopy. For this reason, summer appears to be the critical season of year for deer in the area. The population density is estimated to be one deer per 20 acres.

Study Period

Logging began on the study area in September, 1967, and was virtually completed by November, 1968. This study was begun in December, 1967, and conducted intermittently until July, 1969. During more than half of the interim, the investigator lived near the study area devoting full time to field work.

METHODS

Radio telemetry and tagging were employed to study deer movements. Instrumented animals were radio-tracked from one to two 24-hour periods (diel periods) each week until transmitters failed. Occasional locations were determined between diel tracking periods. During a diel period,

the animal was located once every one to three hours, usually once every two hours. Signal reception was attained by use of a portable receiver and a hand-held antenna.

Movement Parameters

The following movement parameters were used as defined by Marchinton (1968)[3]:

1. *Minimum home range*—The area included within a line connecting the outermost locations of the deer during the entire period of the telemetric and visual contact was referred to as the minimum home range. (The technique for connecting this line was also described by Marchinton.)

2. *Home range major axis*—A line segment formed by connecting the two locations of the deer obtained any time during the study, that are the greatest distances apart was the home range major axis.

3. *Home range minor axis*—A line segment perpendicular to the major axis and connecting the boundaries of the minimum home range at its widest point was the home range minor axis.

4. *Distance between extreme diel locations* (DBE)—The greatest distance between any two locations of the deer during a particular 24-hour tracking period was his DBE for that day.

5. *Minimum total distance moved in diel period* (MTD)—The sum of the distances between sequential locations of an individual deer during a particular 24-hour period of tracking was his MTD for that period.

RESULTS AND DISCUSSION

Summary of Movement Parameters

A summary of movement parameters of radio-instrumented deer in the vicinity of the study area is given in Table 1. However, it is not within the purpose of this report to dwell on mechanical attributes of movement parameters such as home range size, shape, orientation, et cetera. The author agrees with Sanderson (1966) and Downing et al. (1969) in that the sizes and shapes of home ranges have little significance in themselves. Emphasis should not be on movements themselves, but on reasons for these movements.

Multiple Shift in Range

The study area was inundated during most of the winter of 1968. Deer were forced to the uplands, and for this reason, trapping activities were centered near the edge of the floodwater. This edge between the upland and the bottomland varied from small bluffs with a sharp division between pines and hardwoods to a gradual incline characterized by an interspersion of pines and hardwoods. The area belongs to Scott Paper Company and was under lease by Fort Pierce Hunting Club. A section of powerline right-of-way which passes through the area was sown to winter grain. This food plot further concentrated deer which were already concentrated because of the high water.

On February 9 about a week after the floodwater began to subside, an adult doe (No. 3071) weighing approximately 80 pounds and in medium condition was captured in a box trap and instrumented with a radio transmitter. She was captured within 80 yards of the food plot and spent much of her time in that immediate area for the next few days, being recaptured in another trap within 30 yards of the food plot on February 13 (Figure 1b). On February 17 the hunting club, fearing that deer food was waning, placed several pickup loads of ear corn within a short distance of the food plot. This corn was strewn thickly along a dim road. Number 3071 immediately shifted her activity to the area of this ear corn. Though she had been located in this area before

[3] A slight deviation from Marchinton's definitions is that his term "radio locations" will be replaced by "locations."

TABLE 1. Summary of movement parameters of radio-instrumented deer in the vicinity of a clear-cut area of bottomland hardwoods in north Baldwin County, Alabama

Telemetric Study Period (1968)	Deer Number	Sex	Minimum Home Range (Acres)	Major Axis (Miles)	Minor Axis (Miles)	Range of DBE (Miles)	Mean DBE (Miles)	Range of MTD (Miles)	Mean MTD (Miles)
2/ 9 to 4/13	3071	F	346	1.34	0.82	.39-0.91	0.67	1.09-2.41	1.79
2/ 3 to 3/ 1	3062	F	269	0.89	0.62	.58-0.76	0.68	1.48-2.87	2.12
2/ 3 to 2/25	3066 [2]	F	225	0.80	0.65	.58-0.78	0.67	1.93-2.37	2 11
10/19 to 11/20	3092 [2]	F	112	1.09	0.40	.15-0.75	0.47	0.57-1.76	1.16
10/16 to 12/11	3086	F	283	1.23	1.03	.57-1.12	0.86	1.80-3.82	2.59
8/18 to 9/13	3094	F	104	0.76	0.39	.44-0.75	0.58	1.43-2.24	1.83
2/10 to 2/18	3126	M					0.36 [1]		1.07 [1]
1/20 to 2/19	3069 [2]	F							
7/24 to 7/30	3084	F					0.76 [1]		1.01 [1]
8/15 to 8/23	3088	F					0.48 [1]		0.79 [1]
2/13 to 2/15	3127	F		1.00 [1]					
Average			223.2	1.02	0.65		0.66		1.93

1 Data considered insufficient to compute in averages.

2 Fawns.

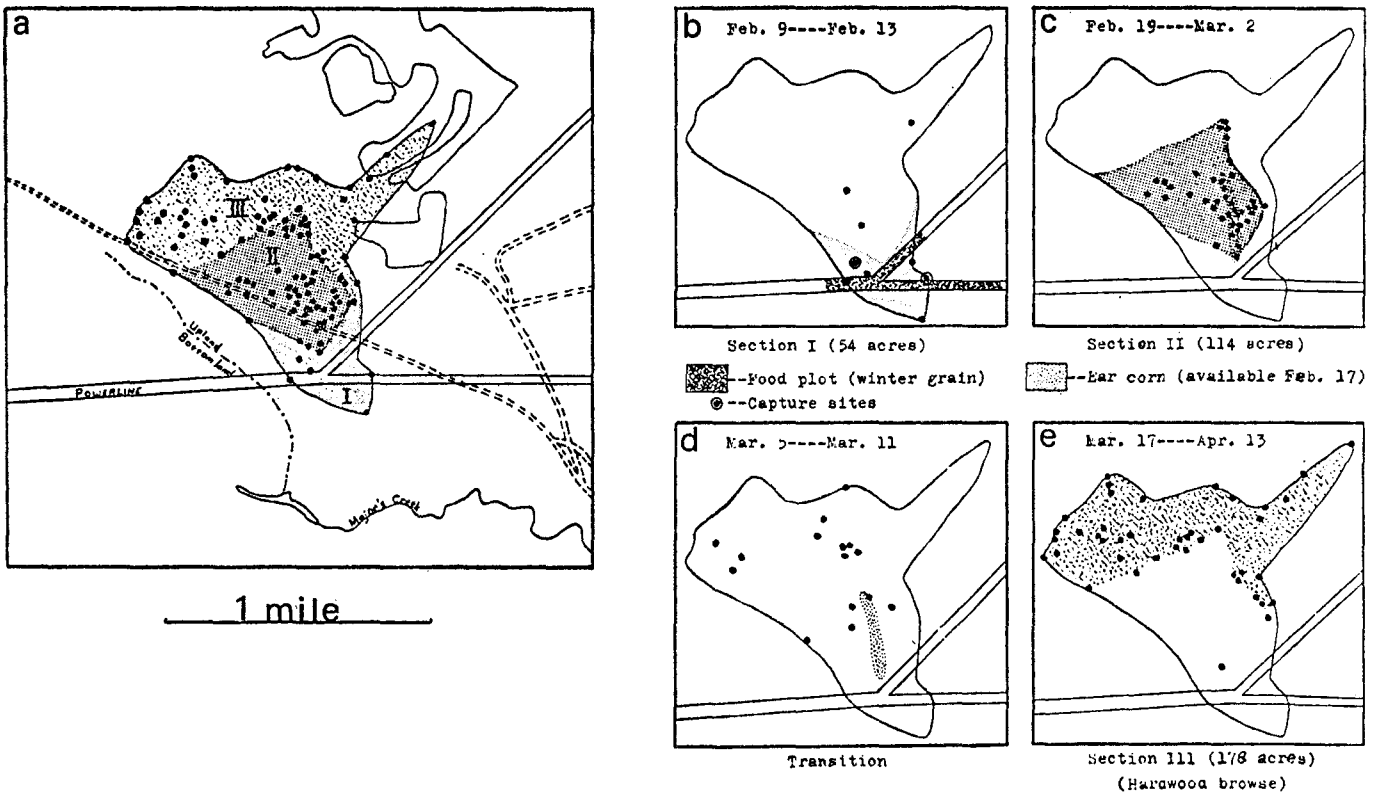

FIGURE 1 -- Minimum home range of No. 3071 as determined by radio-tracking from February 9, 1968, until April 13, 1968. Sections I, II, and III represent areas of activity concentration as related to three different kinds of food.

the corn was put out, it is noteworthy that during two months of subsequent intensive tracking, she was never again located in the area of the food plot; thereby she abandoned 54 acres (section I) of her range (see Figure 1b and 1c). During the following two weeks her activity was extremely limited to the immediate area of the ear corn, and she was observed feeding on it several times. Three diel tracking periods revealed reduced daily movements obviously due to the abundant new food source (Figure 2b, 2c, and 2d).

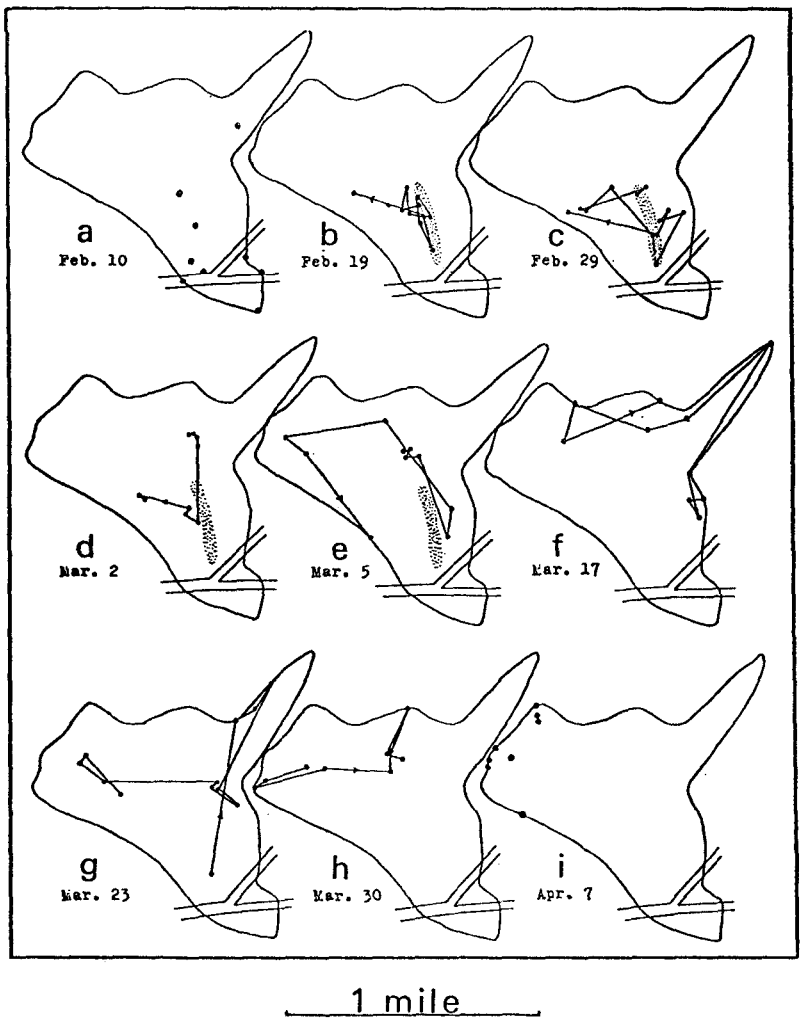

FIGURE 2 -- Sequence of diel movement patterns of No. 3071 showing gradual drifting of center of activity.

On March 5 (about one month after she was initially captured), she began to expand her activity again, wandering into areas where she had never been located before while still returning to the area of the ear corn. This wandering or transition period lasted for about one to two weeks (Figure 1d). The ear corn was just about gone at the time and this, coupled with the fact that spring "greenstuff" was becoming available, are the probable explanations of the transition period.

Beginning about March 17 and until April 13 when the transmitter became too weak for location, she seemed to establish a new range or area of activity (Figure 1e). This 178-acre area is principally an area of interpersion of bottomland hardwoods and upland pines. New spring hardwood growth was more abundant here than the 168 acre pine area she had abandoned. During the final month of radio-tracking, she was located on the first 168 acre area only one time.

From the initial wandering on March 5 until the final tracking period on April 13, four diel tracking periods yielded substantially larger average diel parameters than those obtained during the period when ear corn was abundant (Figures 2e, 2f, 2g, and 2h). This can logically be explained by the fact that the new food source (hardwood browse) was spread over a large area than the ear corn.

This deer was not observed again until November 10, 1968 (nine months after capture), when a member of the hunting club saw her back in the food plot—in the original 54 acres of her range. By this time most of the mast was gone, frost had killed most greenstuff, there was no ear corn, and the food plot was again in succulent winter greenery.

All evidence seems to indicate that these range shifts were related to food preference and/or abundance. The observation on November 10 points out that the shifts were not permanent and suggests a seasonal cycle of activity shifts related to food.

Numerous authors have mentioned shifts in ranges of white-tailed deer for various reasons. Most of these reports, however, are based on general observation or tagging studies. Rongstad and Tester (1969) used an automatic tracking system to record patterns of migration due to weather. To the author's knowledge, the incident reported herein is the only documentation of the mechanics or pattern of a multiple shift in range related to food.

Shifts of ranges or migrations of white-tailed deer related to weather or season are reported by Welch (1960), Severinghaus and Cheatum (1956), Skiff (1947), Rongstad and Tester (1969) and Schmautz as cited by Siglin (1965). Shifts of white-tailed deer ranges as related to a change in food availability are reported in northern states by Severinghaus and Cheatum (1956) and in Arizona by Welch (1960). Downing et al. (1969) relates an instance in the mountains of North Carolina where three marked deer, having been observed around a food plot repeatedly for two months, were seen in a valley six miles away at about the time of spring greenup at the lower elevation. Several weeks later, one of the marked deer was seen back in the mountains where she was originally tagged. According to Downing et al. (1969), Ruff also working in this area in 1938, noted a similar migration and return of deer following spring greenery as a food source. This parallels the shift of No. 3071 to spring greenery and her return to the food plot in the fall. The deer in this study, however, didn't have to travel as far to find a readily available food source.

Marchinton (1968) noted a short temporary shift (about four days) in the center of activity of a fawn into the vicinity of a food plot at about the time young clover became available in the plot. Downing et al. (1969) while working in Virginia counted 133 deer feeding in a small grass plot. They pointed out that this indicates deer will move to a choice food supply, and that movement of this type may be more common than is generally recognized. Similar shifts as related to food have been reported for mule deer (*Odocoileus hemionus*) by Russell (1932), Loveless (1964), and Dixon, Einarson, and Riney as cited by Dasman and Taber (1956).

Other studies involving deer of both species indicate that the animals are reluctant to shift their range, even in the face of adverse food conditions. Dasman and Taber (1956) state that lack of sufficient quantity of food will cause mule deer to travel, but poor quality of food will not, even when lethal malnutrition occurs. Thomas et al. (1964) cite several studies which indicate that white-tailed deer would rather starve to death than leave their home area, even though better food conditions prevailed only a short distance away.

Shifts in range, for whatever the reason, are not usually sudden linear migrations between two home ranges. Hammerstrom and Blake (1939) stated that ebb and flow are characteristic of home range shifts of deer, and that distribution patterns show alternate expansions and contractions. Dasman and Taber (1956) stated that in their study of mule deer, some individual animals were known to extend their home range boundaries peripherally. Dahlberg and Guettinger (1956) stated, "although deer may have a definite affinity for certain areas, there would seem to be an almost continuous movement by a portion of the animals in response to changes in food and cover requirements and availability." The last three citings are descriptive of the gradual peripheral shift of range of No. 3071. Actually the shifts of this deer were probably shifts in center of activity (Hayne, 1949) rather than shifts in home range, since no great distance was involved. Dasman and Taber (1956) state that in areas where winter snowfall doesn't force migration, mule deer shift within familiar home ranges to improve their food supply rather than leave their home ranges.

In regard to the decreased daily movements of No. 3071 during the period of the concentrated food supply, Townsend and Smith (1933) found similar behavior of deer in their area. They state: "It is likely that the home range of a deer is much more limited in extent during the summer, these being the months when the animals . . . find food abundant within a limited area." Sanderson (1966) believes that if all the requirements of a species could be provided in a small area, its home range would probably be smaller than the average now found for the species.

The increase in daily movements of No. 3071 as the concentrated food supply waned parallels findings of Dahlberg and Guettinger (1956) who state: ". . . we have noted that where normal food requirements are not met, there is a tendency to move greater distances."

No. 3094 MOVEMENTS ON THE CLEAR-CUT-AREA

An adult doe weighing approximately 70 pounds and in poor condition was captured with the dart gun on August 18, 1968. She was instrumented with a radio transmitter and monitored until September 13, 1968.

She was first observed with a spotted fawn on September 10, 1968, twenty-three days after she was captured. Because of its size, the fawn was estimated to be several days old. During four to six subsequent sight observations, it was seen with her.

This deer's home range, which was the smallest of all deer monitored (104 acres), was located both on the cut and uncut areas. It seemed to be divided into three distinct sections—two core sections (one on the cut area and the other on the uncut area, both being at the extreme ends of her range) and one section of travel between these core sections (Figure 3a). The latter section was greater than one-third the area of the complete home range, but she was only located in it twice, and she was seen crossing the road or traveling at both times. Close examination of her diel movements tends to verify that she was present in this section of her range only while traveling from one core section to another. She would typically "mill around" in it for a few hours, travel to the first, et cetera (Figure 3b, 3c, and 3d). On August 22 she visited the uncut area twice and the cut area once. On both August 30 and September 10, she visited each area twice during the same diel period.

Her frequent visitations to both core sections suggest that each area offered some benefit different from that offered by the other. At the time this deer was tracked, logging slash on the cut area provided an abundance of food in the form of green leaves, twigs, and fruit. In the uncut portion of her range, muscadines (and later acorns) were abundant. Concentration of deer sign around these foods (mast and slash) indicated that both were used heavily. It is likely that No. 3094 was utilizing both food sources in order to vary her diet. Results of a browse survey suggest that variety is important in the diet of deer in this area. Bartlett (1958) and Lay (1969) also found this to be true in other areas. The home range characteristic of two core areas separated by an area of travel has been reported by workers in other areas. Montgomery (1963) and Marchinton (1968) found that home ranges of deer in mountainous areas tend to follow this pattern. In both instances at least one of the core areas was associated with a food supply.

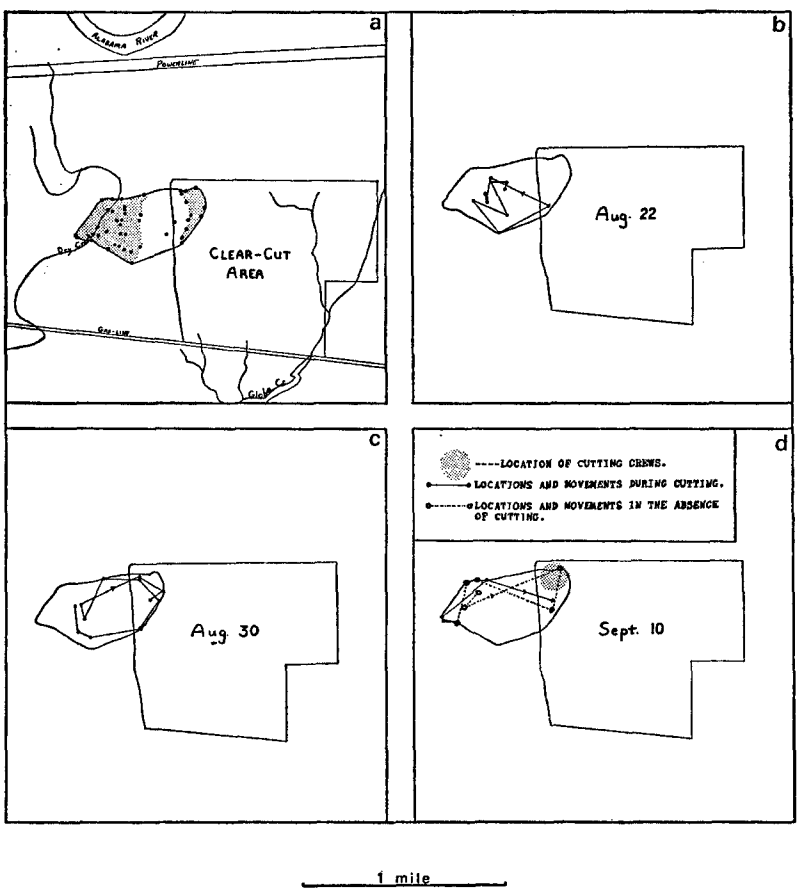

FIGURE 3 -- (a) Minimum home range of No. 3094 as determined by radio-tracking from August 18, 1968, until September 11, 1968, showing two core sections (shaded) and one intermediate section of travel (unshaded). (b,c,and d) -- Three diel movements of No. 3094. Note frequent alternate use of both core sections.

Food variability, then, is one possible explanation for the frequent alternate use of the two core sections. In conjunction, the fact that she had a fawn would lead one to surmise that the core section on the uncut area was where she left her fawn while she traveled to the cut area for food. Since the fawn was never observed with her on the cut area, it is possible that she sensed danger for it in such close proximity to the timber crew. The constant pattern of diel movements could be the result of nursing or tending the young fawn in an area remote from man's activity, traveling to the cut area to feed on the abundant slash, returning to the fawn et cetera. Severinghaus and Cheatum (1956) in referring to the early period in a fawn's life state:

> the duration of the hiding period varies with individuals . . . Perhaps disturbances resulting from man's activities are a factor, though the case is not entirely clear . . . Seemingly it would be an advantage to the feeding doe to have her young safely hidden.

The doe apparently felt that she was safe, herself, in the concealment of slash on the cut area, as she was observed only a few yards from cutting activities on September 10, 1968 (Figure 3d).

After transmitter failure on September 13, 1968, she was observed seven times until November 20, 1968. She was never observed outside her previously determined home range.

As mentioned earlier, this deer had the smallest home range of any deer tracked during this study (104 acres). She also had the smallest mean DBE (0.58 acre) and the second smallest mean MTD (1.83 miles) of any adult deer tracked (Table 1). This can logically be explained by one or both of two reasons. First of all, during the season in which she was tracked, food was relatively abundant. It has already been shown in the case of No. 3071 that decreased movement accompanied an abundant, concentrated food supply. Secondly she had a young fawn while she was tracked, and some studies have indicated decreased movement in this situation. Marshall and Whittington (1968) radio-tracked a doe with a newly born fawn and found her range to be 40 acres during this period. They tracked the same doe and fawn four months later and found her range had almost doubled. Severinghaus and Cheatum (1956) also indicate that does will stay near their fawns during the early days of the fawn's life. Michael (1965) and Dasman and Taber (1956), on the other hand, found no occasion of decreased movement of does with fawns.

No. 3086

A doe, one year old, weighing approximately 70 pounds and in good condition was captured about 100 yards from the clear-cut area. She was captured with the dart gun on October 16, 1968, and instrumented with a radio transmitter which functioned until December 11, 1968.

This deer's home range was fairly well defined by November 7, 1968, when a timber crew began to clear-cut the uncut portion of her range. About one-third of her home range had been subjected to cutting for several months while the rest of it had been free from man's activity. In the new cutting operation beginning November 7, however, the crew in a very short time had skid roads and trees down throughout most of her range.

It is interesting that after the invasion of the uncut part of her range, no significant change in her home range or movement patterns could be detected. There was no obvious shift in center of activity away from or toward the area of cutting (Figure 4). No true core areas or centers of activity were readily apparent in her home range during the time she was monitored. This is probably due to the fact that both food and cover were dispersed, and there was no reason for concentration of activity. Little food was afforded by the slash, since most of the leaves and mast had already fallen before the trees were cut. Cover was already provided by the slash on the old cut area, and mast was generally distributed throughout the uncut portion of her range.

According to results of a deer food survey conducted in the fall, there was very little food available on the old cut area during the period that No. 3086 was tracked. Consequently this area was apparently of little use to her except for the cover provided by slash. This is emphasized by the fact that she almost never used this area except when cutting operations were going on (Figure 4). At these times she generally became sedentary on the old cut area and would remain bedded in the slash for most of the duration of the disturbance (Figure 4b and 4g). From the time logging ceased until it began again, she appeared to feel safe to wander about the uncut portion of her range to feed. On October 21, she remained bedded in slash all day during cutting activities less than 200 yards from her location. Promptly at 4:00 p.m. when cutting ceased, she started moving and continued to move most of the night (Figure 4b). On occasion she would suddenly move a considerable distance during hours of cutting, probably jumped from her bed by workmen (Figure 4d, 4e, and 4f).

This deer had the second largest home range and the largest diel movement parameters of any deer radio-tracked (Table 1). This extensive movement can logically be explained in terms of food availability. While mast was fairly abundant during the early fall, the supply was waning by the time of observation of this animal. Much of the amount left was damaged by insects (69.6% of the acorns according to a fall deer food survey). Most greenery was already destroyed by frost. Consequently she had to forage wider for food, whereas all the other adult deer studied telemetrically had a concentration of some sort of food available. Further supporting this theory is the increase in diel movement parameters of No. 3071 as her food supply changed from a concentrated type (ear corn) to a more dispersed type (spring greenery). It is interesting in this light that on October 21, when No. 3086 stayed bedded most of the day, she increased her night-time movement so that the total MTD and DBE for that diel period were as large or larger than normal (Figure 4b). It seems as though she was "making up for lost time" in her feeding activities after the workmen left.

Comparison of movements of nos. 3094 and 3086

In comparing the movements of No. 3094 and No. 3086, two deer radio-tracked while utilizing the clear-cut area, there are both similarities and differences that appear to be significant. A timber crew reported seeing four deer on November 20, 1968, including these two, cross the road at a common point in their home ranges. The possibility that they may have belonged to the same social group (for at least part of the year) makes a comparison of these two animals even more interesting.

Similarities—It seems important to note that neither animal apparently shifted its range to any extent as a result of the clear-cutting operations. Robinson (1935) found that deer were not driven out by trail invasion of their habitat. The change in ecological conditions produced a new mixed growth of which the deer were quick to take advantage. Dahlberg and Guettinger (1956) and Hurd (1962) note that deer are attracted to logging operations for the same reason. On the other hand, daily movement patterns of both animals appeared to be affected by cutting activities. For example both deer used the clear-cut area during cutting operations, sometimes in close proximity to the loggers, but they usually tended to be sedentary during these periods. Occasionally, however, they would suddenly move a considerable distance, probably frightened by workmen. On one occasion, No. 3094 was seen running directly from the study area at full speed during extensive cutting activities. Similar sudden movements were apparent in the two diel movements of No. 3086 shown in Figures 4e and 4f.

It appears that deer stay put in the vicinity of man's activity as long as they have plenty of cover and are not jumped directly from their beds. In conversation with the foreman of one of the logging crews, he stated that his crew frequently "jump" deer from their beds in

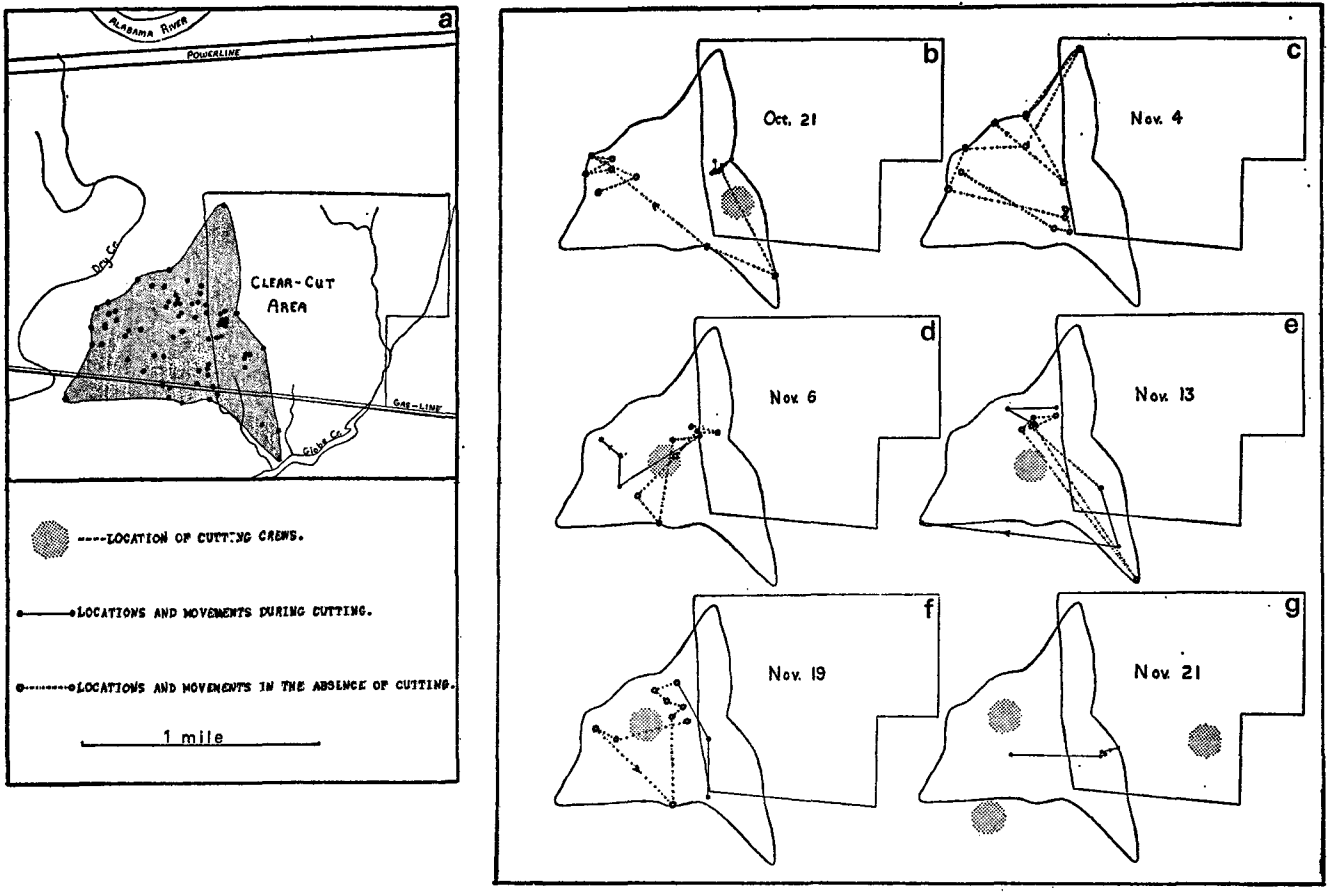

FIGURE 4 (a) -- Minimum home range of No. 3086 as determined by radio-tracking from October 16, 1968, until December 11, 1968.

logging slash, after cutting and operating heavy machinery in the area all morning within only a few yards of the bedded deer.

Dasman and Taber (1956) indicate that disturbance, as by hunters and dogs, does not cause mule deer to leave their home ranges if good cover is present; the deer circle about and seek cover within their ranges. Marshall and Whittington (1968) found that radio-instrumented deer remained within their telemetrically determined home ranges when subjected to heavy hunting pressure. They found that, generally, deer movement increased as hunting pressure increased, but an absence of understory vegetation (or cover) on the study area was believed to be a contributing factor in forcing deer to "move." Carlson and Farmes (1957) found that deer in open areas are more mobile than those in forested areas. Tester and Heezen (1965), in telemetrically monitoring two deer during a drive census, found that one didn't leave its home range during a drive that went right through it; the other was driven out, but returned the same evening. They found that subsequent movements of both deer after the drive were similar to those before the drive. Townsend and Smith (1933) found that deer changed their activity rhythm to be asynchronous with that of man. This is especially evident in the two diel movements of No. 3086 shown in Figures 4b and 4c.

Differences—Several aspects of the home ranges of No. 3094 and No. 3086 are extremely different, but the fact that the former was tracked during summer and the latter in the fall provides grounds for explanation of these differences.

First of all, No. 3094 had the smallest home range (104 acres), the smallest mean DBE (0.58 mile), and the second smallest mean MTD (1.83 miles) of any adult tracked. Number 3086 had the second largest home range (283 acres), the largest mean DBE (0.86 mile) and the largest MTD (2.59 miles) of any adult tracked (Table 1).

The small home range and diel movement parameters of No. 3094 can be attributed to the fact that she had a very young fawn and/or the fact that food was abundant during the season she was tracked, and she didn't have to travel far to feed. Number 3086, on the other hand, didn't have a fawn, nor a plentiful food supply during the period in which she was tracked. She undoubtedly had to cover a larger area to obtain enough food.

Diel movements of No. 3094 tended to follow a pattern, i.e. back and forth from one core section (cut area) to another (uncut area). No pattern was discernible in the diel movements of No. 3086. This could reflect the fact that No. 3094 was taking advantage of two different available foods in two different places (both of which were found in abundance), while No. 3086 had neither food abundance nor variety, and consequently wandered at random in search of what mast she could find. The pattern of No. 3094 may also reflect the fact that she had a fawn, in that she alternately fed on the cut area where food was abundant, and returned to nurse and tend the fawn in an area where it would be safe from man's activities.

Another difference in the diel movements of No. 3094 and No. 3086 is that the latter occupied the cut area only during cutting activities (apparently for cover since there was little food there during this period), while the former spent both nights and days on the cut area. It seems logical that No. 3094 was deriving benefit from food as well as cover on the cut area since food in the form of slash was abundant there while she was being tracked.

In summary, all these differences in the movements of No. 3094 and No. 3086 seem to be related to seasonal availability of food and/or the presence of a young fawn in the case of No. 3094.

Another interesting point concerning the movements of numbers 3094 and 3086 is that a natural salt lick, which was believed to be consistently used by No. 3086, was within 100 to 200 yards of the home range of No. 3094. Whether her failure to use this lick was due to her not needing

extra salt or due to her ignorance of its existence is debatable. In the same light it is also noteworthy that although No. 3071 shifted her activity to the area of ear corn as soon as it was put out, two other deer (No. 3066 and No. 3062), being radio-tracked simultaneously, did not even though their ranges were less than 200 yards away. It would appear that, in both cases, the animals were not aware of the existence of these "commodities."

Dice and Clark (1953) conclude that the boundary of an animal's home range is not complete. Dasman and Taber (1956), however, favor the concept of home ranges being limited by definite boundaries. They point out that the area outside of an animal's home range in unknown territory. They found that qualitatively superior forage did not attract mule deer to new areas and reasoned that this was perhaps because the deer had no knowledge of its presence.

Index of Deer Activity

During the late summer and early fall of 1968 and the summer of 1969, an index to deer activity was derived by counting deer at night with the aid of a spotlight on both the clear-cut and uncut areas. Numbers of deer seen per mile of travel through the cut area were compared with the numbers seen per mile of travel through the uncut area. This technique was utilized to gain information as to the relative change in amount of deer activity on the cut area during and after the cut. Although visibility on the cut area was comparable with that on the uncut area, this was not a necessary attribute for the technique to be functional. The true comparison between the two areas is the relative amount of change in index values. Results are shown in Table 2.

Table 2. Index of deer activity given as number of deer sightings per mile of travel through cut and uncut areas of bottomland hardwoods in North Baldwin County, Alabama

	Deer Sightings	No. of Nights	Uncut	Clear-Cut
Sept. & Oct. 1968	216	18	1.84	1.08
June & July 1969	175	11	1.09	3.47
Change in Index			−0.75	+2.39

During the fall count of 1968, the study area had been completely cut except for a small amount of pulpwood. Frost had killed much of the greenery. The small amount of browse left on the cut area was competing with the ample acorn crop of the uncut area; therefore, the low index value of 1.08 is understandable. In the summer of 1969, however, the food situation was reversed. Abundant browse on the cut area in the form of sprout growth, herbs, and woody vines was superior, both quantitatively and qualitatively, to the skimpy amount of browse on the uncut area. Thus deer activity on the clear-cut area was concentrated as is evidenced by the relatively high index value of 3.47. It must be borne in mind that this is a value representative of deer activity rather than actual numbers of deer, since a given point along the route of travel would be passed from two to five times during a single night, and if an individual deer moved relatively little, it would likely be counted more than once. Thus a high index value reflects little movement, or concentrated deer activity.

SUMMARY AND GENERAL DISCUSSION

Certain aspects of movements of five of the deer radio-tracked in this study (numbers 3071, 3066, 3062, 3094, and 3086) are consistent with numerous reports by other authors based largely on observational

Seasonal index values for the clear-cut area were significantly different at the 99 per cent level, but were not for the uncut area at the same level of significance.

data. Reference should be made to the sections of discussion of movements of No. 3071 and comparison of movements of No. 3094 and No. 3086 for a literature verification of the following generalizations:

1. It appears that deer will shift their center of activity to a concentrated food source available within their home range.

2. Apparently deer will not shift their home range to any great extent solely to reach a concentrated food supply. It seems that ignorance of existence of the food source is the reason for if it isn't within the animal's home range, he has no way of knowing it exists. It will be remembered that in the case of No. 3071, the ear corn was placed within the animal's range of familiarity. An animal may follow a better food supply, even outside its home range, in a situation where food conditions gradually become better the further an animal travels. An example of such a situation is a gradual increase in amount of spring greenery as one habitat intergrades with another (such as from a pine-hardwood community into a hardwood community). For instance, an animal in the former habitat is aware of the spring greenery in that habitat, but the further it travels into the hardwood comunity the more spring greenery becomes available. This is likely the situation that prompted No. 3071 to expand or shift her range the second time. This gradual increase in abundance of spring greenery might also be evidenced in mountainous areas as an animal travels from one elevation to another. Undoubtedly there are individuals that will disperse or wander in the face of a severe food shortage, or for other reasons; in this case, they may accidentally discover the food source. According to the literature, however, deer rarely disperse to seek a better supply of food; in most reported cases, they remain in one area to starve, even when food is available only a short distance away.

3. All evidence further indicates that deer will concentrate their daily activity in the presence of a concentrated food supply, and conversely, expand their activity when food becomes scarce. Such localization of activity has often given game managers the false impression that their food plots have attracted deer from other areas.

Admittedly there are individuals that will not conform to the generalizations given above. Such exceptions are probably few, however, and in considering management implications, are insignificant.

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CAPTURING SNIPE WITH MIST NETS [1]

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ABSTRACT

During the winters of 1967-68 and 1968-69, 1,015 common snipe (*Capella gallinago*) were banded on a fresh water marsh in north

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