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Jay S. Gashwiler
Bureau of Sport Fisheries and Wildlife
1027 Trenton Avenue
Bend, Oregon

Deer Mouse Movement in Forest Habitat

Early, economical stocking of deforested areas is a major problem of foresters in the Douglas-fir (*Pseudotsuga menziesii*) belt. Many factors adversely affect regeneration efforts, such as animals, disease, weather, and others. Of the animals, deer mice (*Peromyscus maniculatus*) have received much attention because of their abundance and consumption of tree seed. The deer mouse movement in forest habitat is of importance in direct seeding operations in the Douglas-fir belt. It is recognized that *Peromyscus* soon occupy underpopulated habitat (Hooven 1963; Spencer 1955; Gashwiler 1959). Although much of this colonization is probably the result of movement from surrounding areas (Blair 1940; Stickel 1946; Hooven 1953; Gashwiler 1969b), specific data on the movement of animals in forest habitat are scantily documented. It was with the hope of adding to the understanding of this movement, and thus aiding foresters, that these data were compiled.

The investigation was made from October 1955 until October 1958 inclusive, on the H. J. Andrews Experimental Forest in Lane and Linn counties, Oregon, near the town of Blue River. The forest is located within the boundaries of the Willamette National Forest on the west slope of the Cascades. It includes the entire watershed of Lookout Creek, a tributary of Blue River.

A 48-acre clearcut (5B) and adjacent forest were selected for study. This area has an elevation ranging from about 2900 to 3500 ft and a southerly slope of about 18 percent. The terrain is bench-like alternating with steep slopes, and the soil is porous clay loam of volcanic origin (Berntsen and Rothacher, 1959). Interpolating the Berntsen-Rothacher precipitation data on the basis of elevation gives a rough estimate of about 113 inches of moisture per year.

The old-growth timber on the study area was mostly overmature and was starting to deteriorate. Percentages of sound timber logged on the clearcut were: Douglas-fir 87 percent, western hemlock (*Tsuga heterophylla*) and others 12 percent, and western redcedar (*Thuja plicata*) 1 percent. The clearcut was burned in October 1955. It was covered with ashes and charred wood when this investigation was started the latter part of the month. By the end of the study, three years after burning, total ground coverage was estimated to be about 14 percent woody plants (including coniferous reproduction) and 16 percent herbaceous species.

Methods

General study plans were to live-trap and mark deer mice on the grid in the clearcut. Soon afterward, generally the next day, lines of live-traps within the timber were also operated to live-trap, mark, and recapture the deer mice to determine the movement between the clearcut and adjacent timber (Fig. 1).

Large Sherman live-traps with wool bedding were used to capture the deer mice. They were baited mostly with scratch feed containing yellow cracked corn, wheat, and oats. The scratch was fortified with and sometimes replaced by oats during warmer periods. Traps on the grid were tended for six consecutive nights during

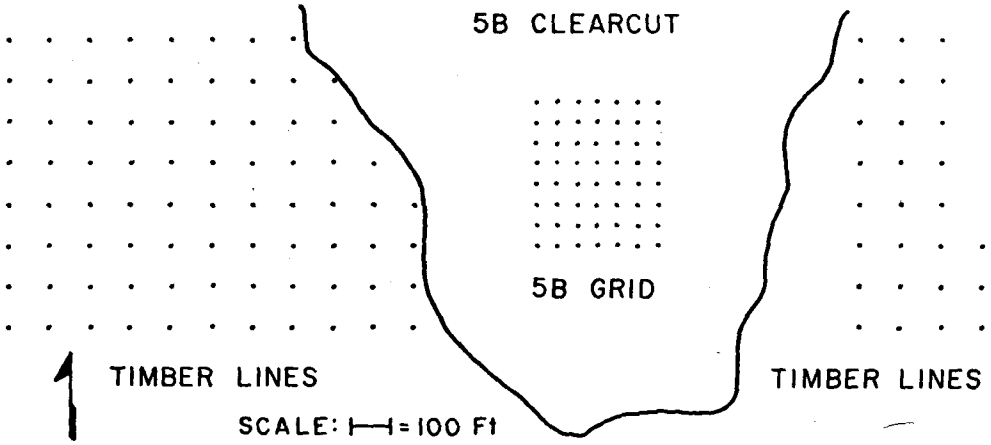

Figure 1. Map of the lower part of the clearcut showing trap sites on the grid and timber lines.

each trapping period. Ordinarily, they were run in the morning; during hot, dry periods they were kept closed during the day and opened in the evening, primarily to reduce mortality of chipmunks (*Eutamias townsendii*). Live-traps in the timber were run for three-night periods, in most cases immediately after the grid trapping. The traps were checked once a day and were left open when tended. Monel fingerling tags were used to ear-tag the animals.

The trap arrangement for the movement study is shown in Figure 1. The grid was located near the center of the east-west clearcut boundaries; trap sites were in an 8-by-7 pattern with 50-ft spacing. The trap lines used to determine deer mouse movement were placed at 100-ft intervals in adjacent timber east and west of the live-trap grid. The nearest line of traps in the timber was about 300 ft from the grid in the clearcut, and the farthest about 1700 ft.

Data were analyzed by chi-square and analysis of variance methods. The 95 percent level was selected as the criterion of significance.

In discussing results, deer mice captured and marked on the grid in the clearcut are referred to as grid deer mice, and those captured in the timber trap lines as timber deer mice.

Results and Discussion

Percentage of Recaptures

The monthly percentage of grid deer mice recaptured on the timber lines ranged from 6 to 52 and averaged 24 (Table 1). This suggests a high, relatively constant rate of interchange between the clearcut and adjacent timber trap sites when one considers that movements of less than 300 ft and over 1700 ft were not measured and that only part of the surrounding forest was sampled. The highest percentage (52) of recaptures occurred in October 1955, immediately after the clearcut was burned for cultural purposes. The fire apparently caused the deer mice temporarily to desert the clearcut for safety in the adjacent forest (Gashwiler, 1959).

TABLE 1. Number of deer mice tagged on the clearcut grid and the number and percentage recaptured on the timber lines.

Year and month	No. tagged	Tagged mice recaptured (timber)	
		Number	Percent
1955—October	21	11	52
1956—May	17	4	24
June	27	11	41
July	20	7	35
August	15	6	40
September	17	5	29
October	21	7	33
November	21	9[a]	43
Sub-total for 1955 and 1956	159	60	38
Average	20	8	---
1957—October	64	4	6
1958—May	37	4	11
October	37	3	8
Sub-total for 1957 and 1958	138	11	8
Average	46	4	---
Grand total	297	71	24
Average, all years	27	6	---

[a] Trapped two days but adjusted for three.

No definite pattern of movement in relation to months was apparent (Table 1). Movement data for 1955 and 1956 were uniformly high, averaging 38 percent, compared with 8 percent for 1957 and 1958. Plant coverage on the clearcut was sparser in 1955 and 1956 than in 1957 and 1958, suggesting a lower abundance of deer mouse plant food. This scanty food supply may have caused the mice to range more widely to meet their food requirements. This assumption agrees with Dice (1941) and Stickel (1960), who found that *Peromyscus* were more mobile under poor than good food conditions. Deer mouse population densities may have also influenced the degree of movement. The average number of deer mice tagged (Table 1) in 1955 and 1956 (20) was less than half that of 1957 and 1958 (46). This suggests that deer mouse movement is also probably greater for light than for heavy population densities. This relationship was found true for wood mice (*Peromyscus leucopus*) in Maryland (Stickel, 1960).

The possible influence of the fall of tree seed on deer mouse movement was also investigated. Although the annual seed crop was not measured on the study area, samples (seed trapping) obtained elsewhere in the Andrews Forest were probably indicative of the relative seed fall there. The number of sound (probably viable) seeds of Douglas-fir and western hemlock that fell on a clearcut in the Andrews Forest was estimated at 2400, 3500, and 14,600 per acre respectively in 1955, 1957, and 1958 (Gashwiler, 1969a), but was 158,500 per acre in 1956. This offered an opportunity to determine whether a relatively heavy seed crop attracted clearcut (grid) deer mice to the more heavily seeded forest. Isaac (1943) gave data that showed the Douglas-fir and hemlock seeds, which were from 200 to 1000 ft within the clearcut, were only one-sixth of those in the virgin forest. The seed dispersal

pattern for 1956 was as follows: The Douglas-fir and hemlock seed fall started slowly; only a trace (300 per acre) had fallen by the first third of September. By the first third of October, about 16 percent (25,800 per acre) of the total crop was shed; this increased to about 18 percent (27,700 per acre) during the first third of November.

Deer mouse recaptures for 1956 had considerable monthly variability, ranging from 24 to 43 percent with much overlapping and no marked trend toward increasing recaptures in adjacent timber as seed fall progressed (Table 1). Recaptures for the pre-seed-fall period (May to September inclusive) averaged 34 percent compared with 38 percent during seed fall (October and November) when about 28,000 sound seed per acre had fallen. These data suggest that the heavier seed fall in the timber did not attract deer mice from the clearcut to the forest habitat, at least not strongly. Since the clearcut was only lightly vegetated, and plants which produced food were probably at a low level, these results gain added credence. However, many factors were probably involved, and more information is needed to establish definitely that a heavy seed fall does not attract clearcut deer mice to the forest edge.

Sex and Age of Travelers

Questions are sometimes raised about the relative amount of movement between sexes and between ages of deer mice. The data from the grid traps were compared with those from the timber lines. If the timber line recaptures showed the same percentage of males to females and of adults to juveniles as the original captures on the grid, and vice versa, it could be inferred that movement by sex class and by age class was essentially similar.

Although monthly variations occurred, averages for the sex and age classes were similar (Table 2). The chi-square test showed no significant difference in sex and age class composition between deer mice captured on the clearcut and those

TABLE 2. Sex and age ratios of deer mouse catches by site and by month of capture or recapture.

Year and month	Total No.		Sex (% male)		Age (% adult)	
	Grid	Timber lines	Grid	Timber lines	Grid	Timber lines
1955						
October	21	11	48	27	90	100
1956						
May	17	4	59	50	100	100
June	27	11	41	55	100	100
July	20	7	45	29	85	86
August	15	6	47	50	100	100
September	17	6	35	50	82	100
October	21	7	62	71	76	86
November	21	9	52	56	71	89
1957						
October	64	13	56	77	100	100
1958						
May	37	4	54	100	34	75
October	37	8	43	25	34	100
1959						
May	4	0	50	0	4	0
Total and average	301	86	50	52	92	95

in the timber. Factors affecting movement probably had about the same influence in the two habitats. Thus it was concluded that movement was not directly attributable to any particular sex or age class.

In a California investigation, Brant (1962) found no consistent difference in movement of *Peromyscus* between sexes; however, he had poor representation of breeding females with their smaller movement patterns. He also indicated that most dispersal was by adults. On the other hand, Howard (1949) reported that juvenile *Peromyscus* in Michigan were the most active in dispersal movements. It should be recognized that dispersal is not the same as the ordinary day-by-day movements of the animals. It is apparent that differences exist in the various accounts of the relationship of sex and age classes to movement among deer mice. Many factors probably influence movement, and some variation in patterns should be expected.

Travel Distances

The distance traveled by deer mice is of importance in reforestation of clearcuts by seeding. It should also be considered when new clearcuts are planned in the vicinity of old ones, with their relatively heavy deer mouse populations which could quickly populate a new area. In this study, some of the travel distances included movement to and from the clearcut and timber; it is assumed they could move either direction with equal facility. Seventy-seven percent of the recaptured deer mice were originally tagged on the clearcut grid, and the other 23 percent on the timber lines. During this investigation, some travel data were secured by comparing the number of deer mouse recaptures per trap at various distances, and by averaging the recapture travel distances.

Recaptures per trap. The distances traveled by deer mice from the grid to the forest were determined by comparing the number of recaptures per trap at the various distances (Fig. 2). The greatest number of mice per trap were captured in the 251- to 350-ft belt. These were the nearest traps to the grid and a heavy catch was expected there. A large number of deer mice were also caught per trap in the 351- to 450-ft belt. These data indicate that a large number of deer mice traveled at least 450 ft from the grid. However, the catch per trap dropped to a relatively low level at a distance of 451 to 1350 ft, suggesting that many deer mice from the grid did not range so far. These data suggest that most of the deer mouse travel was probably less than 450 ft from the grid. About 300 ft of this would have been in the clearcut and 150 ft in the timber. Although this probably approximates the travel distance of deer mice to and from the forest, it should be kept in mind that because of trap placement, low and high movements are not represented. In addition, many mice moving from the grid probably moved beyond the effective range of the line traps, especially at the longer distances, and thereby reduced the number of recaptures.

Average distances. The individual monthly trapping distances between the grid and timber lines were also averaged (Table 3). Examination of the table shows some monthly variation in the average travel distances of males (774 ft) and females (638 ft). These data agree with the findings of Blair (1940), Stickel and Warbach (1960), and Stickel (1968), who reported that adult males generally have greater movement (larger home ranges) than adult females. However, statistical analysis revealed no significant difference between sexes and between months. When data

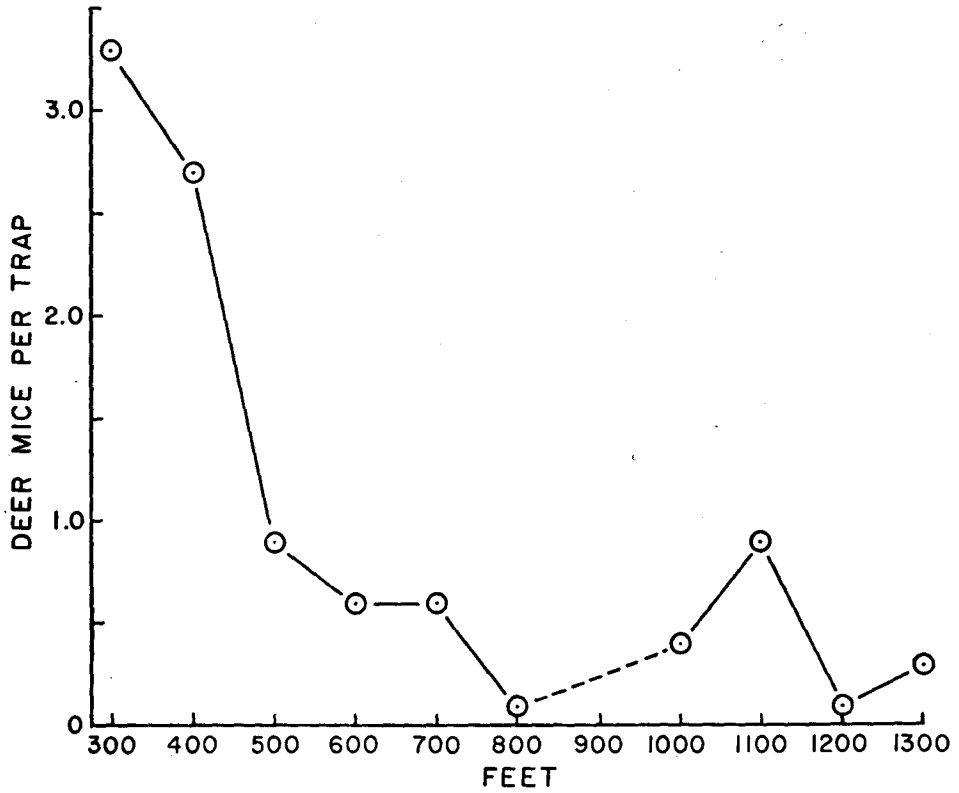

Figure 2. Number of deer mouse recaptures per trap on the timber lines at progressively greater distances from the grid in the clearcut. Distances measured at 100-ft intervals from nearest point on the grid.

TABLE 3. Average distance traveled (number of feet between the most widely separated capture sites for each animal) between the grid and timber lines by sex and by month.

Year and month	Male		Female		Total	
	No. mice	Av. distance (ft)	No. mice	Av. distance (ft)	No. mice	Av. distance (ft)
1955						
October	3	875	8	741	11	768
1956						
May	2	975	2	501	4	738
June	6	554	5	709	11	625
July	2	947	5	641	7	637
August	3	1,033	3	495	6	764
September	2	1,103	3	391	5	676
October	5	823	2	472	7	723
November	5	740	4	556	9	658
1957						
October	3	511	1	610	4	536
1958						
May	4	717	0	0	4	717
October	1	540	2	1,112	3	921
Total	36	774	35	638	71	698

on both sexes were combined, the travel distance averaged 698 ft. The maximum travel recorded was between 1400 and 1500 ft.

The data suggest that deer mice normally move about 450 to 700 ft to and from the clearcuts and adjacent timber. Since movements of less than 300 ft are not represented in the averages, it seems likely that a 700-ft belt around the perimeter of the clearcuts would include many of the deer mice that repopulate the logged areas. In efforts to alleviate the movement of deer mice into direct seeded clearcuts, this 700-ft belt would appear to merit special consideration.

Number of Trips between the Clearcut and Timber

Data were compiled to show the number of trips (originating at either point) made between the clearcut and forest by the deer mice. These data included all (126) recorded travel distances between the two areas. The number of trips and percentage of the deer mice making them are: 1—69 percent, 2—16, 3—3, 4—5, 5—2, 7—2, 8—1, 10—1, and 14—1 percent. The deer mouse who made 14 trips between the clearcut and forest is unusual and of particular interest. It was an adult male and made these trips between October 1955 and November 1956 inclusive; 13 trips were made monthly between May and November 1956. In three instances when traps were closed on the clearcut and opened the same day in the forest area, this animal made the change-over and was caught the next day at the new site. This suggests frequent, perhaps daily, movement of some of the deer mice beyond the clearcut. These data on trips are considered to be minimum figures. However, they reveal considerable movement of deer mice to and from the clearcut and timber. This movement helps to explain the high rate of population turnover of deer mice (Hooven, 1958). It also supports the conclusion of Stickel (1968) that deer mice probably have good knowledge of the terrain surrounding their home range.

Summary

In this study, 24 percent of the deer mice captured on the clearcut were also recaptured the same month in the timber. The greatest number (52 percent) was caught immediately after the clearcut was burned; no monthly recapture pattern was apparent. Food resources and population densities may have influenced the mobility of deer mice. Heavy tree seed fall did not strongly attract deer mice from the clearcut to the forest, and sex and age did not significantly influence movement, although adult males had greater average ranges than adult females. The number of animals recaptured per trap and the average travel data indicated that most of the deer mice traveled from about 450 to 700 ft between the clearcut and the timber. Forest deer mice living within this distance of clearcuts probably cause much of the repopulation problem in forest regeneration by direct seeding.

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