THE EFFECTS OF SOME ATMOSPHERIC VARIABLES ON ROADSIDE ACTIVITY IN THE COTTONTAIL RABBIT

By Richard L. Payne and Ernest E. Provost
S.E. Cooperative Wildlife Disease Study, School of Veterinary Medicine, and School of Forestry, University of Georgia, Athens, Georgia.

ABSTRACT

The widespread use of road counts in estimating population trends emphasizes the need for information on factors influencing animal behavior patterns. The present study, conducted on the Atomic Energy Commission Savannah River Plant in South Carolina, attempted to relate the atmospheric variables of Temperature, Relative Humidity, Vapor Pressure Deficit, and Barometric Pressure to numbers of rabbits (*Sylvilagus floridanus*) seen during morning and evening activity peaks along a specially selected 30-mile route. The route was driven twice in each 24-hour period from July 31 to September 4, 1964. Sling psychrometer readings were taken at five permanent points along the route each time it was counted and the averages converted to the appropriate variables by use of the U. S. Department of Commerce Psychrometric Table No. 235. Barometric pressure was obtained at the beginning of each peak activity period from the U. S. Department of Commerce Weather Bureau at Augusta, Georgia.

The limited number of observations available from this study suggest that although little if any correlation exists between rabbit activity and either temperature or vapor pressure deficit, a positive correlation does exist between activity patterns and both barometric pressure and relative humidity.

INTRODUCTION[1]

It has long been suspected that animal activity patterns are influenced by atmospheric variables. Despite the obvious impact which such factors could have on many wildlife census data, only limited work has been done in this area. Information on roadside activity of rabbits is contained in the reports by Alkon (1961) and Lord (1963) for New York and Illinois, respectively, but to our knowledge no such studies have been conducted in the southeast. This paper summarizes a preliminary investigation on the effects of temperature, relative humidity, vapor pressure deficit and barometric pressure on roadside activity of cottontail rabbits (*Sylvilagus floridanus*). The study was conducted in portions of Aiken and Barnwell Counties, South Carolina, on the Atomic Energy Commission Savannah River Plant (SRP) between July 26 and September 4, 1964. Despite the numerical limitations in our data we present them here as a possible stimulus to further investigation in this important area.

METHODS

An initial study route was selected for high rabbit concentration on July 25, 1964. This route traversed the SRP for 25.7 miles and covered portions of roads 2, F, E, B, and 9 (Figure 1). Permanent points for gathering psychrometric data were set up at five road junctions as follows:

Point No.	*Location*	*Dist. from start*	*Dist. from previous station*
1	Jct. 2&D	.....	.....
2	Jct. 2&F	4.2 mi.	4.2 mi.
3	Jct. F&E	10.7 mi.	6.5 mi.
4	Jct. F&B	17.5 mi.	6.8 mi.
5	Jct. 9&A	25.7 mi.	8.2 mi.

A speed of 35 m.p.h. was selected as the appropriate rate at which to

[1] Journal Series paper number 136 of the University of Georgia College of Agriculture Experiment Stations, College Station, Athens, Georgia.

MAP OF RABBIT STUDY AREA

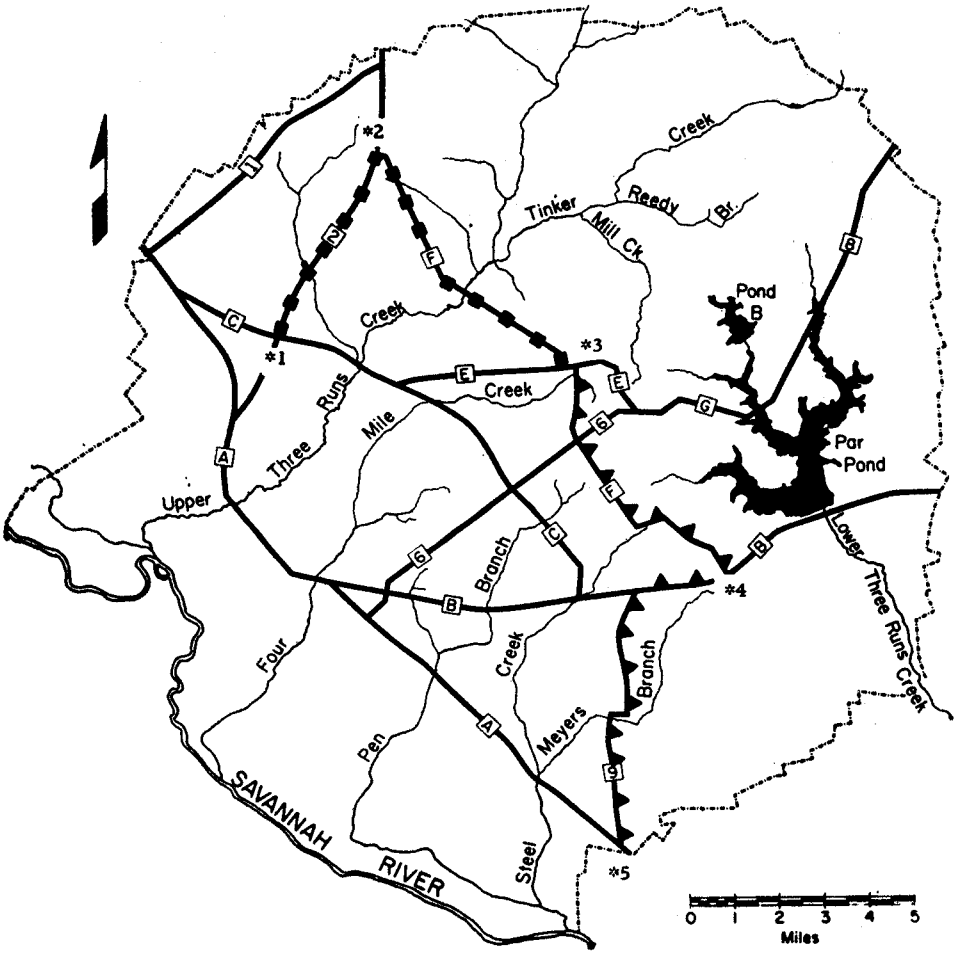


FIGURE 1

travel this route in order that each trip from point number one to point number five could be made in one hour. This period of time included fifteen minutes used for obtaining sling psychrometer readings at each point along the study route.

The route was traveled continuously between the hours of 6 p.m. and 6 a.m. every night for a period of five nights from July 26 through July 31, 1964. This permitted determination of the periods and areas of peak roadside rabbit activity. Based on this information, a permanent study route of 30 miles was established within the original route, covering portions of roads E, F, B, and 9, running from point three to point five and back again. This new route was then traveled during the two

periods of peak nighttime activity from July 31 to September 4, 1964. Five sling psychrometer readings were taken on each trip through the study area at points three, four, five, four, and three, respectively, and numbers of rabbits seen along the roadside were recorded. Each trip was made in one hour by driving at the original speed of 35 m.p.h. A check was made on August 19, 1964, to determine if the two periods of peak roadside activity had shifted. This was done by traveling the study route one hour before, during, and one hour after the presumed peaks.

Temperature, vapor pressure deficit, and relative humidity readings were obtained throughout the study by averaging the five wet bulb-dry bulb psychrometer readings obtained in the field during each period of peak activity. The average psychrometer readings were converted to the appropriate variables by use of the United States Department of Commerce Psychrometric Table No. 235. Barometric pressure was obtained at the beginning of each peak activity period from the United States Department of Commerce Weather Bureau at Augusta, Georgia.

At the termination of the study the range of each of the variables was divided into five equal portions and the average number of rabbits seen at each of these divisions over the entire study was determined. Animals were counted during 36 morning and 37 evening peaks, but results of the study are drawn from only 31 morning and 29 evening peaks, since rain, which drastically reduced activity, was encountered during the other periods.

RESULTS

Activity Peaks

A total of 83 rabbits had been counted at the end of 60 hours of all-night riding during the preliminary five nights of the study. The portions of roads selected for the permanent route produced 86.7 percent of this total. The percentage of the total activity observed with respect to time during the five nights is shown in Figure 2. These data indicate two periods of peak roadside rabbit activity, an evening peak between the hours of 7 and 8 p.m. and a morning peak from 5 a.m. to 6 a.m. Despite the ill-defined morning peak these two periods are considered reliable because heavy rain was encountered on two of the five observations made at each of these time intervals, but no rain occurred at the other periods. Only one rabbit was seen during rain throughout the entire study. However, in a check made on August 19, 1964, it was found that the peaks had shifted one-half hour earlier in each case. Therefore, the new peaks were considered to be from 6:30 to 7:30 p.m. and 4:30 to 5:30 a.m., and the time of traveling the route was shifted accordingly.

Atmospheric Variables

At the termination of the complete study a total of 102 rabbits had been counted from July 26 through September 4, 1964, during the two nightly periods of peak roadside activity. Results of the attempt to correlate rabbit activity with temperature are presented in Table I and Figure 3. These data do not indicate any particular correlation between

TABLE I — COMPARISON OF NOCTURNAL RABBIT ACTIVITY AND TEMPERATURE SRP — JULY 26 - SEPTEMBER 4, 1967.

	Temp. (°F)	*No. observations*	*Avg. no. rabbits/30 mi.*
	60-63	2	1.00
	64-67	5	1.00
	68-71	11	2.45
A.M.	72-75	11	2.02
	76-79	2	0.50
		Total 31	
	69-71	1	0.00
	72-74	4	0.00
P.M.	75-77	9	2.92
	78-80	8	1.44
	81-83	7	0.86
		Total 29	

Rabbits
Periods of Peak Roadside Activity
SRP—July 26 - July 31, 1964

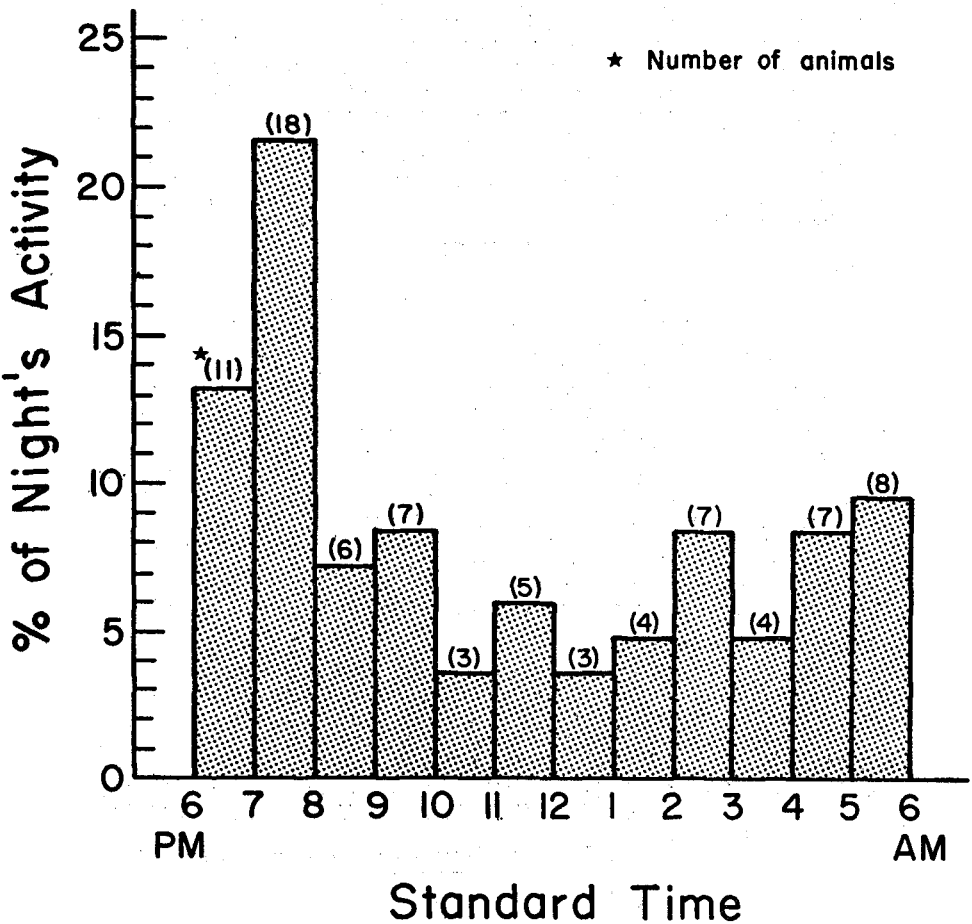
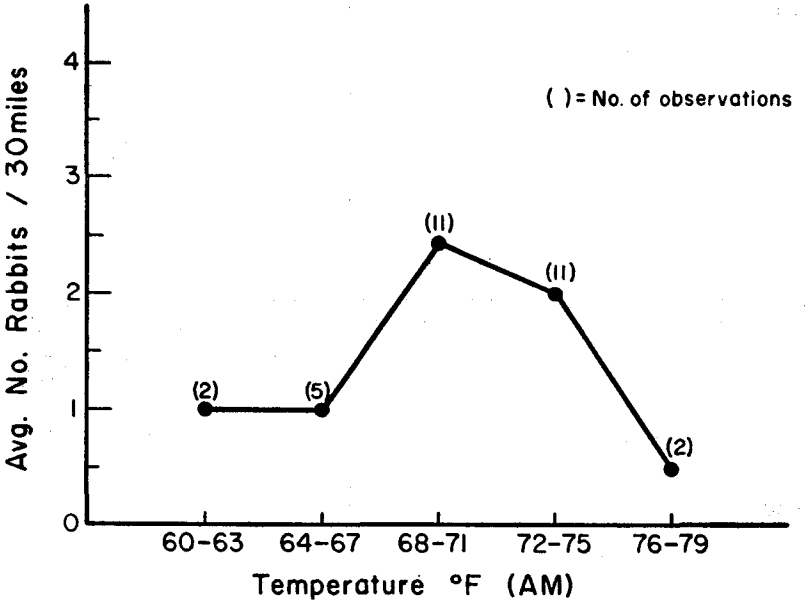


Figure 2

Roadside Rabbit Activity *vs.* Temperature

SRP — Summer 1964



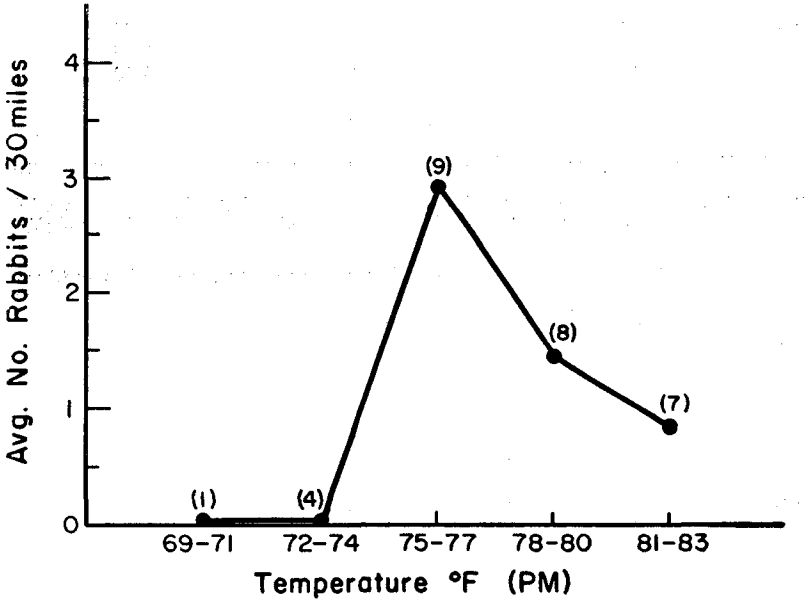


Figure 3

temperature and rabbit activity. Attempts to correlate vapor pressure deficit and rabbit activity also proved futile (Table II and Figure 4).

TABLE 2 — COMPARISON OF NOCTURNAL RABBIT ACTIVITY AND VAPOR PRESSURE DEFICIT SRP—JULY 26-SEPTEMBER 4, 1967

	Vap. press. def.	*No. observations*	*Avg. no. rabbits/30 mi.*
	.025-.054	17	2.25
	.055-.084	7	1.86
A.M.	.085-.114	4	.50
	.115-.144	2	1.00
	.145-.174	1	2.00
		Total 31	
	.030-.081	1	3.00
	.082-.133	10	1.43
P.M.	.134-.185	13	1.73
	.186-.237	2	0.50
	.238-.289	3	1.00
		Total 29	

Data concerning relative humidity and roadside rabbit activity, presented in Table III and Figure 5, however, suggest more correlation. Similarly,

TABLE 3 — COMPARISON OF NOCTURNAL RABBIT ACTIVITY AND RELATIVE HUMIDITY SRP—JULY 26-SEPTEMBER 4, 1967

	Relative humidity(%)	*No. observations*	*Avg. no. rabbtis/30 mi.*
	80-83	2	1.50
	84-87	4	.75
A.M.	88-91	6	1.50
	92-95	15	2.03
	96-99	4	2.93
		Total 31	
	72-76	1	0.00
	77-81	5	0.80
P.M.	82-86	12	0.79
	87-91	10	2.73
	92-96	1	3.00
		Total 29	

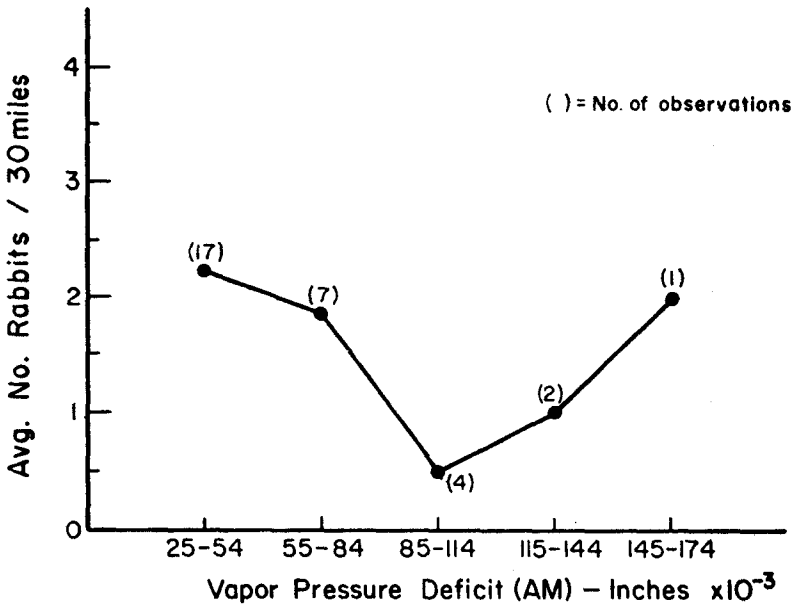
Table IV and Figure 6 indicate that barometric pressure exerts con-

TABLE 4 — COMPARISON OF NOCTURNAL RABBIT ACTIVITY AND BAROMETRIC PRESSURE SRP—JULY 26-SEPTEMBER 4, 1967

	Barometric press.	*No. observations*	*Avg. no. rabbits/30 mi.*
	29.655-29.729	3	0.67
	29.730-29.804	4	2.00
A.M.	29.805-29.879	15	1.68
	29.880-29.954	7	2.14
	29.955-30.029	2	3.50
		Total 31	
	29.665-29.734	5	1.00
	29.735-29.804	8	1.25
P.M.	29.805-29.874	8	1.25
	29.875-29.944	6	1.42
	29.945-30.014	2	4.00
		Total 29	

Roadside Rabbit Activity *vs.*
Vapor Pressure Deficit

SRP — Summer 1964



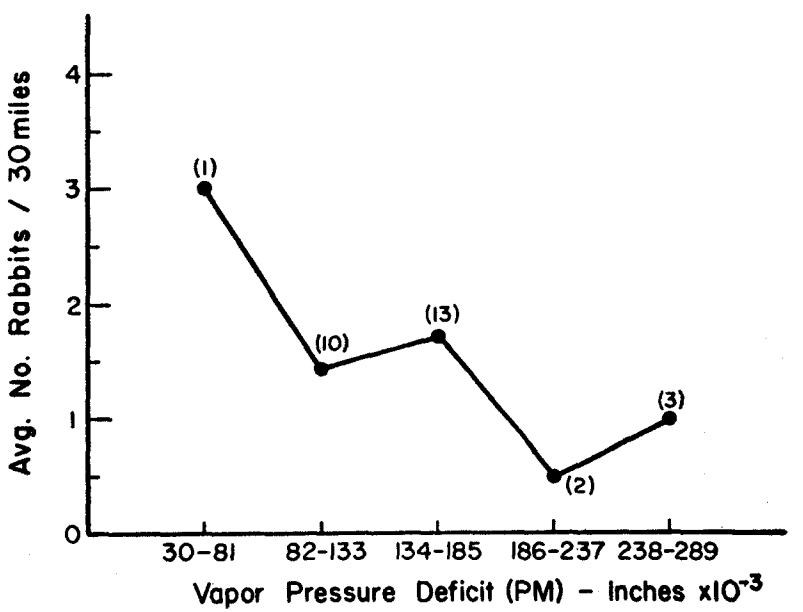
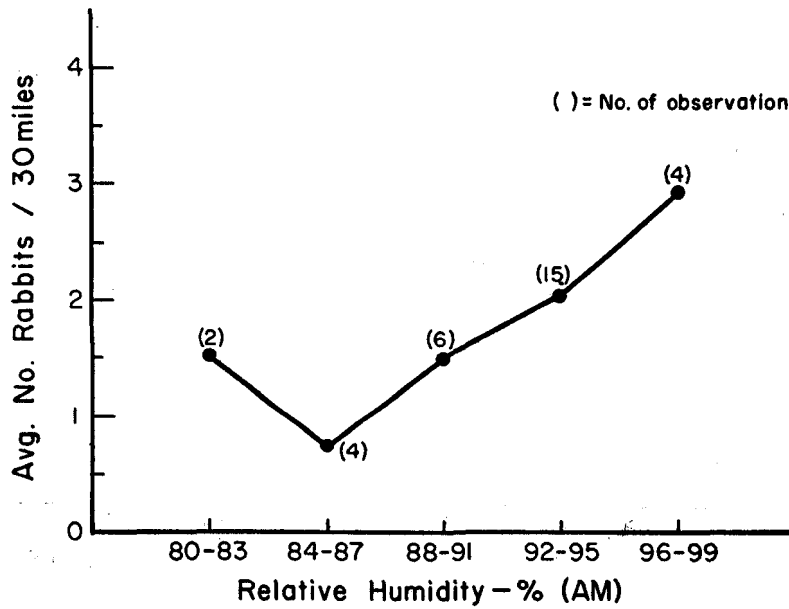


Figure 4

Roadside Rabbit Activity *vs.* Relative Humidity

SRP — Summer 1964



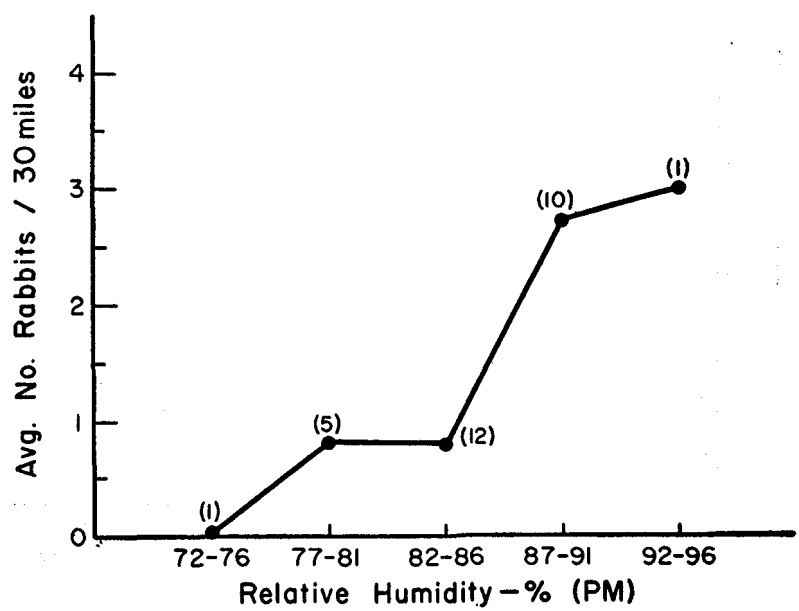
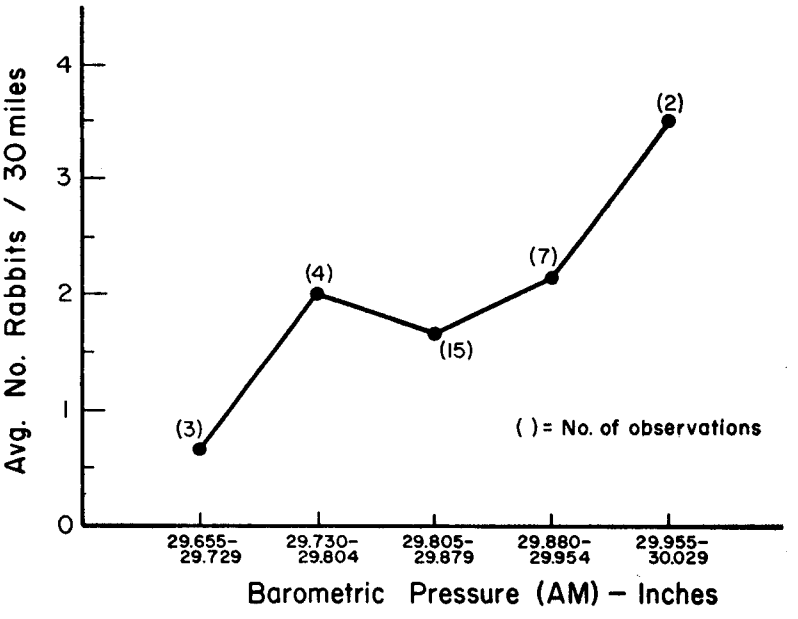


Figure 5

Roadside Rabbit Activity *vs.* Barometric Pressure

SRP — Summer 1964



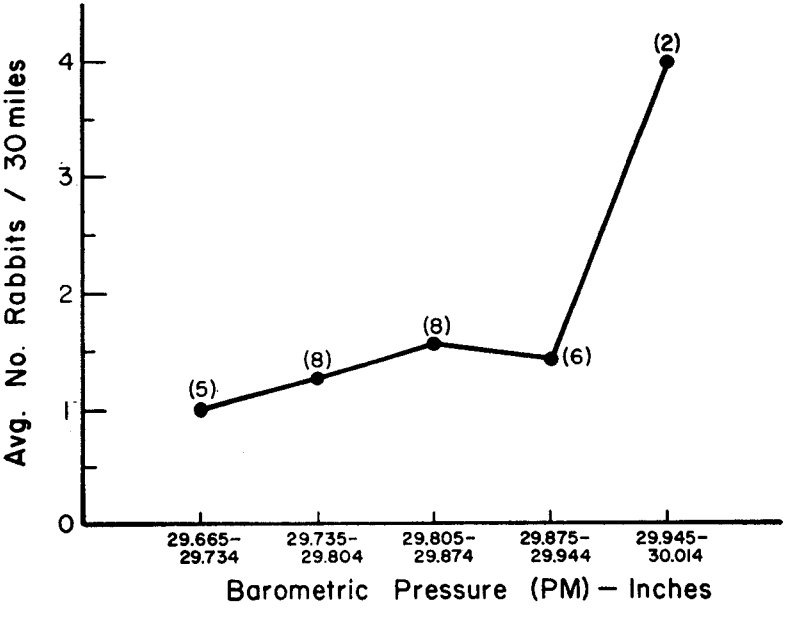


Figure 6

siderable influence on rabbit activity patterns. Data as to the effect of rising or falling barometric pressure are insufficient to warrant any attempt to obtain a correlation because the barometer was rising in all cases during the study with the exception of three mornings and one evening.

DISCUSSION AND CONCLUSIONS

Although the data obtained in this study are considered reliable, the conclusions drawn therefrom must be considered tentative because of the limited number of observations and the fact that the observations were not evenly distributed throughout the five divisions of the variables. The low number of rabbits counted is partially explained by the fact that the months in which the study was conducted are probably at the bottom of the yearly cycle of roadside rabbit activity. This cycle seems to be directly correlated with breeding activity, and inversely correlated with amounts of herbaceous vegetation (Lord, 1963).

The times of peak activity agree closely with the results of the more extensive Illinois study (Lord, 1963). The shift of the evening peak to an earlier time by August 19 may have reflected the decrease in hours of daylight. No explanation is available for the shift of the morning peak unless the two periods are related, temporarily, in rabbit activity patterns.

No apparent correlations exist in our data between the variables of temperature and vapor pressure deficit, and the activity of cottontail rabbits. In a New York study, however, Alkon (1961) did suspect that rabbit activity was inversely correlated with temperature. However, a direct correlation between rabbit activity and relative humidity does seem to exist. The only significant deviation from this statement is found in the two lowest divisions of the A.M. Relative Humidity range (Figure 5). An average of twice as many rabbits were seen at relative humidities of 80-83 percent as were seen at 84-87 percent. However, only two observations were made at the lower division. It should be noted here that the terms "relative humidity" and "vapor pressure deficit" do not necessarily indicate the converse of one another. For example, a vapor pressure deficit of .100 at a temperature of 80°F indicates a relative humidity of about 91 percent, while the same vapor pressure deficit at 60°F shows the relative humidity to be only 81 percent. Both relative humidity and vapor pressure deficit vary with temperature, but relative humidity is the percent of saturation in all cases.

A direct correlation between rabbit activity and barometric pressure is also indicated (Figure 6). It is true that all variables used in this study, with the exception of temperature, vary with barometric pressure. But in all cases a barometric pressure of 30 inches of mercury was used in calculation of the other variables. It is not likely, therefore, that barometric pressure alone is the controlling factor on rabbit activity. If it were, figure six would show more of a direct correlation than it does. The present data suggest that a combination of high barometric pressure and high relative humidity may stimulate rabbit activity.

LITERATURE CITED

Alkon, Philip U. 1961. Determination of summer cottontail rabbit age ratios. State of New York Annual Job Completion Report Investigations Projects. Project No. W-84-R-7. 6 pp. mimeo.

Lord, Rexford D., Jr. 1963. The cottontail rabbit in Illinois. Southern Illinois University Press, Carbondale. pp. 4445.