THE COMPARATIVE UTILITY OF PLANT LIFE-FORM AND OTHER VEGETATIONAL CHARACTERISTICS IN EVALUATING THE HABITAT OF THE COTTONTAIL

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CHAPTER I

INTRODUCTION

The eastern cottontail, Sylvilagus floridanus, the species dealt with in this study, occupies nearly two-thirds of the area of the contiguous United States, and is a common animal everywhere within this range (Hall and Kelson, 1959). In Oklahoma, and some other states, the cottontail is an important game species. If any animal species is to obtain or maintain a high status among game species with man's ever increasing population its habitat must be more definitively understood to be managed objectively. At present, however, the approach to habitat management for most species is highly generalized. This results from the fact that, in general, habitat identification still remains elusive in species definitive terms.

Ecological literature contains many definitions of the term habitat. Dice (1952) referred to habitat as the situation in which any community, species, or individual lives with other species or organisms as well as with the physical features of the habitat. Odum (1959) used the term habitat to mean the place where an organism lives. Elton (1949) defined habitat as an area which seems to possess a certain uniformity with respect to physiography and vegetation. Stebler (1958) defined habitat as a place where the species satisfies its vital needs, such as food, shelter, and living space. He stated further that habitat can be likened to a compound - a mixture of ingredients

essential to the satisfaction of vital needs. This view of habitat is somewhat similar to the partial-habitat of Yapp (1922). Yapp recognizes the partial-habitat as the habitat of an individual during any given period or stage of existence. Some habitat components of the cottontail, for example, would be cover used for escape, for resting, or for nesting.

Because of the wide geographical range of the cottontail, a present need is a description of its habitat based upon what may be recognized as common denominators (Stebler, 1958) or unifying characteristics. In order to do this, it is necessary to identify and describe individual habitat components or partial habitats using a classificatory system other than plant taxa. These categories of the system could be expected to be relatively uniform regardless of geographic district. It has been suggested that the concept of plant life-form as viewed by Peterson (1942) and by Stebler and Schemnitz (1955) may be the most common denomination, whereas most workers have employed other vegetational qualities for this purpose.

The purpose of this investigation is to examine the degree of utility of the concept of plant life-form in comparison with the more traditional methods of plant stem density per unit area and per cent of crown cover in describing the habitat of the cottontail in North Central Oklahoma. The life-forms, stem densities, and overhead coverage of plants at sites used for shelter, escape, cover, and for feeding are compared as to their relative values for defining and evaluating rabbit habitat. Food preference is also described to refine the vegetational analysis of feeding sites.

All of the data were gathered in western Payne County, Oklahoma, in the vicinity of Lake Carl Blackwell. Field work was accomplished between April 1966 and December 1967.

CHAPTER II

DESCRIPTION OF STUDY AREA

Location and Size

The area selected for this study is located nine miles west and one mile north of Stillwater adjacent to Highway 51 and to Lake Carl Blackwell, Payne County, Oklahoma (Fig. 1). It is in portions of sections 16 and 17, T19N-R1E. The study area is more or less a peninsula of approximately 500 acres (Fig. 2).

Land Use

Parts of the area are in heavy use by persons seeking outdoor recreation during much of the year. No hunting, cultivating, or grazing of livestock is allowed.

There are approximately 14 miles of interconnecting roads within the area. Many of the roadsides, especially those adjacent to the Lake, are mowed frequently throughout the growing season. Haying during late summer is done on some of the area.

Climate

The climate of the region is temperate, characterized by dry, hot summers and wet springs and falls. The annual monthly mean temperature for Stillwater over the past 30 years is 60.8 F. The mean precipitation

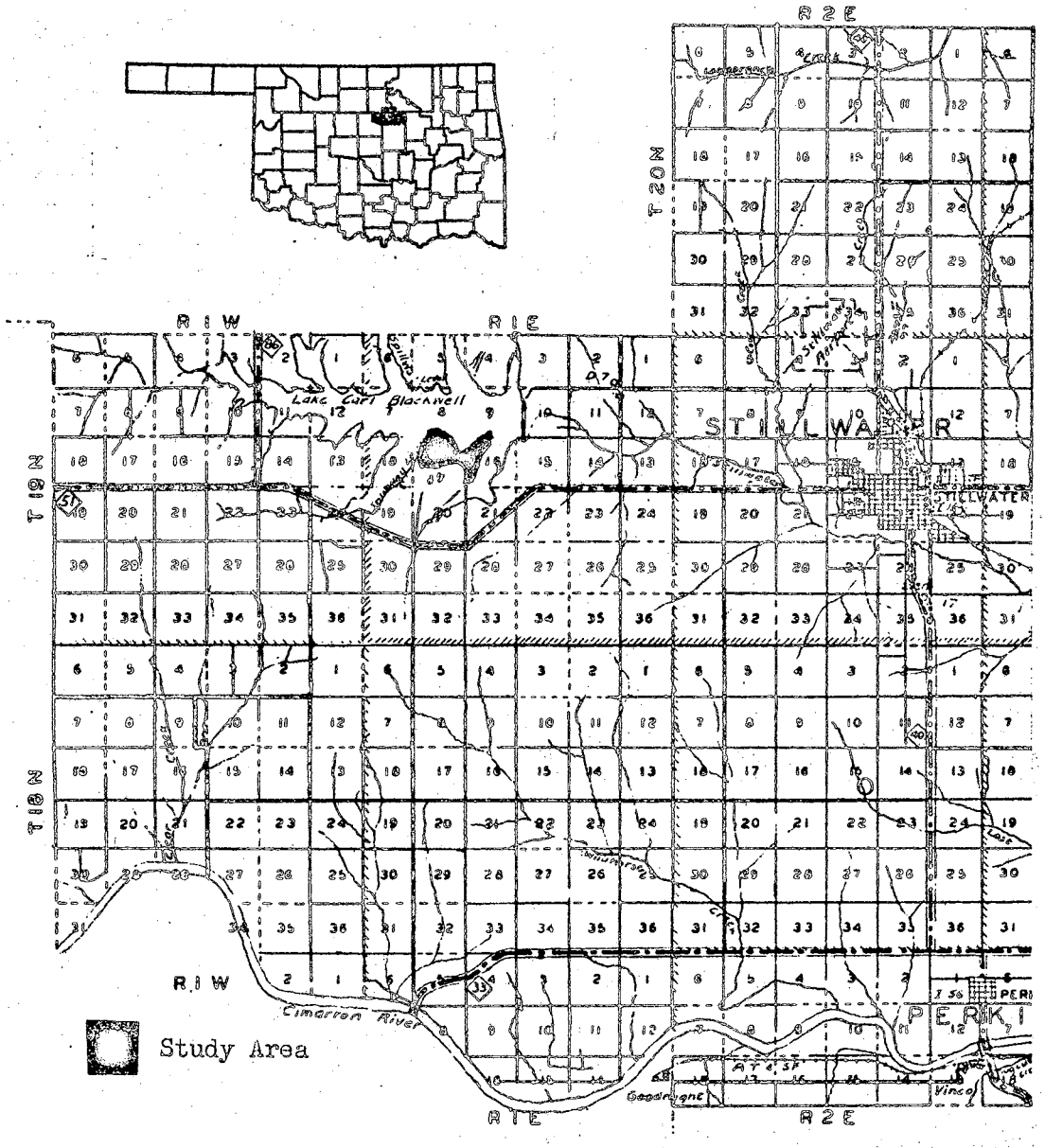

Figure 1. Western Payne County, Oklahoma.

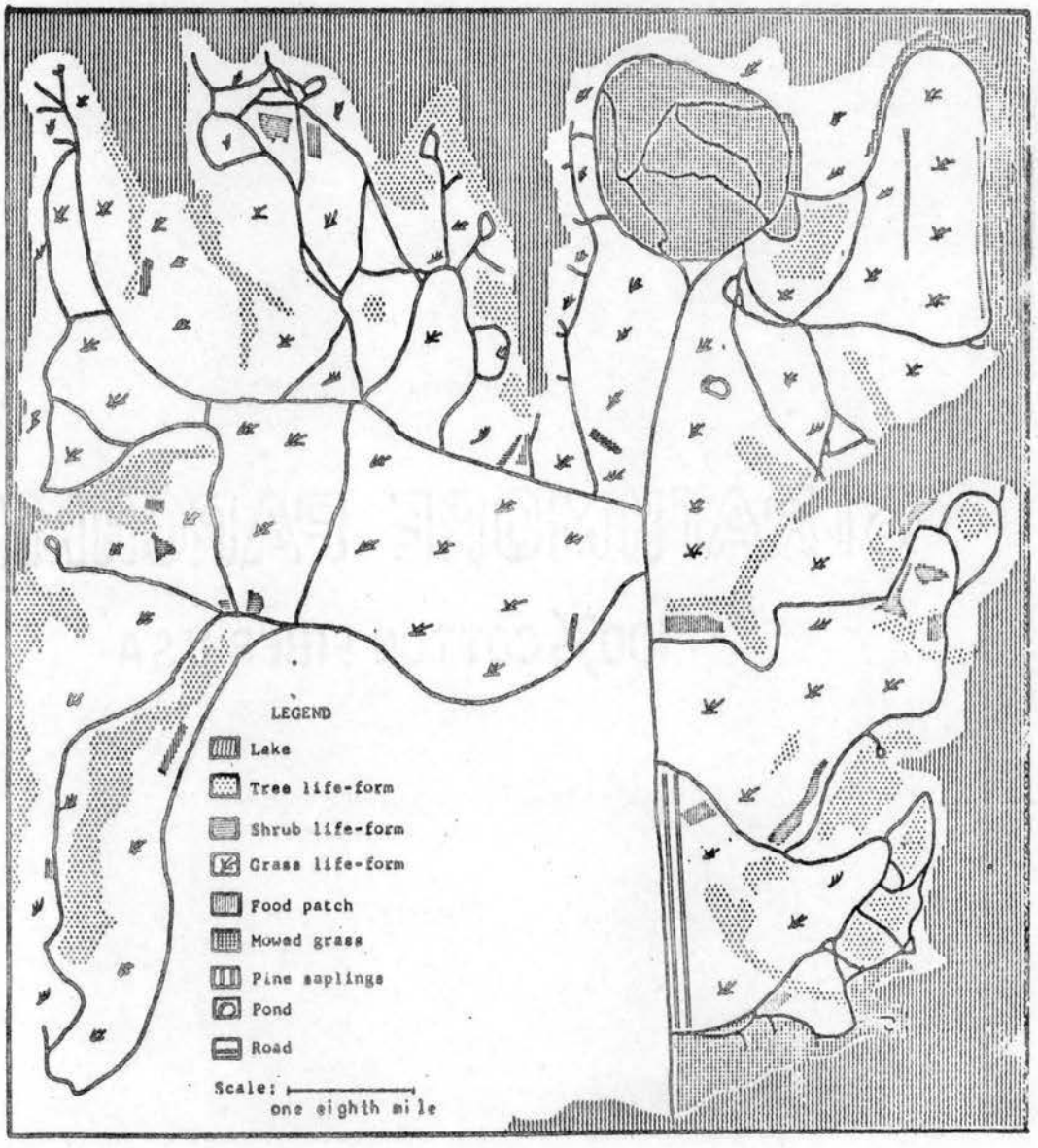

Figure 2. Principal Plant Life-Forms of the Study Area.

based on a 70-year period (1893-1962), is 33.07 inches. The highest monthly precipitation during the 70 year period occurred during the months of May and June.

Topography

The general topography is that of a gradual sloping toward the Lake. Table I reports the degrees and direction of slopes taken from 1000 quadrats placed 50 paces apart (see Chapter III). Of the 1000 quadrats, 73.8 per cent had slopes of 5 degrees or less. The predominant directions of the slope facings are north, east, and west (Table I).

Vegetation

Several descriptions of the vegetation of the general region are available (Bruner, 1931; Blair and Hubbell, 1938; Duck and Fletcher, 1945). In general, the vegetation of the study area is that of prairie interspersed with the "cross timbers" type and timbered ravines. Figure 2 shows the distribution and relative abundance of the major plant life-forms on the study area. This pattern is approximately the same as in the surrounding area.

CHAPTER III

METHODS

The study area was selected by making field surveys and roadside counts of cottontails in the general region. Reports from hunters also aided in the selection. The area chosen for study was the one found with the highest cottontail population density in the general region at the outset of the study. Rabbits were located by systematically walking the study area. In order to put observations made in different seasons on a comparable basis, a systematic walking over the entire area was made each season. The choice of dates for the beginning and end of a given season was arbitrary, since the duration of a given biological season, such as a growing season or dormant season, is an approximation which varies in some detail from year to year. The periods chosen for the different seasons are these: Spring (April, May, June), Summer (July, August, September), Fall (October, November, December), and Winter (January, February, March).

Analysis of Form Sites

In the present report, a form is defined as a specific place scratched out and shaped by a rabbit and commonly used as a resting place one or more times. At each site where a rabbit had taken shelter, as indicated by the presence of a current form, the encompassing vegetation was enclosed with a quadrat measuring 0.5 x 0.5 m and

examined. The enclosed plant species offering the principal overhead cover were classified according to stem density, height, and life-form. Stem density was estimated and recorded using a slight modification of the Hanson (1934) frequency-abundance method. The scale used was 1 = 1 to 4 stalks per quadrat; 2 = 5 to 14; 3 = 15 to 29; 4 = 30 to 99; and 5 = 100 and over. Height was measured in centimeters from the ground to the foliar crown. Overhead cover or canopy provided by the vegetation contained within the quadrat was determined by visually estimating the amount (in per cent) of ground obscured by the vegetation. A modification of DuRietz'a (1931) plant life-form system was used in classifying the principal plant life-forms associated with rabbit form sites. The term life-form is used in the present report in reference to plants. The life-forms were categorized into the following types:

I. Herbaceous plants

A. Grasses

1. Short grass -- less than 25 cm
2. Mid-grass -- 25 cm to 80 cm
3. Tall grass -- more than 80 cm

B. Forbs

1. Short forb -- less than 25 cm
2. Mid-forb -- 25 cm to 80 cm
3. Tall forb -- more than 80 cm

II. Woody plants

A. Tree -- distinct main trunk remaining unbranched in its lower parts.

B. Shrub -- stem branched from its basal parts.

Since man-made structures and natural features other than vegetation were often used by the rabbits, it was necessary to categorize such items as rocks, overhanging ledges, and artifices of various sorts.

Measurements were also made on two features of the topography upon which form sites were located. The degree of slope was recorded by means of placing a meter stick, whenever possible, across the form site and parallel to the direction of the slope and measuring the slope with a clinometer; otherwise it was estimated. The direction at right angle to the face of the slope upon which the form sites were located was estimated and recorded.

Analysis of Escape Sites

Vegetation used for retreat by a rabbit after being flushed from its form by the investigator was designated an escape site in the present study. The escape sites were divided, for analysis, into two categories, namely, the exact site of escape and the approximate site of escape. Data from the two categories, however, are considered collectively where possible. The exact escape site was one in which the rabbit was flushed a second time after fleeing from its form. The approximate escape site was one in which the location to which the rabbit fled after leaving its form had to be estimated.

The analysis of the vegetational and topographical characteristics of exact escape sites was the same as used for form site analysis.

The general description of approximate escape sites included: (1) the dominant plant life-form type with an estimate of its general height, and (2) the direction of the slope with an estimate of its deviation in degrees from the horizontal.

Analysis of Food Use and Feeding Sites

Plants used as food by cottontail rabbits were determined by direct observation on rabbit feedings. The direct observational method provides a satisfactory index to food use by the species, and usually reveals more kinds of food than other methods such as stomach and fecal pellet content analysis (Todd, 1927; Dalke and Sime, 1941; Sweetman, 1949; Dusi, 1952). During one observational period, a rabbit may have been observed to have eaten one or several different plants. Regardless of the quantity of a specific plant eaten by an individual rabbit during one observational period, or the number of times the same individual rabbit was observed eating a specific plant during the same observational period, it was recorded as one observation. This was done because the time spent eating is not necessarily an indication of the amount eaten, and one observational period approximates one feeding period. The short escape distance by many of the rabbits under observation facilitated close observation of feeding activity. At times, nonetheless, a binoculor was used as an observational aid.

After numerous field surveys it became apparent that the number of rabbits feeding in vegetation higher than 25 cm was extremely small and nearly impossible to observe. Thus, plants used for food were classified without regard to stem densities or overhead canopy into four life-form categories: (1) grasses, (2) forbs, (3) shrubs, and (4) trees. The observations were grouped seasonally with the dates for the beginning and end of a given season the same as described above. Notes were also made during observational periods on plants available to the rabbits for food at the site being observed. These were combined into a list of plants available to the rabbit during the activity of feeding.

CHAPTER IV

RESULTS

Form Site Characteristics

A total of 349 recent form sites were located and examined during the study. Rabbits were found in 176 of the form sites. The remaining 173 form sites were unoccupied (Table II).

Cover

The comparative use of the principal plant life-forms associated with form sites is shown in Table II. Form sites were most prevalent in the mid-grass life-form in all seasons. Of the 349 form sites examined, 123 (29.5 per cent) were found in the mid-grass life-form (Table III). The relative seasonal use of this life-form varied from 34.3 per cent of summer observations to 20.5 per cent of the winter observations.

The results brought together in Figure 3 suggest that a relatively high plant density is preferred by rabbits in the mid-grass life-form during all seasons. The mid-grasses providing principal form shelter were never found to have a density of less than 5 stalks per quadrat. Approximately 70 per cent of the total number of form sites having this plant life-form as principal cover were associated with a plant density greater than 30 stalks per quadrat (Fig. 3 and Table IV). A seasonal

shift in preference of plant density categories in the mid-grass life-form was not apparent (Table V).

More than 76 per cent of the total of the form sites in the mid-grass life-form had 50 per cent or more overhead coverage (Table VI and Fig. 4). Higher percentages of form sites in the mid-grass life-form with at least 70 per cent overhead canopy occurred in winter (77.8 per cent) and fall (67.6 per cent) than in spring (48.5 per cent) and summer (23.0 per cent) (Tables VII and VIII). The range in per cent of overhead coverage at form sites, however, was about the same for all seasons with the exception of one form site each in spring and summer in which the canopy provided only a 5 per cent overhead coverage (Fig. 4). This tendency toward greater overhead coverage in fall and winter at form sites is also seen when the form sites are grouped according to season and the amount of overhead cover (Table IX).

The data summarized in Table IV and in Figure 3 show that of the total number of form sites, structures other than vegetation ranked second in importance in providing principal cover. The comparative seasonal use of these structures was almost constant for summer, fall, and winter and less so in the spring. A list of the structures used is shown in Table XI. All of these structures have complete, or nearly complete, overhead cover (Fig. 4) during all seasons. Of the 63 form sites having structures other than vegetation as principal overhead cover, 17 (27 per cent) were found under overhanging ledges (Table X). These ledges were usually associated with arrested gullies from 25 to 50 cm in depth. Vegetation provided the shelter for both side and overhead, but the ledge itself provided most of the overhead cover. Ledges were used by rabbits for form shelters during all seasons.

Rocks ranked with boardwalks in being second in importance among other structures used for a form shelter. The data, however, do suggest a seasonal preference in the use of these two types of shelter. Rocks were used most often in fall and winter, while boardwalks were used only in summer and fall. Farm machinery, several boat piers, a post pile, and a propane tank were also used as form shelters only in the summer and fall seasons. Brush piles were used by rabbits most often in the winter.

Of the 349 form sites observed in this study, 49 (14.0 per cent) represented the shrub life-form. There was little indication of a seasonal change in the relative use of this life-form type (Table III). Most of the shrubs chosen for form shelter had densities of 1 to 4 stalks per quadrat. The data suggest that rabbits using the shrub life-form as a form shelter prefer a greater stem density in shrubs during winter than in other periods of the year (Table V).

The amount of overhead concealment provided by the shrub life-form at form sites was relatively high. Approximately 70 per cent of the form sites in the shrub life-form had 50 per cent or more overhead concealment. The data suggest little seasonal change in the amount of overhead cover preferred by rabbits using the shrub life-form for form shelter.

The tall-forb life-form was the principal cover of approximately 10 per cent of the total form sites located. The results show a slight tendency for rabbits to use the tall forbs more during winter than in other periods (Table III) and that the density of the tall forbs chosen by rabbits as form shelter increases in fall and winter (Table V). The amount of overhead concealment provided by the tall-forb life-form at

form sites was relatively high during all seasons. However, when the seasons are compared separately, the summer form sites in the fall forbs had the least amount of overhead coverage (Tables VII and VIII).

The mid-forb life-form was the principal cover for 33 form sites (9.5 per cent of the total found). The seasonal use of this life-form varied from 7.6 per cent of the fall observations to 14.1 per cent of the spring observations (Table III). The data show only a slight difference between the relative uses of this life-form during winter and summer.

Little seasonal preference for a particular plant density in the mid-forb life-form is apparent. Only during spring and summer were forms found in mid-forbs having 100+ stalks per quadrat (Table V).

The amount of overhead cover provided by the mid-forbs at form sites varied from 5 per cent to 100 per cent. Data collected from form sites in this life-form suggest no seasonal change in overhead cover preference (Table VII and Fig. 4).

The tall grass and the tree life-forms provided the principal overhead cover at 29 form sites each. There were, however, seasonal differences in their use. No forms had trees as their principal cover in winter. During the rest of the year the relative seasonal percentages for the use of the tree life-form remained about the same. All trees that provided overhead cover at form sites had a low density (Table V and Fig. 3), and provided a relatively high percentage of overhead coverage (Table VII).

Tall grasses provided overhead cover at form sites during all seasons, but were used mostly in the winter (Table V). During fall and winter the tall grasses used as form shelter had a density of not less

than 15 to 29 stalks per quadrat. Also, the tall-grass situations used by rabbits for form sites during fall and winter provided a relatively high percentage of overhead cover (Table VII).

Very few rabbit form sites were in the short-grass or the short-forb life-forms. Short grasses were not used as form shelter during winter, yet this was the only period in which short forbs were used for form shelter. The amount of overhead coverage provided by these two life-forms varied, but it was usually low (Table VI and Fig. 4).

The percentages of ground obscured by overhead canopy at form sites are shown in Table IX. Of the 349 form sites examined, 103 (29.5 per cent) had 100 per cent overhead cover. Over 75 per cent of the total form sites had at least 50 per cent overhead cover. During fall and winter, form sites were more commonly found in areas having more than 75 per cent overhead cover. In winter and fall, 2/3 to 3/4 of form sites were in areas with more than 75 per cent overhead cover and in spring and summer 1/3 to 1/2 of the form sites were in areas with more than 75 per cent overhead cover.

Table XI shows the relative abundance of plants associated with form sites in different seasons. The data suggest that no particular plant density is preferred in all seasons, but indicate that preferences vary seasonally.

The data at hand suggest that within any life-form rabbit density varies and that this variation may be attributed to the variation in the amount of overhead cover within the life-form. Thus, a relationship may exist between the life-form chosen as a form shelter and a particular life-form offering a relatively high per cent of overhead cover.

Escape Site Characteristics

A total of 170 escape sites were analyzed during the course of this study (Table XII). Of these, 98 were exact escape sites and 72 were approximate.

Cover

The relative importance of the principal plant life-forms associated with escape sites is shown by the data in Table XIII. Of the 170 approximate and exact escape sites, 46 (27.1 per cent) were in the shrub life-form. The shrub life-form was not, however, used to the same extent throughout the year. The lreative seasonal use of this life-form was 29.4 per cent, 38.2 per cent, 17.2 per cent, and 21.8 per cent of the spring, summer, fall, and winter observations, respectively (Table XIII).

Of the 46 escape sites having shrubs as their principal cover, 21 were exact escape sites. In general, shrubs associated with exact escape sites never had a density higher than 1 to 4 stalks per quadrat (Table XIV). Shrubs associated with exact escape sites in spring, however, had a density higher than this (Table XV and Fig. 5).

More than 70 per cent of the exact escape sites associated with the shrub life-form had 70 per cent or more overhead coverage (Table XVI). The overhead concealment provided by the shrubs at exact escape sites was never less than 20 per cent. The data collected at exact escape sites with shrubs as their principal cover do not suggest any seasonal change in the amount of overhead cover preferred (Tables XVII and XVIII). Approximately 73 per cent, 67 per cent, 72 per cent, and 67 per cent of the exact escape sites located during spring, summer,

fall, and winter, respectively, had 70 per cent or more overhead cover. This information suggests a preference by rabbits for a great amount of overhead cover at escape sites in all seasons regardless of the life-form furnishing the principal cover (Table XIX).

The data summarized in Table XIII show that of the total escape sites, structures other than vegetation ranked second in importance in providing escape shelter. A list of these structures is provided in Table XX. The relative seasonal use of these structures was least in summer. During the other seasons of the year they ranked first (Table XIII) in providing escape shelter. Most of these structures provided almost complete overhead concealment (Fig. 6). Of the 44 exact escape sites possessing a structure other than vegetation as principal cover, rocks formed the principal cover of 9. These were used as escape shelter in all seasons. In 7 instances each, brush piles and farm machinery were used as escape shelter. Brush piles were used in all seasons, while farm machinery was used mostly in the summer. Four observations were made on rabbits using road culverts as escape shelter. Piles of lumber, posts, and junk were used 3 times during the study. A small overturned boat and a wheelless truck bed were each used once as escape shelter.

The mid-grass life-form was used as escape shelter 23 times (13.5 per cent of all escape sites) during the study. The data (Table XIII), however, suggest a marked change in the relative seasonal use of this life-form. The mid-grass life-form provided principal escape shelter in only 5.9 per cent of the spring observations, while it accounted for 27.6 and 13 per cent of the fall and winter observations, respectively.

Of the 23 escape sites in mid-grass, 7 were exact escape sites and they all were used in either fall or winter. Figures 5 and 6 show that mid-grasses providing principal overhead cover at exact escape sites had high densities and provided a high percentage of overhead cover.

The tree and tall-forb life-forms each provided the principal cover at 17 escape sites. The relative seasonal use of the tree life-form was found to be 8.8 per cent, 12.7 per cent, 8.6 per cent, and 8.7 per cent of the spring, summer, fall, and winter observations, respectively. These data do not suggest a seasonal change in preference for either of these life-forms as escape shelter.

Six exact escape sites occurred in the tree life-form, which never exceeded a density of more than 1 to 4 stalks per quadrat (Tables XIV and XV). The range in the percentage of overhead cover provided by trees was 30 to 60 per cent (Table XVI and Fig. 6). There is no hint here of a preference for seasonal change in the amount of overhead cover at exact escape sites in the tree life-form.

The tall-forb life-form provided the principal overhead cover at 9 exact escape sites. At 7 of these sites, the tall forbs had a density of from 5 to 59 stalks per quadrat. At the other 2 sites found in this life-form, the tall forbs had a higher stem density (Table XIV). No seasonal change in preferred stem density of tall forbs at exact escape sites is indicated by the data.

The range in percentage overhead coverage provided by tall forbs at exact escape sites was 40 to 100 per cent (Table XVI and Fig. 6). The data collected from exact escape sites with tall forbs as their principal cover suggest no seasonal change in the preferred amount of overhead cover at escape sites (Tables XVII and XVIII).

Approximately 8 per cent of the total escape sites were in the tall-grass life-form. This life-form was used most in the summer accounting for 14.6 per cent of the summer observation and least in the fall comprising only 1.7 per cent of the fall observations.

Of the 5 exact escape sites in the tall-grass life-form, 3 were associated with a plant density of less than 14 stalks per quadrat, 1 with the 15 to 29 density category, and 1 with 30 to 99 density category (Table XIV). The tall forbs providing shelter at exact escape sites in winter had the higher densities (Fig. 5).

The amount of overhead concealment provided by the tall forbs at exact escape sites varied from 30 to 90 per cent. Although the tall forbs providing cover at exact escape sites in winter had a higher density than those associated with exact escape sites during other seasons, the amount of overhead concealment provided by them did not show an increase.

Of the 170 escape sites examined during the study, only 9 were in the mid-forb life-form. The relative seasonal use of this life-form varied from 2.9 per cent in the spring to 8.7 per cent in the winter.

Six exact escape sites were found in the mid-forb life-form. At 2 of these sites, the forbs had a density of 30 to 99 stalks per quadrat, at 3 sites the forbs had 15 to 29 stalks per quadrat (Fig. 5).

The amount of overhead cover provided by the mid-forbs at exact escape sites was variable but generally was more than 40 per cent (Fig. 6). No escape sites were found in the short-grass or the short-forb life-form. Table XXI shows the relative abundance of plants associated with exact escape sites. The data suggest a tendency to use sites having low stem densities.

Food Use and Feeding Site Characteristics

Feeding Sites

A total of 460 direct observations were made of feeding cottontails. These included 140 observations during spring, 201 during summer, 79 during fall, and 40 during winter. No rabbits were feeding in any vegetation higher than 25 cm. Such vegetation provided little, if any, overhead cover. Most of the vegetation of this type was man-induced through mowing or other roadside disturbances. Thus, the major feeding sites in all seasons were found to be along roadsides and on mowed areas.

Food Use and Availability

Table XXII is a list of plants available to cottontails during feeding activities. This list includes 35 grasses, 54 forbs, and 20 trees and shrubs.

Forty-five different species of plants were used by cottontails for food. These included 20 species of grasses, 21 species of forbs, 2 species of trees, and 2 species of shrubs. Of the plants considered available, rabbits used 57.4 per cent of the grasses, 38.8 per cent of the forbs, 18 per cent of the shrubs, and 25 per cent of the trees.

Spring Foods

Cottontails were observed feeding upon 14 different species of grasses and 12 species of forbs during the spring season. Trees and shrubs were not used as food at that time. Grasses served as food to

a greater extent than forbs. Grasses made up 71.5 per cent of the total feeding efforts observed in spring while forbs made up 28.5 per cent.

Among the grasses, Bermuda appeared to be the most favored. It was used in more than 22 per cent of the spring feedings. Crabgrass and Johnsongrass were also important accounting for 19.4 per cent and 14.3 per cent, respectively, of the total spring feedings observed. The remaining 11 species of grasses comprised 15.6 per cent of all spring feedings (Table XXIII).

Among the forbs, clover (Trifolium spp.) was the most important food, followed closely by white and yellow sweet clovers. These three plants made up 17.9 per cent of the total spring feedings. The remaining 9 forbs accounted for 10.6 per cent of the spring feedings.

Summer Foods

Grasses again were the principal food plants of rabbits in summer, accounting for 76.6 per cent of the summer feedings. The remaining 14 species comprised 16 per cent of the summer feedings (Table XXIV).

A total of 14 different species of forbs were identified as being fed upon by rabbits. They accounted for 21.9 per cent of all summer feedings. Clover (Trifolium spp.) ranked first among the forbs comprising 8.4 per cent of the feedings in summer. Six observations were made of rabbits feeding on puncture vine. Twenty-one observations on the remaining 12 species of forbs comprised 10.5 per cent of all summer feedings. Blackberry, oak, and elm were observed once each being used as food.

Fall Foods

Forty-four observations on 8 species of grasses comprised 55.2 per cent of all fall feedings. Bermuda ranked number one among grasses comprising 20.3 per cent of all fall observations, and brome and little bluestem made up 11.4 per cent and 8.8 per cent, respectively. Twelve observations of rabbits feeding on the remaining 5 species of grasses comprised 15.2 per cent of the fall feedings (Table XXV).

Six species of forbs also were fed upon by cottontails during the fall. Sweet clover, clover (Trifolium spp.) and Illinois bundle flower were the most important ones accounting for 11.4, 8.8, and 5.0 per cent, respectively, of all fall feedings. The remainder of the observations of forbs being eaten comprised less than 4 per cent of the fall feedings.

Trees and shrubs accounted for 15.2 per cent of all fall feedings. Observations of rabbits feeding on blackberry accounted for 13.9 per cent of total fall feedings. The use of elm as food was observed only once during the fall.

Winter Foods

During the winter period, 6 different species of grasses were fed upon by rabbits, accounting for 57.5 per cent of all feedings. Japanese brome comprised 32.5 per cent of all winter feedings while Bermuda grass comprised 12.5 per cent. Four species of grasses accounted for 12.5 per cent of all winter feedings (Table XXVI).

Four species of forbs comprised 22.5 per cent of the total winter observations of feedings. Clover (Trifolium spp.) accounted for 15 per cent of these.

Trees and shrubs accounted for 20 per cent of all winter feeding observations. Feedings on blackberry accounted for 12.5 per cent of all winter records. One observation each was made on rabbits feeding on sumac, oak, and elm during the winter.

CHAPTER V

DISCUSSION

Form Site Characteristics

In the present study, cottontails were found using a variety of plant life-forms and other habitat features as principal shelter for their form sites. In general, the provision of a high percentage of overhead canopy seems to be a common characteristic of form sites. While mensurational data of these features from studies in other localities are few, several investigators have given descriptions of the vegetation or structures providing cover at form sites that support the results of the present study.

In Oklahoma, Phillips (1936) states that cottontails are typically inhabitants of thickets, wooded ravines, weedy places, and other situations with abundant overhead cover. Jones (1959) found forms in grass clumps, brush piles, rock outcrops, and tree stumps in Kansas. In Iowa, Hendrickson (1938) observed cottontail forms in clumps of foxtail, in a planting of buckthorn, in a planting of cedars with branches close to the ground and unmown herbaceous growth around the trees, in a stove-wood stack, at the base of a lambsquarter plant with foxtail and crabgrass around it, at bases of corn hills or short leafy corn stalks, and in 8-inch water-main pipes lying on the ground. In Illinois, Lord (1963) found on one of his study areas that rabbits preferred a part of

the area planted with trees. He also states that open areas which have an Erigeron-Solidago consocies as the principal vegetation were well occupied by rabbits. Friley (1955) reported that the preferred situation for forms in Michigan was native herbaceous vegetation. Next in preference were brush and briars, oat stubble, woods, orchards, and marsh and marsh edges. The categories here are broad and the investigators do not take note of the amount of canopy at form sites. From this review, however, it is apparent that cottontails use a wide variety of cover types as shelter for their forms in any given locality and the descriptions of these cover types suggest, as was found in the present study, a preference for a dense overhead canopy. Thus, overhead canopy may provide a more definitive habitat description than plant life-form through a wider variety of conditions or circumstances.

Although there was no suggestion of a drastic seasonal change in life-form preference, this study tends to show that within a given life-form type there was a seasonal change in the amount of overhead cover preferred by rabbits at form sites. The seasonal changes in life-form preference that were observed are perhaps the result of rabbits shifting to more favorable overhead cover.

The results of the present investigation support the observations reported in other studies that cottontails prefer greater overhead concealment in fall and winter than in spring and summer. Workers in Michigan (Allen, 1939; Haugen, 1942; Linduska, 1947) have observed that use of heavy cover increases as air temperature decreases. It appears that in the selection of a form site it is the canopy of the vegetation that is primarily sought by the rabbit and not a particular plant life-form.

A preference for plants reaching a particular density at form sites was not apparent from the results of the present study. Denseness of overhead cover appears more important to rabbits than stem density. This is suggested from the side variety of vegetation types used for principal form shelters and from the fact that a higher stem density is required in some vegetational types than in others to provide the same amount of overhead concealment. Stem density at form sites seems not to be important except as it contributes to density of canopy.

Escape Site Characteristics

While specific data on escape cover used for retreat by rabbits were not found in the literature, several investigators have mentioned or implied that escape cover is "heavier cover" compared to that which is used as form cover (Friley, 1955; Haugen, 1942). According to the present study, a high percentage of overhead cover is preferred by rabbits at escape sites regardless of the type of life-form furnishing the principal cover and of the season. The data do suggest that, perhaps, greater overhead concealment is preferred at escape than at form sites (Tables X and XXI) during all seasons. Only 5.1 per cent of the escape sites found during the present study had 30 per cent or less overhead concealment, while 16.1 per cent of the form sites found had 30 per cent or less overhead cover. The data also show that the relative use of different plant life-form types preferred as escape shelter differed from that preferred at form sites and that the vegetation chosen as escape shelter generally had a lower stem density than that at form sites. This suggests that while a dense overhead canopy is

preferred by rabbits at escape sites, easy access is also sought. A low stem density presumably allows the rabbit greater maneuverability, visibility, and speed than could be had with higher stem densities. The seasonal change in relative use of plant life-forms for escape cover may be influenced by seasonal changes in the amount of overhead cover provided by plant life-forms and by the rabbit preferring a dense overhead canopy rather than a particular life-form.

For escape sites, the combination of overhead canopy and stem density provides a more definitive description of the escape component of the cottontail's habitat than does plant life-form.

Food Habits and Feeding Site Characteristics

Apparently an open situation is preferred for activities such as feeding, grooming, play, and courtship. In the present study no rabbits were observed feeding in areas that provided overhead cover. The rabbits were probably in open areas mainly for feeding since it was the major activity observed. On occasion, however, activities interpreted to be grooming, play, and courtship were observed in these places. The amount of time spent in these activities was not compared with that spent in feeding activity, but the time spent feeding was by far the greatest. There appears to be little requirement for shelter during these activities, yet these situations were within easy reach of good protective cover. Lord (1963) found that mowing an area would increase its use by rabbits; Bigham (1965) found that feeding cottontails were most numerous near farmsteads that had mowed lawns. A short-plant life-form, therefore, appears to be a common characteristic of feeding sites.

Forty-five species of plants fed upon by cottontails were identified. Seton (1937) states:

> ...to make a complete list of the plants that serve the cottontail as food would mean a catalogue of 99% of the flora of the United States. Nearly every kind of green grass, succulent herb or flowering plant, native or foreign, is acceptable to the cottontail.

Todd (1927) lists 73 species of plants eaten by cottontails in New York. Sweetman (1949) lists 64 species in 22 families that are extensively used by rabbits as food in Massachusetts. In Connecticut, Dalke and Sime (1941) recorded a total of 70 kinds of plants fed upon by rabbits. The broad geographic range of the cottontail suggests that it uses a wide variety of plants for food. The variety of plant species used as food by the cottontail also might indicate that food is not the most important management consideration (Dusi, 1952). However, the results of the present study indicate that the cottontail prefers certain food plants over others where an abundance of several kinds is present. This preference for certain species might results in a differential utilization of certain areas.

By changing the plant life-form through mowing or other methods, man can not only increase the utilization of an area but also increase the use of some plant species for food by the cottontail. Herbaceous plants made up the greater portion of the rabbit's diet in the present study. Grasses were the principal foods during all seasons with Bermuda grass being the most important. Most of the principal food species in the present study were those that can tolerate mowing. In areas where the plant species are kept short for long periods of time, rabbits will probably make more use of the species that can tolerate

such treatment. This perhaps could explain the preference shown in the present study and also the extensive use of some agricultural crops such as alfalfa.

In Connecticut, Dalke and Sime (1941) found that in the late fall and winter the rabbit changes from a diet of herbaceous plants to one of woody perennials. However, since snow was infrequent and did not remain on the ground longer than a day or two during the present study, cottontails probably were not forced to make extensive use of woody plants. Nevertheless, some shrubs were taken as food during every season except spring. On occasion some shrubs were fed upon as much as herbaceous plants, even when the latter were available in a succulent condition. The shrubs being eaten, however, were on the edge of a short-plant life-form type. Utilization of shrubs for food perhaps is increased by mowing or grazing around them so the rabbit can stay in a short-plant life-form type while eating them.

CHAPTER VI

SUMMARY AND CONCLUSIONS

From the result presented in the present study, it appears that of the three vegetational characteristics (life-form, stem density, and overhead canopy) life-form is the least specific indicator of where a rabbit goes to do a specific action. Plant life-form does appear to separate rabbit activity into different components to some degree. Most form sites were found in the mid-grass life-form, most escape sites were found in the shrub life-form, and feeding sites were found inthe short-grass life-form.

The result revealed that within each life-form there are variations of rabbit use that may be attributed to overhead canopy and stem density. Form sites within a life-form were found to be distributed where the overhead canopy was 50 per cent or more with little regard for stem density. Thus, overhead canopy offers a finer degree of distinction for the form site component of the cottontail's habitat than does plant life-form.

Most escape sites within a life-form were found distributed where overhead canopy was 70 per cent or more and stem density low. Thus, the vegetational characteristics of overhead canopy and stem density provides a finer degree of distinction for the escape site component of the cottontail's habitat than does the plant life-form. The phenology and distribution of plant species may temporarily affect the

palatability and feeding preferences causing variations in local concentrations of rabbits within the short-grass life-form in response to food selection.

Plant life-form is useful in distinguishing major activities of cottontails in a broad area but overhead canopy and stem density appear to determine the utility of the life-form in greater distinction. Therefore, in cottontail management first considerations should be given to the amount of area and interspersion of the proper plant life-forms. Secondly, consideration should be given to qualitative vegetational characteristics within each life-form such as stem density, overhead canopy, and food species in order to provide optimum habitat for the cottontail. Effective management requires that a life-form consist of the appropriate plant species which provide the necessary structural qualities. The plant species that are best suited to provide these necessary qualities will undoubtedly vary between localities because of differences in soil, climate, topography, and other features.

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APPENDIX A

FORM SITE CHARACTERISTICS
(TABLES AND FIGURES)

TABLE I

DEGREES AND DIRECTION OF SLOPE TAKEN
FROM 1000 QUADRATS 50 PACES APART

Degrees of Slope	O	N	NE	E	SE	S	SW	W	NW	TOTAL	% OF GRAND TOTAL
0	196	-	-	-	-	-	-	-	-	196	19.6
1	-	4	4	7	4	6	-	9	10	44	4.4
2-3	-	66	24	45	22	34	17	55	39	302	30.2
4-5	-	30	19	39	35	14	8	35	16	196	19.6
6-7	-	11	10	8	10	11	3	9	10	72	7.2
8-9	-	4	4	3	3	4	1	1	-	20	2.0
10-11	-	13	8	14	8	9	1	16	4	73	7.3
12-13	-	1	1	2	1	-	2	2	2	11	1.1
14-15	-	1	1	10	3	2	2	10	6	35	3.5
16-17	-	2	2	1	-	-	1	-	3	9	0.9
18-19	-	-	-	-	-	-	-	1	-	1	0.1
20-21	-	2	1	6	2	-	-	-	1	12	1.2
22-30	-	3	-	1	-	1	-	1	1	7	0.7
31+	-	3	2	4	-	6	1	4	2	22	2.2
TOTAL	196	140	76	140	88	87	36	143	94	1000	100
% OF GRAND TOTAL	19.6	14.0	7.6	14.0	8.8	8.7	3.6	14.3	9.4	100	-

TABLE II

FORM SITES LOCATED BY SEASON

Season	Occupancy of Form Sites: Rabbits Present	Rabbits Absent	Total
Spring*	34	30	64
Summer*	59	64	123
Fall*	58	60	118
Winter	25	19	44
TOTAL	176	173	349

*Includes data for two consecutive years, 1966-1967.

TABLE III

RELATIVE SEASONAL USE OF PLANT LIFE-FORM TYPES WHICH PROVIDE OVERHEAD COVER AT FORM SITES

	Spring		Summer		Fall		Winter		Total	
Life-Form	#	%	#	%	#	%	#	%	#	%
Tree	6	9.4	11	8.9	12	10.2	-	-	29	8.3
Shrub	9	14.1	17	13.8	16	13.6	7	15.9	49	14.0
Tall Grass	6	9.4	9	7.3	6	5.1	8	18.2	29	8.3
Mid-Grass	22	34.3	35	28.5	37	31.3	9	20.5	103	29.5
Short Grass	1	1.5	2	1.6	4	3.4	-	-	7	2.0
Tall Forb	6	9.4	13	10.6	9	7.6	6	13.6	34	9.7
Mid-Forb	9	14.1	11	8.9	9	7.6	4	9.1	33	9.5
Short Forb	-	-	-	-	-	-	2	4.5	2	0.6
Other	5	7.8	25	20.4	25	21.2	8	18.2	63	18.1
TOTAL	64	100	123	100	118	100	44	100	349	100

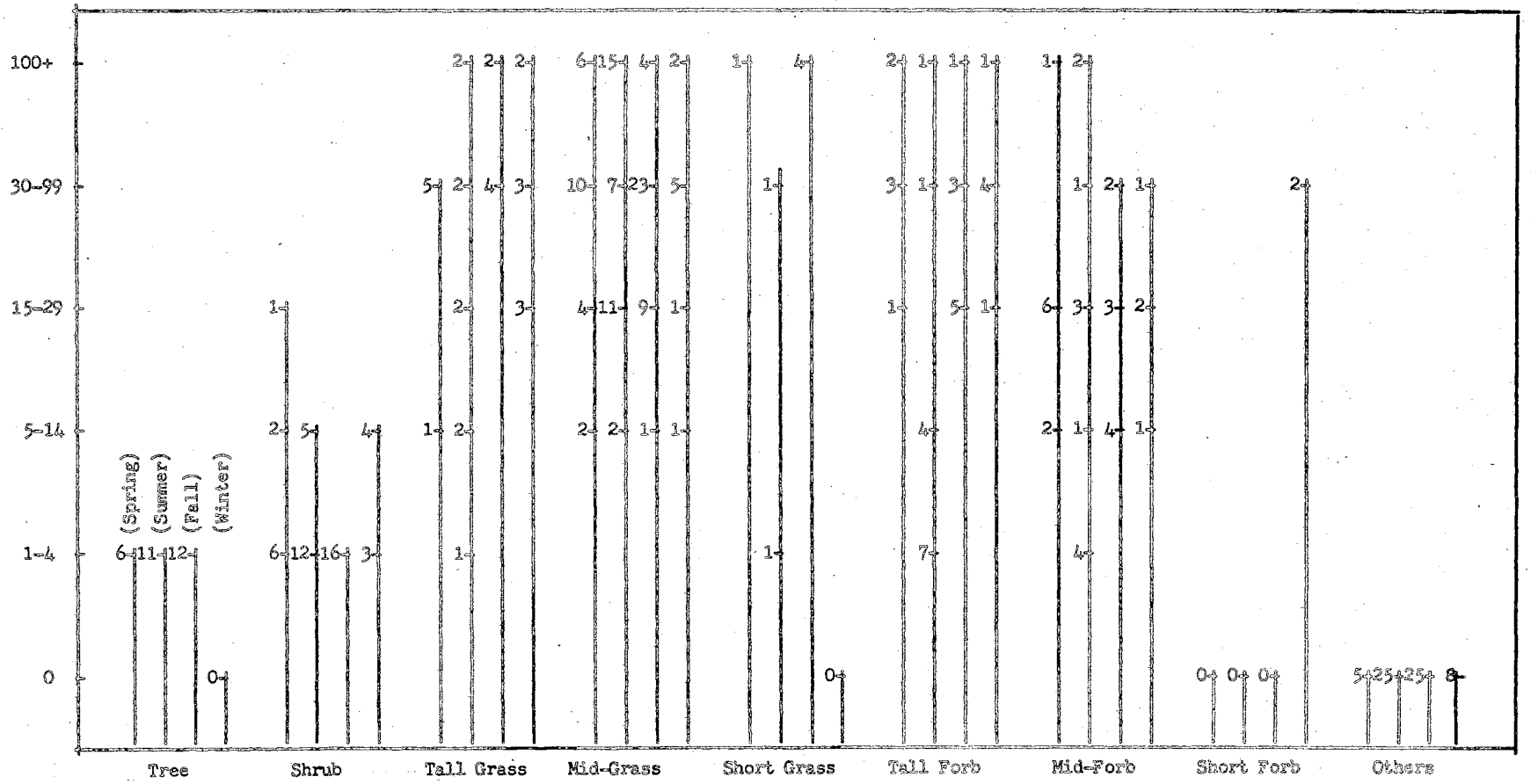

Figure 3. Relative Abundance (Plants/0.5 meter sq) of Plants in Life-Forms Associated with Form Sites. Numerals equal the number of observations for each density category for each plant life-form type.

TABLE IV

RELATIVE DENSITY OF PLANTS IN LIFE-FORMS
ASSOCIATED WITH FORM SITES

Plants/ 0.5 Meter Square	Life-Form															
	Tree		Shrub		TallGrass		Mid-Grass		ShortGrass		Tall Forb		Mid-Forb		ShortForb	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
1-4	29	100	37	75.5	1	3.5	-	-	1	14.3	7	20.6	4	12.1	-	-
5-14	-	-	11	22.5	3	10.3	6	5.9	-	-	4	11.7	8	24.2	2	100
15-29	-	-	1	2.0	5	17.2	25	24.4	-	-	7	20.6	14	42.5	-	-
30-99	-	-	-	-	14	48.3	45	43.7	1	14.3	11	32.4	2	12.1	-	-
100+	-	-	-	-	6	20.7	27	27.0	5	71.4	5	14.7	3	9.1	-	-
TOTAL	29	100	49	100	29	100	103	100	7	100	34	100	33	100	2	100

TABLE V

SEASONAL PREFERENCES FOR PLANT DENSITIES EXPRESSED IN LIFE-FORMS PROVIDING PRINCIPAL COVER AT FORM SITES*

Vegetational Life-Form	Plants Per 0.5 Meter Square																			
	1-4				5-14				15-29				30-99				100+			
	SP	S	F	W	SP	S	F	W	SP	S	F	W	SP	S	F	W	SP	S	F	W
Tree	100	100	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Shrub	66.6	70.6	100	57.1	22.2	29.4	-	42.9	11.2	-	-	-	-	-	-	-	-	-	-	-
Tall Grass	-	11.2	-	-	16.7	22.2	-	-	-	22.2	-	37.5	83.3	22.2	66.6	37.5	-	22.2	33.4	25.0
Mid-Grass	-	-	-	-	9.0	5.7	2.7	11.1	18.2	31.4	24.4	11.1	45.5	20.0	62.1	55.6	27.3	42.9	10.8	22.2
Short Grass	-	50.0	-	-	-	-	-	-	-	-	-	-	-	50.0	-	-	100	-	100	-
Tall Forb	-	53.9	-	-	-	30.7	-	-	16.7	-	55.6	16.7	50.0	7.7	33.3	66.6	33.3	7.7	11.1	16.7
Mid-Forb	-	36.4	-	-	22.2	9.1	44.5	25.0	66.6	27.2	33.3	50.0	-	9.1	22.2	25.0	11.1	18.2	-	-
Short Forb	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	-	-	-	-

*Numerals are percentages of total form sites found during the season in the particular life-form.
SP = Spring; S = Summer; F = Fall; W = Winter.

TABLE VI

RELATIVE OVERHEAD COVERAGE EXPRESSED IN LIFE-FORMS
ASSOCIATED WITH FORM SITES

% Overhead Coverage	Life-Form																	
	Tree		Shrub		TallGrass		Mid-Grass		ShortGrass		Tall Forb		Mid-Forb		ShortForb		Others	
	#	%*	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
0	-	-	-	-	-	-	-	-	1	14.3	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	2	1.9	3	42.8	-	-	4	12.1	-	-	-	-
10	-	-	1	2.0	1	3.4	8	7.8	-	-	-	-	1	3.0	1	50.0	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	3	9.1	-	-	-	-
20	3	10.4	5	10.2	1	3.4	-	-	1	14.3	1	2.9	3	9.1	-	-	-	-
25	-	-	2	4.1	-	-	4	3.9	-	-	-	-	1	3.0	-	-	-	-
30	2	6.9	1	2.0	1	3.4	2	1.9	-	-	1	2.9	2	6.1	1	50.0	-	-
35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	1	3.4	7	14.3	4	13.8	3	2.9	-	-	5	14.7	3	9.1	-	-	-	-
45	1	3.4	-	-	1	3.4	3	2.9	-	-	-	-	-	-	-	-	-	-
50	1	3.4	7	14.3	-	-	19	18.5	-	-	2	5.9	6	18.2	-	-	-	-
55	1	3.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	1	3.4	7	14.3	3	10.3	8	7.8	-	-	4	11.8	3	9.1	-	-	-	-
65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70	3	10.4	1	2.0	4	13.8	6	5.8	-	-	8	23.6	-	-	-	-	-	-
75	-	-	-	-	-	-	3	2.9	-	-	1	2.9	-	-	-	-	-	-
80	2	6.9	5	10.2	4	13.8	8	7.8	1	14.3	6	17.7	3	9.1	-	-	-	-
85	-	-	-	-	-	-	2	1.9	-	-	-	-	2	6.1	-	-	-	-
90	6	20.8	8	16.4	2	7.0	13	12.6	1	14.3	3	8.8	1	3.0	-	-	-	-
95	2	6.9	-	-	-	-	1	1.0	-	-	-	-	-	-	-	-	4	6.34
100	6	20.7	5	10.2	8	27.7	21	20.4	-	-	3	8.8	1	3.0	-	-	59	93.66
TOTAL	29	100	49	100	29	100	103	100	7	100	34	100	33	100	2	100	63	100

*Percentages are of total form sites found in the particular life-form.

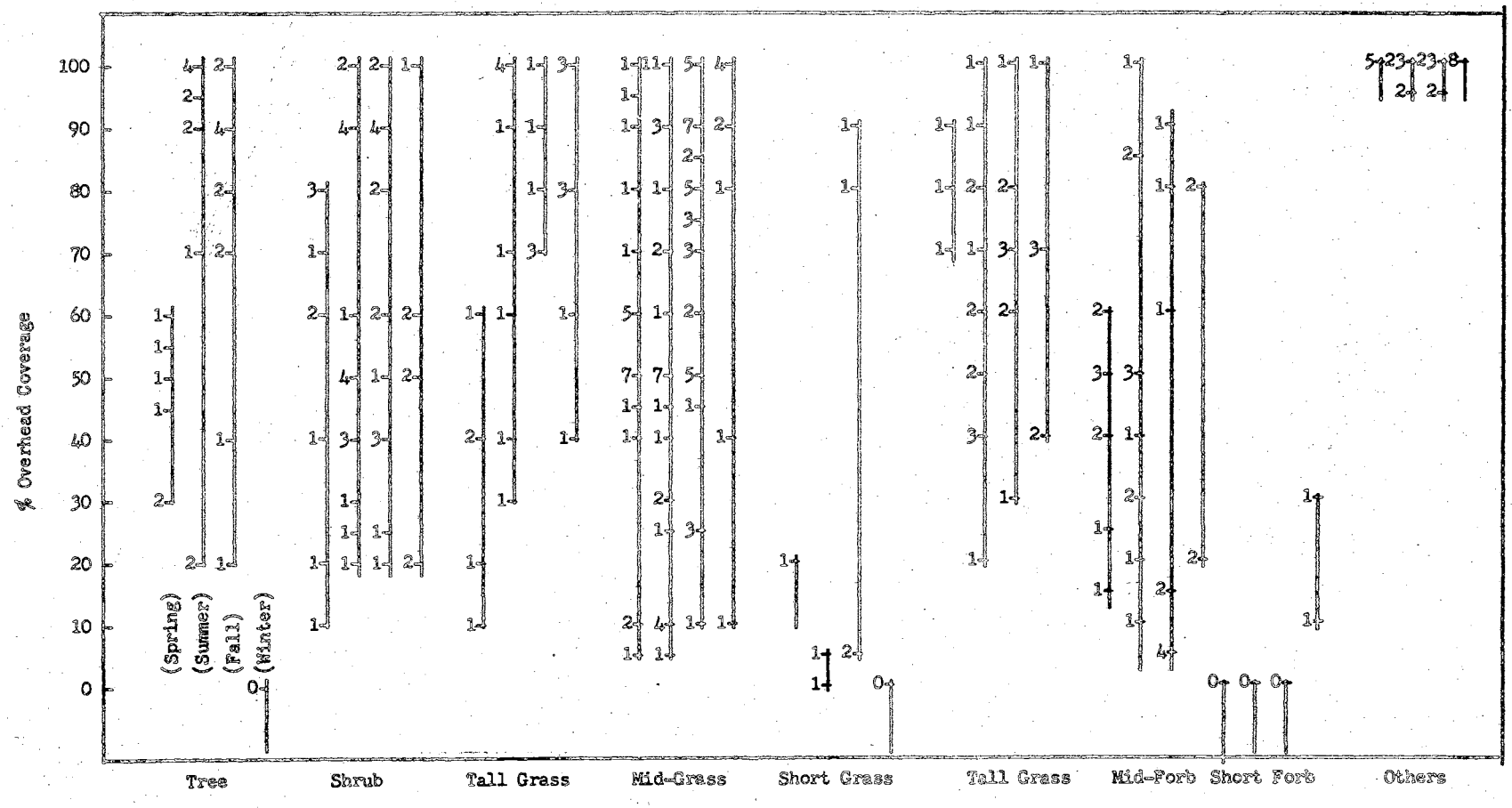

Figure 4. Relative Overhead Coverage (%) Expressed in Life-Forms Associated with Form Sites. The vertical lines represent the range in percent of overhead coverage, and the numerals equal the number of observations for each overhead coverage category.

TABLE VII

SEASONAL PREFERENCES FOR OVERHEAD COVERAGE EXPRESSED IN LIFE-FORMS PROVIDING PRINCIPAL COVER AT FORM SITES* IN SPRING AND SUMMER

	Life-Form															
	Tree		Shrub		Tall Grass		Mid-Grass		ShortGrass		Tall Forb		Mid-Forb		ShortForb	
Coverage	SP	S	SP	S	SP	S	SP	S	SP	S	SP	S	SP	S	SP	S
0	-	-	-	-	-	-	-	-	-	50.0	-	-	-	-	-	-
5	-	-	-	-	-	-	4.6	2.9	-	50.0	-	-	-	-	-	-
10	-	-	11.1	-	16.7	-	8.9	11.4	-	-	-	-	11.1	9.1	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	18.2	11.1	5.9	16.7	-	-	-	100	-	-	7.7	11.1	9.1	-	-
25	-	-	-	5.9	-	-	-	2.9	-	-	-	-	-	-	-	-
30	33.2	-	-	5.9	-	11.1	-	5.7	-	-	-	-	-	18.2	-	-
35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	-	-	11.1	17.5	53.2	11.1	2.6	2.9	-	-	-	23.0	22.2	9.1	-	-
45	16.7	-	-	-	11.7	-	4.6	2.9	-	-	-	-	-	-	-	-
50	16.7	-	-	23.5	-	-	31.7	20.0	-	-	-	15.4	33.3	22.2	-	-
55	16.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	16.7	-	22.2	5.9	16.7	11.1	22.6	2.9	-	-	-	15.4	22.2	-	-	-
65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70	-	9.1	11.1	-	-	11.1	4.6	5.7	-	-	33.3	7.7	-	-	-	-
75	-	-	-	-	-	-	-	-	-	-	33.3	-	-	-	-	-
80	-	-	33.4	-	-	-	4.6	2.9	-	-	16.7	15.4	-	-	-	-
85	-	-	-	-	-	-	-	-	-	-	-	-	-	18.2	-	-
90	-	18.2	-	23.5	-	11.1	4.6	8.5	-	-	16.7	7.7	-	-	-	-
95	-	18.2	-	-	-	-	4.6	-	-	-	-	-	-	-	-	-
100	-	36.3	-	11.9	-	44.5	4.6	31.4	-	-	-	7.7	-	9.1	-	-
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	-	-

*Numerals are percentages of total form sites found during the season in the particular life-form.
SP = Spring; S = Summer.

TABLE VIII

SEASONAL PREFERENCES FOR OVERHEAD COVERAGE EXPRESSED IN LIFE-FORMS PROVIDING PRINCIPAL COVER AT FORM SITES* IN FALL AND WINTER

% Overhead Coverage	Life-Form															
	Tree		Shrub		Tall Grass		Mid-Grass		Short Grass		Tall Forb		Mid-Forb		ShortForb	
	F	W	F	W	F	W	F	W	F	W	F	W	F	W	F	W
0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	50.0	-	-	-	44.5	-	-	-
10	-	-	-	-	-	-	2.7	11.1	-	-	-	-	-	-	-	50.0
15	-	-	-	-	-	-	-	-	-	-	-	-	22.2	-	-	-
20	8.3	-	6.2	28.6	-	-	-	-	-	-	-	-	-	50.0	-	-
25	-	-	6.2	-	-	-	8.1	-	-	-	11.1	-	-	-	-	-
30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50.0
35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	8.3	-	18.6	-	-	12.5	-	11.1	-	-	-	33.3	-	-	-	-
45	-	-	-	-	-	-	2.7	-	-	-	-	-	-	-	-	-
50	-	-	6.2	28.6	-	-	13.5	-	-	-	-	-	-	-	-	-
55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	-	-	12.5	28.6	-	17.5	5.4	-	-	-	22.2	-	11.1	-	-	-
65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70	16.7	-	-	-	50.0	-	8.1	-	-	-	33.4	50.0	-	-	-	-
75	-	-	-	-	-	-	8.1	-	-	-	-	-	-	-	-	-
80	16.7	-	12.5	-	16.6	37.5	13.3	11.1	25.0	-	22.2	-	11.1	50.0	-	-
85	-	-	-	-	-	-	5.4	-	-	-	-	-	-	-	-	-
90	33.3	-	25.0	-	16.7	-	19.0	22.2	25.0	-	-	-	-	-	-	-
95	-	-	-	-	-	-	-	-	-	-	-	-	11.1	-	-	-
100	16.7	-	12.5	14.2	16.7	37.5	13.5	44.5	-	-	11.1	16.7	-	-	-	-
TOTAL	100	-	100	100	100	100	100	100	100	-	100	100	100	100	-	100

*Numerals are percentages of total form sites found during the season in the particular life-form. F = Fall; W = Winter.

TABLE IX

RELATIVE PERCENTAGES OF OVERHEAD COVERAGE
OF FORM SITES IN DIFFERENT SEASONS

% Overhead Coverage	Spring		Summer		Fall		Winter		Total	
	#	%	#	%	#	%	#	%	#	%
0	-	-	1	0.8	-	-	-	-	1	0.3
5	1	1.6	2	1.6	6	5.1	-	-	9	2.6
10	4	6.2	5	4.1	1	0.8	2	4.6	12	3.4
15	1	1.6	-	-	2	1.7	-	-	3	0.9
20	3	4.6	5	4.1	2	1.7	4	9.1	14	4.0
25	1	1.6	2	1.6	4	3.4	-	-	7	2.0
30	2	3.2	6	4.9	1	0.8	1	2.2	10	2.9
35	-	-	-	-	-	-	-	-	-	-
40	6	9.4	9	7.3	4	3.4	4	9.1	23	6.6
45	3	4.6	1	0.8	1	0.8	-	-	5	1.4
50	11	17.2	16	13.0	6	5.1	2	4.6	35	10.0
55	1	1.6	-	-	-	-	-	-	1	0.3
60	11	17.2	5	4.1	7	5.9	3	6.8	26	7.4
65	-	-	-	-	-	-	-	-	-	-
70	3	4.6	5	4.1	11	9.3	3	6.8	22	6.3
75	1	1.6	-	-	3	2.5	-	-	4	1.2
80	6	9.4	3	2.5	14	11.9	6	13.6	29	8.3
85	-	-	2	1.6	2	1.7	-	-	4	1.2
90	3	4.6	11	8.9	18	15.3	2	4.6	34	9.7
95	1	1.6	4	3.2	2	1.7	-	-	7	2.0
100	6	9.4	46	37.4	34	28.9	17	38.6	103	29.5
TOTAL	64	100	123	100	118	100	44	100	349	100

TABLE X

STRUCTURES OTHER THAN VEGETATION WHICH PROVIDE OVERHEAD COVER AT FORM SITES

Structure	Season				Total	% Total
	Spring	Summer	Fall	Winter		
Overhanging Ledge	2	6	7	2	17	27.0
Rocks	1	1	5	2	9	14.3
Boardwalk	-	6	3	-	9	14.3
Farm Machinery	-	3	5	-	8	12.7
Cabin	2	3	2	-	7	11.1
Brush Pile	-	1	1	4	6	9.5
Boat Pier	-	3	2	-	5	7.9
Post Pile	-	1	-	-	1	1.6
Propane Tank	-	1	-	-	1	1.6

TABLE XI

RELATIVE ABUNDANCE OF PLANTS ASSOCIATED WITH FORM SITES IN DIFFERENT SEASONS

Plants/ 0.5 Meter Square	Spring		Summer		Fall		Winter		Total	
	#	%	#	%	#	%	#	%	#	%
1-4	12	20.3	36	36.7	28	30.1	3	8.3	79	27.6
5-14	7	11.9	14	14.4	5	5.4	6	16.7	32	11.2
15-29	12	20.3	16	16.3	17	18.3	7	19.4	52	18.2
30-99	18	30.5	12	12.2	32	34.4	15	41.7	77	26.9
100+	10	17.0	20	20.4	11	11.8	5	13.9	46	16.1
TOTAL	59	100	98	100	93	100	36	100	286	100

APPENDIX B

ESCAPE SITE CHARACTERISTICS
(TABLES AND FIGURES)

TABLE XII

ESCAPE SITES LOCATED BY SEASON

Season	Exact Escape Sites	Approximate Escape Sites	Total
Spring*	24	10	34
Summer*	24	31	55
Fall*	35	23	58
Winter	15	8	23
Total	98	72	170

*Includes data from two consecutive years.

TABLE XIII

RELATIVE SEASONAL USE OF LIFE-FORM TYPES WHICH PROVIDE OVERHEAD COVER AT APPROXIMATE AND EXACT ESCAPE SITES

Life-Form	#	%	#	%	#	%	#	%	#	%
Tree	3	8.8	7	12.7	5	8.6	2	8.7	17	10.0
Shrub	10	29.4	21	38.2	10	17.2	5	21.8	46	27.1
Tall Grass	2	5.9	8	14.6	1	1.7	2	8.7	14	8.2
Mid-Grass	2	5.9	2	3.6	16	27.6	3	13.0	23	13.5
Short Grass	-	-	-	-	-	-	-	-	-	-
Tall Forb	5	14.7	6	10.9	3	5.2	3	13.0	17	10.0
Mid-Forb	1	2.9	2	3.6	4	6.9	2	8.7	9	5.3
Short Forb	-	-	-	-	-	-	-	-	-	-
Other	11	32.4	9	16.4	19	32.8	5	21.8	44	25.9
TOTAL	34	100	55	100	58	100	23	100	170	100

TABLE XIV

RELATIVE DENSITY OF PLANTS IN LIFE-FORMS
ASSOCIATED WITH EXACT ESCAPE SITES

Plants/ 0.5 Meter Square	Life-Form															
	Tree		Shrub		Tall Grass		Mid-Grass		Short Grass		Tall Forb		Mid-Forb		Short Forb	
	#	%*	#	%	#	%	#	%	#	%	#	%	#	%	#	%
1-4	6	100	16	76.2	1	20	-	-	-	-	-	-	-	-	-	-
5-14	-	-	2	9.5	2	40	-	-	-	-	3	33.3	1	16.7	-	-
15-29	-	-	2	9.5	1	20	1	14.3	-	-	4	44.5	3	50.0	-	-
30-99	-	-	1	4.8	1	20	5	71.4	-	-	1	11.1	2	33.3	-	-
100+	-	-	-	-	-	-	1	14.3	-	-	1	11.1	-	-	-	-
TOTAL	6	100	21	100	5	100	7	100	-	-	9	100	6	100	-	-

*Percentages are of total escape sites found in the life-form.

TABLE XV

SEASONAL PREFERENCES FOR PLANT DENSITIES EXPRESSED IN LIFE-FORMS PROVIDING PRINCIPAL COVER AT EXACT ESCAPE SITES*

Vegetational Life-Form	Plants Per 0.5 Meter Square																			
	1-4				5-14				15-29				30-99				100+			
	SP	S	F	W	SP	S	F	W	SP	S	F	W	SP	S	F	W	SP	S	F	W
Tree	100	100	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Shrub	28.6	100	100	100	28.6	-	-	-	28.6	-	-	-	14.2	-	-	-	-	-	-	-
Tall Grass	-	50	-	-	100	50	-	-	-	-	-	50	-	-	-	50	-	-	-	-
Mid-Grass	-	-	-	-	-	-	-	-	-	-	20	-	-	-	60	100	-	-	20	-
Short Grass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tall Forb	-	-	-	-	-	75	-	-	66.4	25	-	50	33.3	-	-	-	-	-	-	50
Mid-Forb	-	-	-	-	-	-	33.4	-	-	100	33.3	-	-	-	33.3	100	-	-	-	-
Short Forb	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Numerals are percentages of total exact escape sites found during the season in the particular life-form.
SP = Spring; S = Summer; F = Fall; W = Winter

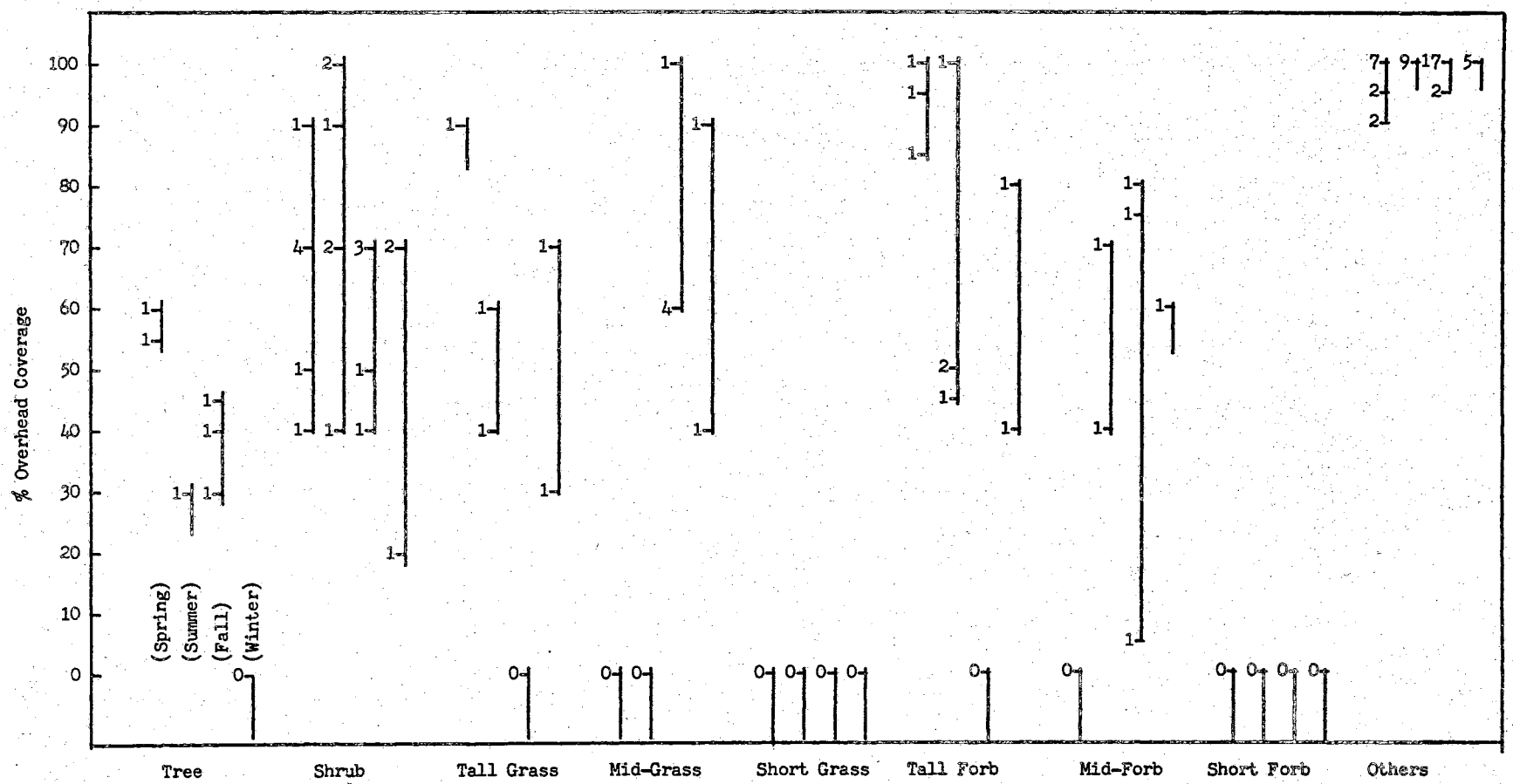

Figure 5. Relative Abundance (Plants/0.5 meter sq) of Plants in Life-Forms Associated with Exact Escape Sites. Numerals equal the number of observations for each density category for each plant life-form type.

TABLE XVI

RELATIVE OVERHEAD COVERAGE EXPRESSED IN LIFE-FORMS
ASSOCIATED WITH EXACT ESCAPE SITES

% Overhead Coverage	Life-Form															
	Tree		Shrub		TallGrass		Mid-Grass		Short Grass		Tall Forb		Mid-Forb		Short Forb		Others	
	#	%*	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
5	–	–	–	–	–	–	–	–	–	–	–	–	1	16.7	–	–	–	–
10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
15	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
20	–	–	1	4.8	–	–	–	–	–	–	–	–	–	–	–	–	–	–
25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
30	2	33.2	–	–	1	20.0	–	–	–	–	–	–	–	–	–	–	–	–
35	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
40	1	16.7	3	14.3	1	20.0	1	14.3	–	–	1	11.1	1	16.7	–	–	–	–
45	1	16.7	–	–	–	–	–	–	–	–	1	11.1	–	–	–	–	–	–
50	–	–	2	9.5	–	–	–	–	–	–	2	22.2	–	–	–	–	–	–
55	1	16.7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
60	1	16.7	–	–	1	20.0	4	57.1	–	–	–	–	1	16.7	–	–	–	–
65	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
70	–	–	11	52.4	1	20.0	–	–	–	–	–	–	1	16.7	–	–	–	–
75	–	–	–	–	–	–	–	–	–	–	–	–	1	16.7	–	–	–	–
80	–	–	–	–	–	–	–	–	–	–	1	11.1	1	16.6	–	–	–	–
85	–	–	–	–	–	–	–	–	–	–	1	11.1	–	–	–	–	–	–
90	–	–	2	9.5	1	20.0	1	14.3	–	–	–	–	–	–	–	–	2	4.5
95	–	–	–	–	–	–	–	–	–	–	1	11.1	–	–	–	–	4	9.1
100	–	–	2	9.5	–	–	1	14.3	–	–	2	22.3	–	–	–	–	38	86.4
TOTAL	6	100	21	100	5	100	7	100	–	–	9	100	6	100	–	–	44	100

*Percentages are of total exact escape sites found in the life-form.

TABLE XVII

SEASONAL PREFERENCES FOR OVERHEAD COVERAGE EXPRESSED IN LIFE-FORMS PROVIDING PRINCIPAL COVER AT ESCAPE SITES* IN SPRING AND SUMMER

% Overhead Coverage	Life-Form															
	Tree		Shrub		Tall Grass		Mid-Grass		Short Grass		Tall Forb		Mid-Forb		Short Forb	
	SP	S	SP	S	SP	S	SP	S	SP	S	SP	S	SP	S	SP	S
0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	-	-	14.3	16.7	-	50.0	-	-	-	-	-	-	-	50.0	-	-
45	-	-	-	-	-	-	-	-	-	-	-	25.0	-	-	-	-
50	-	-	-	-	-	-	-	-	-	-	-	50.0	-	-	-	-
55	50.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	50.0	-	-	-	-	50.0	-	-	-	-	-	-	-	-	-	-
65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70	-	-	57.1	33.3	-	-	-	-	-	-	-	-	-	50.0	-	-
75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
85	-	-	-	-	-	-	-	-	-	-	33.3	-	-	-	-	-
90	-	-	14.3	16.7	100	-	-	-	-	-	-	-	-	-	-	-
95	-	-	-	-	-	-	-	-	-	-	33.3	-	-	-	-	-
100	-	-	-	33.3	-	-	-	-	-	-	33.4	25.0	-	-	-	-
TOTAL	100	100	100	100	100	100	-	-	-	-	100	100	-	100	-	-

*Numerals are percentages of total exact escape sites examined during the season in the particular life-form. SP = Spring; S = Spring.

TABLE XVIII

SEASONAL PREFERENCES FOR OVERHEAD COVERAGE EXPRESSED IN LIFE-FORMS PROVIDING PRINCIPAL COVER AT EXACT ESCAPE SITES* IN FALL AND WINTER

% Overhead Coverage	Life-Form															
	Tree		Shrub		Tall Grass		Mid-Grass		Short Grass		Tall Forb		Mid-Forb		Short Forb	
	F	W	F	W	F	W	F	W	F	W	F	W	F	W	F	W
0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
5	–	–	–	–	–	–	–	–	–	–	–	–	33.3	–	–	–
10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
15	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
20	–	–	–	33.3	–	–	–	–	–	–	–	–	–	–	–	–
25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
30	33.3	–	–	–	–	50.0	–	–	–	–	–	–	–	–	–	–
35	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
40	33.3	–	20.0	–	–	–	–	50.0	–	–	–	50.0	–	–	–	–
45	33.4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
50	–	–	20.0	–	–	–	–	–	–	–	–	–	–	–	–	–
55	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
60	–	–	–	–	–	–	80.0	–	–	–	–	100	–	–	–	–
65	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
70	–	–	60.0	66.7	–	50.0	–	–	–	–	–	–	–	–	–	–
75	–	–	–	–	–	–	–	–	–	–	–	–	33.3	–	–	–
80	–	–	–	–	–	–	–	–	–	–	–	50.0	33.4	–	–	–
85	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
90	–	–	–	–	–	–	–	50.0	–	–	–	–	–	–	–	–
95	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
100	–	–	–	–	–	–	20.0	–	–	–	–	–	–	–	–	–
TOTAL	100	–	100	100	–	100	100	100	–	–	–	100	100	–	–	–

*Numerals are percentages of total exact escape sites examined during the season in the particular life-form. F = Fall; W = Winter.

TABLE XIX

RELATIVE PERCENTAGES OF OVERHEAD COVERAGE AT EXACT ESCAPE SITES IN DIFFERENT SEASONS

% Overhead Coverage	Spring		Summer		Fall		Winter		Total	
	#	%	#	%	#	%	#	%	#	%
0	–	–	–	–	–	–	–	–	–	–
5	–	–	–	–	1	2.8	–	–	1	1.0
10	–	–	–	–	–	–	–	–	–	–
15	–	–	–	–	–	–	–	–	–	–
20	–	–	–	–	–	–	1	6.7	1	1.0
25	–	–	–	–	–	–	–	–	–	–
30	–	–	1	4.2	1	2.8	1	6.7	3	3.1
35	–	–	–	–	–	–	–	–	–	–
40	1	4.2	3	12.5	2	5.7	2	13.3	8	8.2
45	–	–	1	4.2	1	2.8	–	–	2	2.0
50	1	4.2	2	8.3	1	2.8	–	–	4	4.1
55	1	4.2	–	–	–	–	–	–	1	1.0
60	1	4.2	1	4.2	4	11.5	1	6.7	7	7.2
65	–	–	–	–	–	–	–	–	–	–
70	4	16.6	3	12.5	3	8.7	3	20.0	13	13.3
75	–	–	–	–	1	2.8	–	–	1	1.0
80	–	–	–	–	1	2.8	1	6.7	2	2.0
85	1	4.2	–	–	–	–	–	–	1	1.0
90	4	16.6	1	4.2	–	–	1	6.7	6	6.1
95	3	12.5	–	–	2	5.7	–	–	5	5.1
100	8	33.3	12	50.0	18	51.6	5	33.2	43	43.9
TOTAL	24	100	24	100	35	100	15	100	98	100

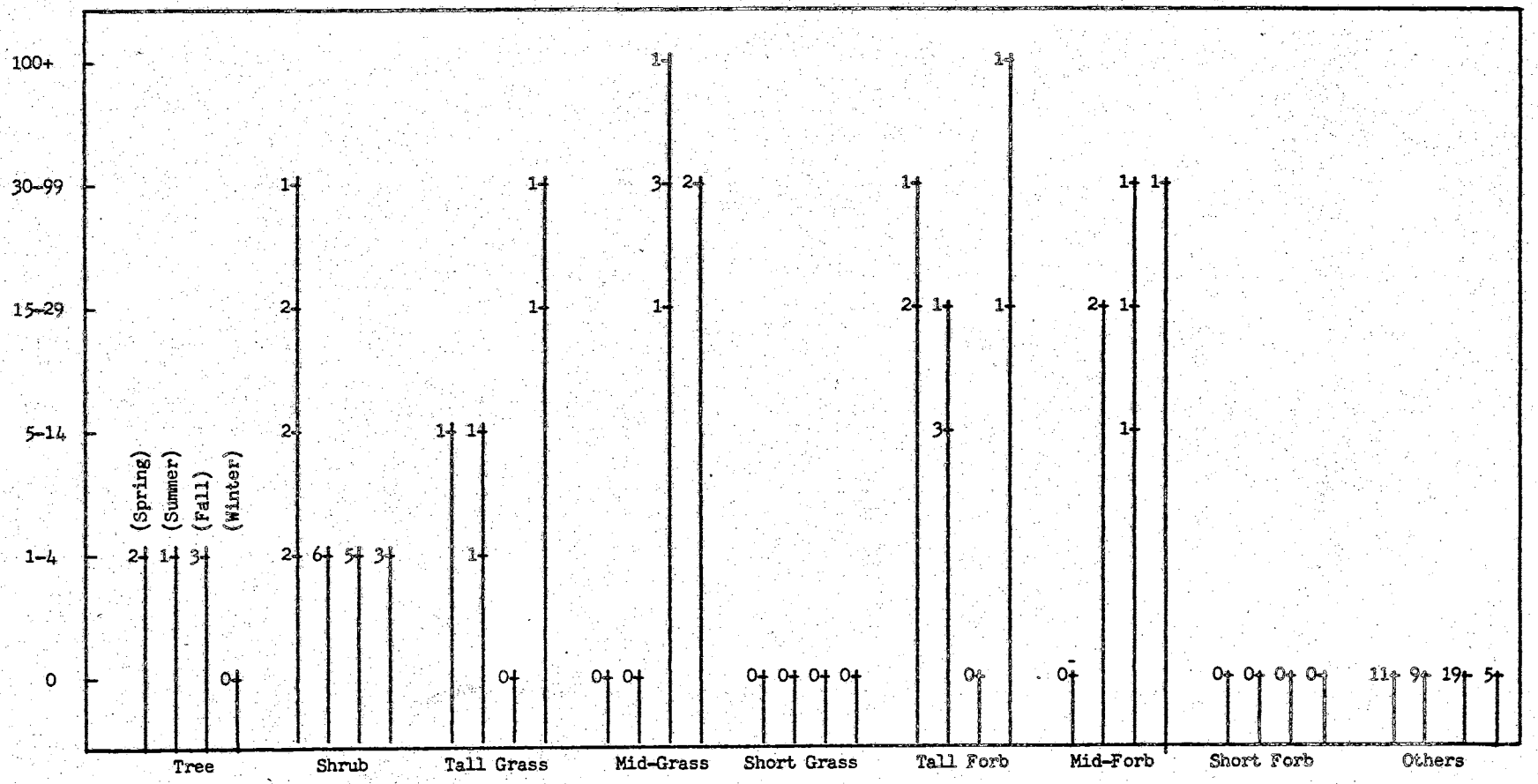

Figure 6. Relative Overhead Coverage (per cent) Expressed in Life-Forms Associated with Exact Escape Sites. The vertical lines represent the range in per cent of overhead coverage, and the numerals equal the number of observations for each overhead coverage category.

TABLE XX

STRUCTURES OTHER THAN VEGETATION WHICH PROVIDED OVERHEAD COVER AT EXACT ESCAPE SITES

Structure	Season				Total	%
	Spring	Summer	Fall	Winter		
Rocks	1	2	4	2	9	20.5
Brush Piles	2	1	2	2	7	15.9
Farm Machinery	1	-	6	-	7	15.9
Buildings	1	3	1	1	6	13.6
Road Culvert	2	1	1	-	4	9.1
Lumber Piles	-	-	3	-	3	6.8
Post Piles	3	-	-	-	3	6.8
Junk Piles	-	1	2	-	3	6.8
Overturned Boat	1	-	-	-	1	2.3
Truck Bed	-	1	-	-	1	2.3

TABLE XXI

RELATIVE ABUNDANCE OF PLANTS ASSOCIATED WITH EXACT ESCAPE SITES IN DIFFERENT SEASONS

Plants/ 0.5 Meter Square	Season								Total	
	Spring		Summer		Fall		Winter			
	#	%	#	%	#	%	#	%	#	%
1-4	4	30.7	8	50.0	8	53.4	3	30	23	42.6
5-14	3	23.0	5	31.2	-	-	-	-	8	14.8
15-29	4	30.7	3	18.8	2	13.4	2	20	11	20.4
30-99	2	15.6	-	-	4	26.6	4	40	10	18.5
100+	-	-	-	-	1	6.6	1	10	2	3.7
TOTAL	13	100	16	100	15	100	10	100	54	100

APPENDIX C

FOOD USE AND FEEDING SITE CHARACTERISTICS (TABLES)

TABLE XXII

A LIST OF FOOD PLANTS AVAILABLE TO THE RABBITS DURING FEEDING ACTIVITIES

Scientific Name	Common Name
Grasses	
Alopecurus spp.	Foxtail
Andropogon gerardi	Big bluestem
A. saccharoides	Silver bluestem
A. scoparius	Little bluestem
A. virginicus	Broomsedge bluestem
Aristida sp.	Threeawn
Bouteloua curtipendula	Sideoats grama
B. gracilis	Blue grama
B. hirsuta	Hairy grama
Bromus japonicus	Japanese brome
Buchloe dactyloides	Buffalo grass
Cenchrus pauciflorus	Mat sandbur
Chloris verticillata	Windmill grass
Cynodon dactylon	Bermuda grass
Digitaria sp.	Crab grass
Distichlis stricta	Inland saltgrass
Eleusine indica	Goose grass
Elymus canadensis	Canada wildrye
Eragrostis spp.	Love grass
Leptoloma cugnatum	Fall witch grass
Manisurus cylindrica	Carolina jointtail
Muhlenbergia schreberi	Nimblewill
Panicum oligosanthes	Scribner panicum
P. virgatum	Switch grass
Paspalum ciliatifolum	Fringeleaf paspalum
Schedonnardus paniculatus	Tumble grass
Sorghastrum nutans	Indiangrass
Sorghum halepense	Johnson grass
Sorghum spp.	Sorghum
Spartina pectinata	Prairie cord grass
Sporobolus asper	Tall dropseed
S. cryptandrus	Sand dropseed
Tridens flavus	Purpletop
Uniola latifolia	Broadleaf uniola
Phleum sp.	Timothy

TABLE XXII (continued)

Scientific Name	Common Name
Forbs	
Ambrosia psilostachya	Western ragweed
A. trifida	Giant ragweed
Amorpha canescens	Lead plant
Anemone caroliniana	Carolina windflower
Antennaria campestris	Prairie catspaw
Artemisia ludoviciana	Louisiana sagewort
Aster ericoides	Heath aster
Callirhoe involucrata	Purple poppymallow
Cassia fasciculata	Showy partridgepea
Chenopodium album	Lamb's quarter
Chrysopsis pilosa	Soft goldaster
Cirsium undulatum	Wavyleaf thistle
Coreopsis tinctoria	Plains coreopsis
Croton spp.	Croton
Dalea candida	White prairie clover
D. purpurea	Purple prairie clover
Desmanthus illinoensis	Illinois bundle flower
Diodia teres	Rough buttonweed
Erigeron canadensis	Marestail fleabane
E. strigosus	Daisy fleabane
Euphorbia chaemesyce	Prostrate euphorbia
E. marginata	Snow-on-the-mountain
Gutierrezia dracunculoides	Annual broomweed
Haplopappus ciliatus	Wax goldenweed
Helianthus spp.	Sunflower
Lactuca scariola	Prickly lettuce
Lepidium densiflorm	Prairie peppergrass
Lespedeza capitata	Roundhead lespedeza
L. virginica	Slender lespedeza
Liatris punctata	Dotted gayfeather
Linum sulcatum	Grooved flax
Melilotus alba	White sweet clover
M. officinale	Yellow sweet clover
Oenothera spp.	Evening primrose
Oxalis stricta	Sheepsorrel
Physalis spp.	Ground cherry
Plantago spp.	Plantain
Polygonum aviculare	Prostrate knotweed
Psoralea tenuiflora	Wild alfalfa
Ratibida columnifera	Prairie coneflower
Rudbeckia hirta	Blackeyed susan
Ruellia humilis	Fringeleaf ruellia
Rumex spp.	Dock
Dalvia azurea	Pitchersage
Schrankia uncinata	Catclaw sensitive brier

TABLE XXII (continued)

Scientific Name	Common Name
Forbs	
Solanum eleagnifolium	Silverleaf nightshade
S. rostratum	Buffalo bur
S. torreyi	Torrey nightshade
Solidago spp.	Goldenrod
Taraxacum officinale	Common dandelion
Tribulus terrestris	Puncture vine
Trifolium spp.	Clover
Verbena stricta	Tall verbena
Vernonia baldwini	Baldwin ironweed
Xanthium strumarium	Cocklebur
Trees and Shrubs	
Celtis occidentalis	Western hackberry
Cephalanthus occidentalis	Buttonbush
Cornus drummondii	Rough leaf dogwood
Gleditsia triacanthos	Honey locust
Parthenocissus quinquefolia	Virginia creeper
Populus deltoides	Eastern cottonwood
Prunus spp.	Plum
Quercus stellata	Post oak
Q. marilandica	Blackjack oak
Rhus glabra	Smooth sumac
R. radicans	Poison ivy
R. copallina	Winged sumac
Robinia pseudoacacia	Black locust
Rubus spp.	Blackberry
Salix spp.	Willow
Smilax bonanox	Saw greenbrier
Symphoricarpus orbiculatus	Buckbrush
Ulmus americana	American elm
Vitis spp.	Grape

TABLE XXIII

PLANTS USED AS FOOD BY COTTONTAILS IN SPRING
BASED ON 140 DIRECT FEEDING OBSERVATIONS

Common Name	Scientific Name	# of Obser-vations	% Total Obser-vations
Grasses			
Bermuda grass	Cynodon dactylon	31	22.2
Crabgrass	Digitaria spp.	27	19.4
Johnson grass	Sorghum halepense	20	14.3
Scribner panicum	Panicum oligosanthes	5	3.6
Little bluestem	Andropogon scoparius	4	2.9
Indian grass	Sorghastrum nutans	3	2.1
Threeawn	Aristida spp.	2	1.4
Japanese brome	Bromus japonicus	2	1.4
Big bluestem	Andropogon gerardi	1	0.7
Buffalo grass	Buchloe dactyloides	1	0.7
Mat sandbur	Cenchrus pauciflorus	1	0.7
Windmill grass	Chloris verticillata	1	0.7
Goose grass	Eleusine indica	1	0.7
Dropseed	Sporobolus spp.	1	0.7
Forbs			
Clover	Trifolium spp.	11	7.9
Yellow sweet clover	Melilotus alba	9	6.4
White sweet clover	Melilotus officianle	5	3.6
Puncture vine	Tribulus terrestris	4	2.9
Western ragweed	Ambrosia psilostachya	3	2.1
Heath aster	Aster ericoides	2	1.4
Rough buttonweed	Diodia teres	1	0.7
Prostrate euphorbia	Euphorbia choemesyce	1	0.7
Pepper grass	Lepidium densiflorum	1	0.7
Sheepsorrel	Oxalis stricta	1	0.7
Plantain	Plantago spp.	1	0.7
Dandelion	Taraxacum officinale	1	0.7

TABLE XXIV

PLANTS USED AS FOOD BY COTTONTAILS IN SUMMER
BASED ON 201 DIRECT FEEDING OBSERVATIONS

Common Name	Scientific Name	# of Observations	% Total Observations
Grasses			
Bermuda grass	Cynodon dactylon	63	31.1
Crabgrass	Digitaria spp.	49	24.3
Buffalo grass	Buchloe dactyloides	10	5.0
Threeawn	Aristida spp.	6	3.0
Johnson grass	Sorghum halepense	6	3.0
Windmill grass	Chloris yerticillata	3	1.5
Lovegrass	Eragrostis spp.	3	1.5
Sand dropseed	Sporobolus cryptandrus	3	1.5
Little bluestem	Andropogon scoparius	2	1.0
Goose grass	Eleusine indica	2	1.0
Foxtail	Alopecurus spp.	1	0.5
Big bluestem	Andropogon gerardi	1	0.5
Silver bluestem	Andropogon saccharoides	1	0.5
Sideoats grama	Bouteloua curtipendula	1	0.5
Japanese brome	Bromus japonicus	1	0.5
Fall witch grass	Leptoloma cognatum	1	0.5
Sorghum	Sorghum spp.	1	0.5
Forbs			
Clover	Trifolium spp.	17	8.4
Puncture vine	Tribulus terrestris	6	3.0
Sheep sorrel	Oxalis spp.	4	2.0
Wild alfalfa	Psoralea tenuiflora	3	1.5
Phosphate euphorbia	Euphorbia chaemesyca	2	1.0
Wax goldenweed	Haplopappus ciliatus	2	1.0
White sweet clover	Melilotus alba	2	1.0
Dandelion	Taraxacum officinale	2	1.0
Western ragweed	Ambrosia psilostachya	1	0.5
Lamb's quarter	Chenopodium album	1	0.5
Pepper grass	Lepidium densiflorum	1	0.5
Slender lespedeza	Lespedeza virginica	1	0.5
Dotted gayfeather	Liatris punctata	1	0.5
Ground cherry	Physalis spp.	1	0.5
Trees and Shrubs			
Blackberry	Rubus spp.	1	0.5
Oak	Quercus spp.	1	0.5
Elm	Ulmus spp.	1	0.5

TABLE XXV

PLANTS USED AS FOOD BY COTTONTAILS IN FALL
BASED ON 79 DIRECT FEEDING OBSERVATIONS

Common Name	Scientific Name	# of Observations	% Total Observations
Grasses			
Bermuda grass	Cynodon dactylon	16	20.3
Brome	Bromus japonicus	9	11.4
Little bluestem	Andropogon scoparius	7	8.8
Sand dropseed	Sporobolus cryptandrus	5	6.3
Buffalo grass	Buchloe dactyloides	4	5.0
Big bluestem	Andropogon gerardi	1	1.3
Threeawn	Aristida spp.	1	1.3
Timothy	Phleum spp.	1	1.3
Forbs			
Sweet clover	Melilotus spp.	9	11.4
Clover	Trifolium spp.	7	8.8
Illinois bundleflower	Desmanthus illinoensis	4	5.0
Western ragweed	Ambrosia psilostachya	1	1.3
Carolina windflower	Anemone caroliniana	1	1.3
Broomweed	Gutierrezia dracunculoides	1	1.3
Shrubs			
Blackberry	Rubus spp.	11	13.9
Trees			
Elm	Ulmus spp.	1	1.3

TABLE XXVI

PLANTS USED AS FOOD BY COTTONTAILS IN WINTER
BASED ON 40 DIRECT FEEDING OBSERVATIONS

Common Name	Scientific Name	# of Observations	% Total Observations
Grasses			
Japanese brome	Bromus japonicus	13	32.5
Bermuda grass	Cynodon dactylon	5	12.5
Dropseed	Sporobolus spp.	2	5.0
Little bluestem	Andropogon scoparius	1	2.5
Fall witchgrass	Leptoloma cognatum	1	2.5
Johnson grass	Sorghum halepense	1	2.5
Forbs			
Clover	Trifolium spp.	6	15.0
Western ragweed	Ambrosia psilostachya	1	2.5
Heath aster	Aster ericoides	1	2.5
Broomweed	Guterrezia dracunculoides	1	2.5
Shrubs			
Blackberry	Rubus spp.	5	12.5
Sumac	Rhus spp.	1	2.5
Trees			
Oak	Quercus spp.	1	2.5
Elm	Ulmus spp.	1	2.5

VITA

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