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William L. Baxter
Nebraska Game and Parks Commission

Carl W. Wolfe
Nebraska Game and Parks Commission

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THE INTERSPERSION INDEX AS A TECHNIQUE FOR EVALUATION OF BOBWHITE QUAIL HABITAT

William L. Baxter and Carl W. Wolfe, Nebraska Game and Parks Commission, Lincoln

Abstract:

An index based on the interspersion of vegetative types proved useful in evaluating quail habitat. Application of the technique for related studies indicated that interspersion indices may find wider application for assessing habitat deficiencies, for evaluating land areas for production of a diversity of wildlife species, and for planning.

Over 40 years ago, the concept of habitat interspersion was advanced by Aldo Leopold (6). Indicating then that "we are only on the threshold of an understanding of the ecology of game species," Leopold went on to

postulate his law of interspersions that recognized "game is a phenomenon of edges." Although the validity of Leopold's premises have been documented both directly and indirectly many times in the past 4 decades, the complexity and frustration in describing ecological diversity of game range has continued to pose a problem for wildlife managers.

On the basis of recognition and use alone, the terms interspersions and diversity were not commonly part of wildlife jargon for many years. Even though the concepts were recognized, they were undefined both quantitatively and qualitatively. The Wildlife Review, for example, carried neither of these terms in its index from 1935 to 1951. Hammerstrom, Mattson and Hammerstrom (3) were perhaps the earliest investigators to demonstrate the validity of Leopold's concepts in their work to maintain the prairie chicken in Wisconsin. They related the interspersions of habitat types to the mobility of prairie chickens, and investigated the tolerance of the species to variation in composition and interspersions of habitat. Kelker (5) rephrased Leopold's law, stating "the abundance of resident species requiring two or more cover types appears to depend on the interspersions of numerous small blocks of such types."

More recently, Pimlott (8) stated, "the message is clear that diversity of habitat is the life blood of the majority of species and the ramifications extend from the subsistence of an individual to the viability of a population and to the survival of the species." Assuming that most wildlife managers agree with this premise, the task of developing a method for evaluating habitat diversity is an important need.

That early wildlife investigators recognized deficiencies of habitat and of management steps needed to correct them is evident. Stoddard (9) in his monumental classic on bobwhite quail management, listed in detail the steps needed for transforming nonproductive quail cover to that capable of producing and carrying significant bobwhite densities. Leopold (6) and Errington and Hammerstrom (2) provided the basic approach to studying food and cover requirements for effective game management. Fundamental habitat concepts were delineated by Kabat and Thompson (4) as related to Wisconsin bobwhites. Their quail:hedge-row-mile index was a primary step in providing a usable descriptive tool for game managers. Leopold's interspersions concepts were finally "coming home."

Today's rapid change in land-use patterns coupled with ever-increasing human demands have placed an increasing burden on the contemporary wildlife manager. Faced with the need to optimize every environmental effect and to defend his decisions, the manager needs a definitive expression of habitat quality. This need, in recent years, has not been confined to wildlife interests alone. Resource planners, also, have encountered situations containing pressing needs to describe recreational land values and potentials for management. There is now an additional need to interface wildlife habitat values with highway corridors, urban and rural population shifts, and other land-use changes brought about by expanding technology and economic growth.

Because of the need to define habitat quality in Nebraska's quail management program, a study was initiated to empirically measure the

quality of quail habitat and to determine if this could be related to quail population indices.

The study area consisted of 3 counties, containing some of Nebraska's best bobwhite habitat, located in the southeast portion of the State. From north to south, the area included Cass, Otoe, and Pawnee Counties.

Cass, Otoe, and Pawnee Counties are part of an eroded glacial drift plain capped with Loveland and Peorian loess, both being wind-deposited formations. The soils that developed under the influence of tall-grass vegetation are characterized by high organic matter, granular structure, and a comparatively uniform chemical composition.

The climate in this region is typical of areas situated near the center of a large continent in the temperate zone: warm summers, cold winters, and moderate precipitation. The mean annual temperature is approximately 51 F; the mean annual precipitation is 30 inches; and the mean relative humidity is 70%. The average growing season is 156 to 167 days.

Procedures

Preliminary studies, based on 3 previously established, 20-mile-long bobwhite audio-census routes, 1 in each county, were devised to quantitatively evaluate land use. Aerial photographs were examined in the county ASCS offices to measure existing land use along each route. Using a polar planimeter, habitat acreage was measured in 0.5-mile-wide transects along each side of the route based on the following classification:

1. Cropland (row crops, small grains, legumes)
2. Grassland (pastures, native prairie, grassed waterways, fence rows)
3. Woody vegetation
4. Farmsteads (parcels of land containing houses, outbuildings, etc.)
5. Miscellaneous (stock ponds, quarries, roadways)

Assuming that the audio census used in these counties provided an accurate index of the number of whistling males within 0.5 mile on either side of a census route, we measured the habitat within these limits along the length of each route. We located the audio-census route on aerial photographs (660 ft/inch scale) then superimposed the sample transect along the route, extending the width to 0.5 mile on each side (Fig. 1).

We derived the interspersian index by drawing lines diagonally across each quarter section of land bordering the audio-census routes (Fig. 1), then counting the number of times the established vegetation classifications changed along the course of each line. The number of changes in each line in each quarter section was summed (Fig. 2). The quarter-section totals were then summed to determine the total for each route.

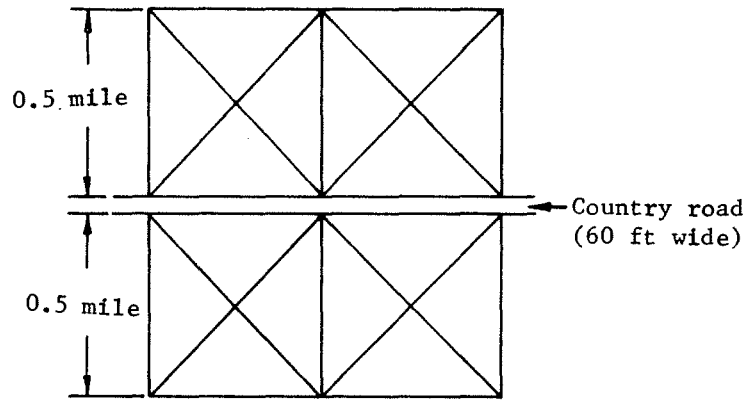
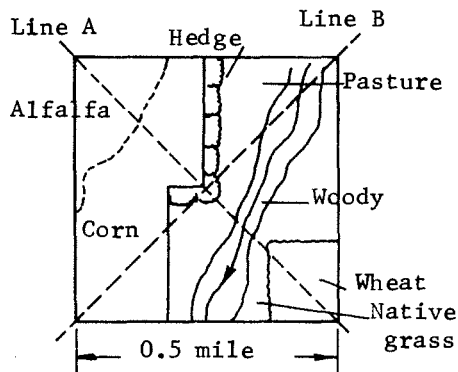
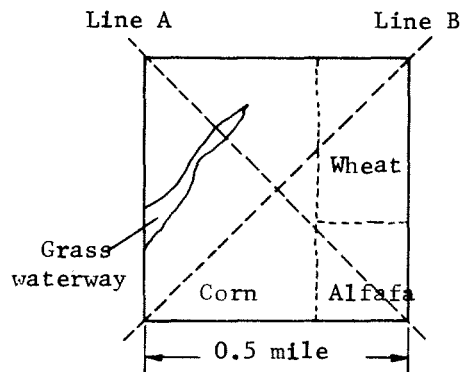


Figure 1. Diagram of diagonal lines used in calculating the interspersion index



Sample Calculation of Interspersion Index

<u>Area 1</u>	<u>Area 2</u>
Line A = 6	Line A = 3
Line B = 5	Line B = 1
I-index = 11	I-index = 4



Sample Calculation of Interspersion Index

<u>Area 1</u>	<u>Area 2</u>
Line A = 6	Line A = 3
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I-index = 11	I-index = 4

Figure 2. Determination of interspersion index from simulated aerial photographs

The interspersion index simply represented the number of changes from 1 cover type to another. The relationship of the interspersion index to the audio-census data for each route was calculated by linear correlation.

Findings

Land use along the 3 quail-census routes as determined from aerial photographs is presented in Table 1.

Table 1. Comparative land-use patterns in Cass, Otoe, and Pawnee Counties

Land-use	Cass		Otoe		Pawnee	
	Acres	% Total acres	Acres	% Total acres	Acres	% Total acres
Cropland	10,828.5	83.81	9,685.8	78.21	5,801.3	43.69
Grassland	747.2	5.78	1,590.6	12.85	5,001.5	37.66
Woodland	1,111.0	8.60	981.9	7.93	2,298.7	17.31
Farmsteads	153.7	1.19	105.6	0.85	130.7	0.98
Miscellaneous	79.8	0.62	20.1	0.16	47.8	0.36
Total acres sampled	12,920.2	100.00	12,384.0	100.00	13,280.0	100.0

The number of acres sampled along the transects ranged from 12,384 in Otoe County to a high of 13,280 in Pawnee County. These data show that very noticeable land-use differences existed among the counties. The intensity of agricultural land use decreased from north to south. Approximately 84% of the land along the Cass County route was classified as cropland. In Pawnee County, slightly less than 44% of the land was in this category. Cropland constitutes 78% of the land along the Otoe County route.

The amount of grassland in the counties was inversely related to cropland. The percentage of grassland increased from north to south. Cass, the northernmost county, had approximately 0.5 as much grassland as Otoe County and 0.17 as much as Pawnee County, the southernmost county.

There were approximately twice as many acres of woody vegetation along the Pawnee County route as there were along either of the other routes, with the smallest acreage occurring in Otoe County. Because woody cover is an essential element of the bobwhite's habitat needs, we felt that a closer examination of woody cover characteristics was advisable.

We examined the woody cover in the northernmost and southernmost counties with respect to acreage and cover type according to the following classification:

1. Windbreaks (multiple-row tree plantings; usually associated with farm buildings)
2. Hedgerows
3. Woodland tracts less than 3 acres
4. Woodland tracts 3 to 5 acres
5. Woodland tracts 5 to 10 acres
6. Woodland tracts greater than 10 acres

Table 2 shows the distribution of woody cover areas by acreage and type in Cass and Pawnee Counties. Pawnee County exceeded Cass County in every category except windbreaks.

Table 2. Extent and distribution of woodland vegetation^a

Woodland class	Cass		Pawnee	
	Acres	% Total woody	Acres	% Total woody
Windbreak	143.1	12.88	136.9	5.96
Hedgerow	64.9	5.84	332.0	14.44
<3 Acres	150.5	13.55	428.3	18.63
3-5 Acres	121.0	10.89	159.5	6.94
5-10 Acres	174.4	15.70	320.0	13.92
>10 Acres	457.1	41.14	922.0	40.11

^aData were not collected in Otoe County

The differences in categories such as hedgerows and plots up to 5 acres in size were of particular interest. Pawnee County had 5 times as many acres in the hedgerow category, 2.8 times as many tracts of woody cover less than 3 acres in size, and 1.3 times as many acres devoted to the 3- to 5- acre class.

The interspersion index values for the 3 counties were: Cass County - 404; Otoe County - 631; and Pawnee County - 984 (Table 3).

Preseason inventories of bobwhite quail populations are routinely conducted each year during July using a standardized audio-index or whistle count. Means from the Game Division's preseason inventories of bobwhite quail for the years 1964-1967 are shown in Table 3.

Table 3. Comparisons of preseason inventories of bobwhite quail (4-year average number of calls per stop) and interspersian indices.

Characteristics	Cass	Otoe	Pawnee
Mean number of calls per stop (1964-1967)	1.88	2.50	5.14
Interspersian index	404	631	984

The bobwhite quail is a species characteristically associated with edge. The interspersian indices indicated that Pawnee County had more junctions of plant communities per unit area than did Cass or Otoe Counties. Therefore, the higher preseason population inventories in Pawnee County were believed to be an expression of greater interspersian of habitat. The relationship between the interspersian and whistle-call indices was tested by linear correlation. The calculated r value of 0.976 indicated a significant correlation between quail numbers and the frequency of cover type change.

Modifications of this technique have been utilized by others within our agency as well as by other agencies. Game Division technicians have applied a field modification of this technique in most quail areas of the state. After completing the whistle-count route, the technician reverses direction and travels the route while visually recording all changes from any cover type to woody cover in or immediately adjacent to the road right-of-way. The number of cover-type changes recorded are used as an index to interspersian of woody cover in the counties. Correlation analysis of these data has indicated that a highly significant relationship exists between this index and the whistle-call index.

The interspersian index method was also used to assign wildlife values to each section of land in an 11-county ecological study conducted by our planning personnel (1). The goal of this study was to assemble information needed in the decision-making process for the conservation and enhancement of the environmental resources which have significant fish and wildlife, outdoor recreation, cultural, historic, scientific or educational values. As used in that study, the term "wildlife" meant upland game species and song birds.

Van Doren, Hazard, Stallings, and Schnacke (10), consulting engineers for the Nebraska State Department of Roads, used a highly detailed modification of the Interspersian Index to assign wildlife values to a corridor study for freeway bypasses at Lincoln, Nebraska. In determining

the locations having the least social cost, 10 elements including wildlife were utilized in an overlay system similar to those utilized by McHarg (7).

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BOBWHITE POPULATIONS AND HUNTING ON ILLINOIS PUBLIC HUNTING AREAS

David Russel Vance, and Jack A. Ellis, Illinois Natural History Survey, Effingham

Abstract:

Bobwhite (*Colinus virginianus*) populations on 2 public hunting areas in Illinois have been intensely utilized by hunters since 1964. Hunting has removed an average of 60-70%, and as much as 81%, of fall bobwhite populations, with no apparent detrimental effect on subsequent