REGIONAL DIFFERENCES IN WEIGHT AND ANTLER MEASUREMENTS OF ILLINOIS DEER

WILLIAM F. RICHIE
Cooperative Wildlife Research Laboratory,
Southern Illinois University, Carbondale

ABSTRACT. — Northern Illinois deer had a significantly greater dressed weight and antler beam diameters than southern Illinois deer. The incidence of spike-horned males was 7 percent for the north and 16 percent for the south. The role of land-use, habitat quality and soils are discussed in relation to deer nutrition as possible explanation of these differences in northern and southern deer.

Various experimental studies with the white-tailed deer, *Odocoileus virginianus*, have established a relationship between nutrition, body size and antler development (Nichol 1938; Davenport 1939; French et al. 1956). These studies demonstrate that controlled variation in diet produces a difference in weight and degree of antler development. Evidence that such a phenomenon exists under natural conditions has been recorded by Severinghaus et al. (1950), Severinghaus (1955), Gill (1956), Adams (1960), Banasiak (1961) and others. Generally they have shown regional differences in deer size and antler development as being related to range quality. The objectives of my study were to use age-weight-antler beam diameter criteria as indicators of regional nutritional level in Illinois white-tailed deer, and to survey regional land-use practices and soil qualities as inferences to habitat quality and nutrition of Illinois deer.

METHODS

Two segments of Illinois were studied. A northern area consisted of JoDaviess and Carroll counties (Fig. 1). Jackson, Jefferson, Johnson, Gallatin, Union and Williamson counties comprised the southern area. Data utilized were obtained from county check stations during the 1966 and 1967 Illinois state deer-hunting season. All deer were

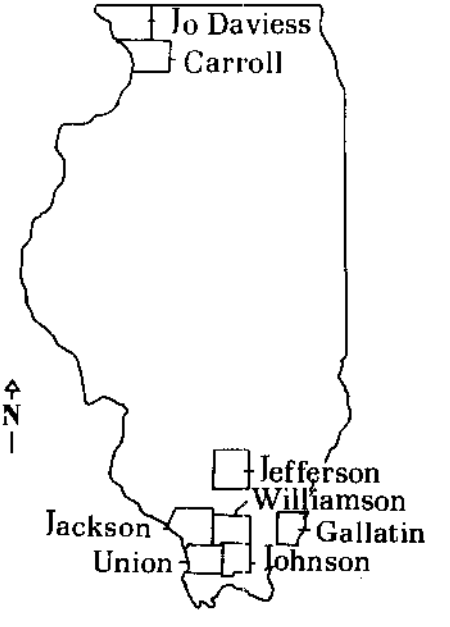

FIGURE 1. Study areas and counties of Illinois represented in the study.

weighed (field dressed), aged (Severinghaus (1949), and the diameter of the left antler beam measured to the nearest millimeter, 1 inch above the pedicel.

The t-test for independent samples was used for all comparisons involving two means (north-south). An asterisk (*) indicates statistical significance in all tables; $P \leq .05$ was selected for all statistical tests.

Results

Comparison of Illinois Deer Weights

Analysis of weight data showed a significant difference in dressed weight between northern and southern Illinois deer of all age classes except males 4½-years old and older; northern deer were heavier in all instances (Tables 1 and 2). The significant mean weight differences of northern and southern Illinois deer suggest a nutritional (habitat quality) difference in these two areas of the state.

Comparison of Illinois Deer Antler Development

Mean antler beam diameters of each age-class were significantly greater in northern deer than in southern deer (Table 3). These dif-

Table 1.—Comparison of field-dressed weights of male deer, by age-classes, for northern and southern Illinois.

Age	Mean Weight (lbs.)		Range			N		
	North	South	North	South	$S\bar{d}$	North	South	t
½	74	61	39–100	33–107	0.77	272	421	17.2*
1½	128	112	85–190	72–150	1.26	193	402	12.5*
2½	160	135	105–211	81–219	3.31	83	178	7.5*
3½	173	149	131–220	88–220	4.83	40	127	4.9*
4½+	164	164	141–186	91–203	8.48	10	63	0.05

Table 2.—Comparison of field-dressed weights of female deer, by age-classes, for northern and southern Illinois.

Age	Mean Weight (lbs.)		Range			N		
	North	South	North	South	$S\bar{d}$	North	South	t
½	66	53	39–93	23–87	0.87	221	305	15.2*
1½	100	85	74–134	59–114	0.41	121	192	38.2*
2½	111	93	86–144	62–131	1.56	93	137	11.3*
3½	113	93	91–145	73–127	2.55	29	95	7.9*
4½+	114	95	90–133	74–126	2.97	19	66	6.5*

TABLE 3.—Comparison of antler beam diameters, by age-classes, for northern and southern Illinois deer.

Age	Mean Antler Beam Diameter (mm)		Range		Sd	N		t
	North	South	North	South		North	South	
1½	23.8	21.6	14–32	10–32	0.32	150	391	6.8*
2½	31.2	27.1	20–45	11–43	0.79	63	175	5.1*
3½	37.6	31.5	25–48	18–47	1.75	30	124	3.5*
4½+	40.8	35.7	35–48	15–51	2.54	7	62	2.0*

ferences also suggest a nutritional (habitat quality) difference in the two study areas.

A third measure of habitat quality was the frequency of occurrence of spike-horned 1½-year old male deer. Severinghaus (1950) indicated that 80 percent of the 1½-year old deer from the poor quality Adirondack region developed only spike horns. Banasiak (1961) reported that 63 percent of yearling bucks in Maine had spike horns. Adams (1960) found a spike horn incidence of 98 percent in 1957 for over-populated northeastern Alabama habitat. Of 150 yearling males checked in northern Illinois, 7 percent showed spikes while in southern Illinois 16 percent of 402 yearlings were so recorded. The data are consistent with trends suggested by weight and antler beam findings, and present another indication of regional differences in Illinois deer and implied habitat quality.

Comparison of Land-Use Practices

Obvious differences are evident with regard to the extent of forested land and the type of agriculture practices for the two study areas; however, the extent of agricultural activity is comparable in both areas (Table 4). Forested land comprises 10 percent of the northern study area compared to 30 percent in the southern study counties. Total agricultural area (currently in production) is slightly greater in the northern area (39.8 percent) than in the southern area (32.1 percent). Differences were found in the type and extent of cropping activity in the two study areas. In the north the order of cropland significance was corn 55.1 percent, hay crops 26.8 percent (92 percent alfalfa and alfalfa mixtures, 8 percent clover-timothy and other grasses), oats 13.5 percent, soybeans 2.1 percent and wheat 0.1 percent. In the south the order of cropland significance was corn 43 percent, soybeans 29.5 percent, wheat 16 percent, hay crops 10.9 percent (23 percent alfalfa and alfalfa mixtures, 77 percent clover-timothy and other grasses) and oats 0.3 percent.

Soil Comparisons

To permit a comparison of soils found in the northern and southern study areas a numerical rating system has been devised. Such a sys-

TABLE 4.—Comparison of land-use practices for northern and southern Illinois study counties.

County	All Land[1]	Forest	Agriculture[3]	Agricultural Land[2] (Expressed as % of all Agriculture Land)				
	Acreage (Thousand)	% All Land	% All Land	Corn	Soybean	Wheat	Oats	Pasture
North								
Carroll	299.5	7.0	54.3	65.6	2.9	.2	12.1	18.9
JoDaviess	393.0	15.1	38.9	47.0	1.0	.....	15.0	36.5
Total	792.5	10.1	39.8	55.1	2.1	0.1	13.5	26.8
South								
Gallatin	209.9	26.1	54.5	72.6	14.2	10.2	0.1	2.6
Jackson	385.9	35.0	34.5	37.8	28.5	23.3	0.5	8.8
Jefferson	367.4	17.8	45.9	28.9	44.7	17.8	0.2	8.0
Johnson	220.8	38.0	16.0	43.6	16.7	3.5	0.2	35.0
Union	265.0	36.6	23.5	41.1	20.9	17.4	0.2	19.5
Williamson	273.4	30.3	14.9	37.1	37.1	8.8	0.1	15.9
Total	1,732.4	30.0	32.1	43.0	29.5	16.0	0.3	10.9

[1] Data from Essex and Gansner (1965).
[2] Data from Illinois Agricultural Statistics, Annual Summary-1968.
[3] Includes only agricultural land in production during 1966.

tem facilitates comparisons of soil characteristics by quantifying descriptions such as "rapid", "slow", "moderate", etc. The rating system shows differences in general soil qualities, generally resulting in higher ratings for soil associations of northern study counties (Table 5). Since the extent of each soil association differs, a weighted average was computed for upland, terrace, and bottomland soil associations of the two study areas. Upland, terrace and bottomland ratings for the northern counties were 20.3, 16.1 and 21.2 respectively, compared to ratings of 16.3, 17.1 and 17.9 for southern study counties. No statistical evaluation is applicable to these values.

Discussion

Land-Use Practices

Essex and Gansner (1965) define forest land to be at least 10 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. On this basis, forested lands in the southern Illinois region are three times that of the northern area (Table 4). Hence there is more forested habitat available for southern Illinois deer and presumably a greater capacity to carry deer populations. It is unlikely that all forest land constitutes suitable deer habitat as quality is an important consideration when comparing woodland habitat. Because investigations on available browse species of Illinois forest vegetation and their nutritional quality are lacking no attempt has been made to evaluate this aspect in the present study. However, the respective quality of northern and southern Illinois forest habitat can be inferred from weight and antler beam data (Tables 1, 2 and 3).

Agriculture in JoDaviess and Carroll counties emphasizes beef cattle and dairy production (Table 4). Agriculture in the southern area is geared to cash-grain crops such as corn, soybeans and wheat (Table 4). There is no doubt that deer in both regions utilize agricultural crops as food, but, the chronology, types and degree of crop utilization are not known. Possibly agriculture oriented to beef cattle and dairying is more favorable to deer nutrition than cash-grain crops. In the northern counties hay crop acreage is primarily in alfalfa and alfalfa mixtures (92 percent), while southern county hay crop acreage reflects clover-timothy and other grasses (77 percent). The relative nutritional value of these species would favor alfalfa. Corn is the primary crop in both study areas. Deer utilize corn in both regions and it is apparent that the extent of corn acreage is considerably greater in the northern study counties, implying greater availability. It appears reasonable that these differences may be responsible, in part, for the measured difference between northern and southern Illinois deer by contributing differentially to the quality of the respective regional habitats.

Current deer havest levels on a county basis indicates that the northern area may be supporting a larger population than that of southern Illinois (Table 6). Because it is evident that there is considerably less forested area, and presumably less typical deer habitat, in the

TABLE 5.—Weighted average comparisons of soil characteristics for the soil associations of the northern and southern Illinois study counties[1].

Location	Soil Characteristics								Total
	Drouth Res.	Productivity	Parent Mat.	Thickness	Permeability	Slope	Surface Color	Silt Pan	
North									
Upland	3.0	2.2	3	3.8	3.5	2.5	2.3	0	20.3
Terrace	2.3	1.9	2	3.0	1.8	3.0	2.3	0	16.3
Bottom	3.5	3.3	3	2.0	4.0	3.0	2.5	0	21.2
South									
Upland	2.4	2.0	2.6	3.6	2.6	2.7	1.2	—.7	16.4
Terrace	2.8	2.4	2.0	2.9	2.7	3.0	1.6	—.4	17.0
Bottom	3.2	2.4	1.8	3.4	2.9	3.0	1.3	0	18.0

[1] Numerical equivalents for descriptive categories were established with the assistance of the SCS, Carbondale, Illinois. Maximum rate=25. Drouth Res.: Poor=1, Fair=2, Good=3, Very Good=4. Productivity: Low=1, Mod. Low=1.5, Moderate=2, Mod. High=2.5, High=3, Very High=4. Parent Material: Loess=3, Med. text. mat.=3, Sandy=1, Fine text. mat.=1. Permeability: Rapid=2, Moderate=4, Mod. Slow=3, Slow=2, Very Slow=1. Slope: 0-12%=3, 13-20%=2, 21%+=1. Thickness: 36-60"=4, 20-35"=3, 10-19"=2, <10"=1. Surface Color: Dark=3, Mod. Dark=2, Light=1. Siltpan or Claypan: Present=-1, Absent=0.

northern study area, the deer harvest suggests that the agricultural land-use practices are contributing to the maintenance of quality habitat. This effect probably reflects the contribution to available nutrition for deer and may be considered as a factor which increases the efficiency, or effectiveness of the northern habitat.

By comparison, southern Illinois has relatively more forested land, theoretically implying more available deer habitat; but, there is less agricultural supplementation because of the land-use practices. Possibly the effective carrying capacity may be more limited because of the lack of nutritional supplementation from adjacent or interspersed agricultural land. Further speculation on these relationships seem unwarranted until the relative significance of forest and agricultural land as deer habitat is investigated and population density data are obtained.

Soils

Soil fertility is the raw material by which wildlife is produced (Albrecht 1946). The quality and quantity of a wildlife crop is a direct reflection of such raw materials. In relation to deer nutrition, soils that vary in fertility differ in productivity. This difference can be extended to the nutritive value of the vegetation supported by these soils. Accordingly, habitat in the northern and southern Illinois study counties could exhibit qualitative differences in nutritive value of deer foods reflecting differences in soil fertility status.

Hundley (1959) investigated the available nutrients in deer-browse species growing on soils of different origin but was not able to detect clear trends and consistencies in the nutritive values of the plant species examined. However, in some instances the nutritive value of the same plant species was distinctly influenced by soil type.

The rating of soil characteristics revealed a disparity in the quality of northern and southern Illinois soil associations (Table 5). These differences may be reflected in the nutritive value of Illinois deer food and thus, could provide a partial explanation for the demonstrated difference in weight and antler development of northern and southern Illinois deer. Chemical analyses of soils and corresponding deer foods are needed before more meaningful cause and effect relationships can be established.

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TABLE 6.—Deer harvest trends for the northern and southern Illinois study counties.[1]

Year	North			South						
	Carroll	JoDaviess	Average	Gallatin	Jackson	Jefferson	Johnson	Union	Williamson	Average
1957	193	137	165	16	60	.....	15	173	41	61
1958	351	266	308	29	96	.....	29	264	80	100
1959	388	258	323	55	72	.....	56	228	84	99
1960	226	193	209	50	53	.....	67	135	90	79
1961	387	418	402	77	107	.....	131	222	163	140
1962	430	551	490	96	151	.....	224	288	226	197
1963	463	605	534	97	109	72	296	230	227	172
1964	337	465	401	113	109	37	310	254	254	180
1965	357	451	404	125	129	71	304	275	285	198
1966	329	373	351	72	78	71	281	226	253	164
1967	277	414	345	68	101	68	309	258	223	171

[1] Data from J. Calhoun (personal communication).

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