

A STUDY OF THE CENTRAL PLACE HIERARCHY
IN NORTH CENTRAL OKLAHOMA .

By

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PREFACE

The theory of central place hierarchy originated with Walter Christaller in southern Germany in 1933. This theory was slow in reaching scholars other than those with the ability to read the German language. A recent translation by Carlisle W. Baskin in his doctoral dissertation made this work available to the reader not knowing German.

Christaller expounded a theory that central places follow a distinct hierarchial pattern. Other geographers, including John E. Brush, Brian J. L. Berry and William L. Garrison have made application of this theory to regions other than southern Germany. This study is an attempt to apply the theory of Christaller and the modifications of Brush, Berry and Garrison to a region of Oklahoma.

During the course of this study, tests and comparisons of the central place hierarchy were made based on population, sales tax returns, and types of functions. Types of functions were determined by a field survey of the central places within this study area, a region of north central Oklahoma that encompasses the cities of Enid, Ponca City and Stillwater. The number of types of functions in each central place was used as the basis for a system of grouping places into orders. Measurements of distance between orders of central places thus determined were made and compared to Christaller's $\sqrt{3}$ system of measurement. Analysis of the study area proved that an established hierarchy of central

places did exist within this region.

Indebtedness is acknowledged to Drs. Ralph E. Birchard and Edward E. Keso, Professor James H. Stine and other faculty members of the Geography Department of Oklahoma State University for their valuable guidance and thoughtful assistance through the loan of books and other materials used in this study. Further thanks are expressed to Professor James H. Stine for the many hours spent in discussion sessions relating to the problems of area analysis. Special thanks are expressed to my wife, Loyce Jean, and my children for the sacrifices made during the preparation of the study.

The author is grateful to the United States Army for the assignment as a full time student to this university and thereby making the attainment of this degree possible.

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CHAPTER I

CHRISTALLER'S CENTRAL PLACE THEORY

The purpose of this study is to make a local application of some of the theoretical principles of central places as employed by Walter Christaller and others. An area of Oklahoma has been selected in which population distribution, numbers of central place functions, spatial arrangement of central place functions, transportation networks, and other factors related to the evaluation of central places will be considered.

The Application of Theory by Christaller

Cities, towns, or other settlements are the collection of people in a centralized location that is generally served by an agglomeration of functions or activities. People living outside these settlements are also served by these same functions or activities. Separately located functions or services may be found that serve only the people of the surrounding rural area. These cities, towns, or other settlements and their associated functions and services have a spatial arrangement that is full of geographic significance.

Walter Christaller hypothesized that the spatial distribution of these settlements tends to follow a definite hierarchial pattern which

he explains with his central place theory.¹ Christaller described those places that provide services or functions for the surrounding area as "central places" and the services or functions performed as "central place functions."

Concentrations of people and functions normally are expected to occur where the assembly of goods and services are the cheapest. Therefore most central place functions should be expected to concentrate, because of economies of scale, in central places with largest population where transportation costs are the lowest. Coupled with this theory is the assumption that the larger the city or central place, the larger the number of central place functions and the larger the complementary area served by these functions. These central places would vary from the very small, with possibly only one service function of limited capacity serving an extremely small regional area, up to the large city with a multitude of services and functions. Many of these are highly specialized, with a wide potential and serving a vast tributary area which also encompasses the small regional areas. Theoretically the small places should be relatively close together and more numerous, with the larger places being few and widely spaced. Christaller envisioned this distribution as a hierarchy of centers, graduating from large numbers of the smallest places up through

¹Carlisle W. Baskin, "A Critique and Translation of Walter Christaller's *Die Zentralen Orte in Suddeutschland*" (unpub. Ph. D. dissertation, University of Virginia, 1957), p. 3.

a few larger cities and ultimately to a single largest city.²

The existence of a central place is relative to the area which it serves. Likewise, the tributary region surrounding the central place, its hinterland, is a necessity to the continued existence of the central place.³ This is the "complementary region," as named by Christaller. The number, spacing and hierarchial size of the central places are affected by its resource productivity, be it either natural or human, and its variations throughout a region in a particular stage of economic development.⁴ The complementary region supplies the central place with rudimentary goods and services. In return for this support the central place provides the complementary region with refined goods and services of a more specialized nature. Thus the center and its hinterland become complementary to each other as the central place fits itself into the hierarchy of central places.

Two principal methods exist by which goods reach a customer. One is for the goods to be brought to the customer by a traveling merchant and the other is for the customer to go to a central place for the goods. A combination of these two may exist in some areas

²Ibid., p. 64.

³Ibid., p. 7.

⁴Ralph E. Birchard, "The Spatial Structure of the Oklahoma City Metropolitan Region" (unpub. Ph. D. dissertation, State University of Iowa, 1954), pp. 5-6.

where both the merchant and the consumer travel to a common central place on specific dates. (The Korean periodic market is an example.⁵ Reference will later be made to some periodic service functions found in the Oklahoma study area.) Centralized services and activities normally are conducted at established places in order to reach all consumers with the minimum of cost and travel. The central place becomes the center of trade.⁶ In it, goods and services are assembled, partly for the use of its occupants, with the surplus being distributed according to the demand of the complementary region.

The spatial hierarchy of central places develops (1) according to the local demand for the goods and services the central place offers, (2) the type of goods or services and the number of customers required to support its existence within the central place, (3) the competitive desire of the function to locate as close as possible to the maximum number of customers, and (4) the friction of distance over which the customer must travel in order to avail himself of the goods or service.⁷ These conditions should normally cause centers with equivalent functions to be spaced approximately equi-distant

⁵James H. Stine, "Temporal Aspects of Tertiary Production Elements," (unpub. paper, Oklahoma State University, June 5, 1960), p. 4.

⁶Baskin, pp. 129-30.

⁷August Lösch, The Economics of Location, (New Haven, 1954), pp. 68-78.

from each other, provided the complementary regions of each were nearly uniformly productive and equally populated with persons with similar requirements.

Under ideal conditions each central place would have a circular tributary area with the central place located exactly at the center. If three or more circular trade areas are located adjacent to one another there would exist a void or unserved area when the boundaries are tangent to one another. If this void were eliminated by the centers of the circles being closer to each other, then an overlap of trade area exists between adjacent trade areas. Christaller established that the best shaped region was the hexagon, a geometric figure about the size and shape of the circle, which could be placed adjacent to others of equal size with all the area being covered.

Christaller's study was conducted in southern Germany and there he recognizes typical sizes for the settlements. Using his hexagonal theory he calculated the average population for each size class settlement, the area of the tributary region, and the distance between these settlements. The numbers of each class of cities grouped themselves, for the largest downward to the smallest, in the following arrangement: 1; 2; 6; 18; 54; 162; etc. He found that the spatial arrangement of the different orders of central places followed a pattern, so that the distance between similar sized centers increased by $\sqrt{3}$ over the next smaller order. For example, the smallest order central place identified by Christaller was the market hamlet or Markttort, which was spaced seven kilometers apart. Cities

of the next larger order were spaced $\sqrt{3}$ times this distance, or twelve kilometers apart, as Table I shows. Christaller believed that this hierarchial order was typical for most of western Europe.

Inasmuch as varying economic conditions might influence the relationship of the population and the size of its tributary area, Christaller assumed that population alone was not a true measure of the importance of a central place. He used as a supplementary index the number of telephones per one thousand population, and further adjusted this index to each local area, based on the economic conditions of that area. Edward Ullman points out that this system is not valid for most areas of the United States as telephones are very common in homes and are therefore not a good index to commercial activity.⁹

Other Applications of Theory

Several studies have been made of areas other than southern Germany using applications of some of Christaller's ideas. Most notable of these is one covering the region of southwestern Wisconsin by John E. Brush.¹⁰ Among other regional areas that have been studied are: northwest Iowa by August Lösch,¹¹ Snohomish County, Washington

⁹Ibid., p. 838.

¹⁰John E. Brush, "The Hierarchy of Central Places in Southwestern Wisconsin," The Geographical Review, XLIII, No. 3, 1953, pp. 380-402.

¹¹Lösch, pp. 365-430.

TABLE I⁸

CENTRAL PLACE DISTRIBUTION IN SOUTHERN GERMANY

CENTRAL PLACES	TOWNS		TRIBUTARY AREAS	
	Distance Apart (Km.)	Population	Size (Sq. Km.)	Population
Market hamlet (Marktort)	7	800	45	2,700
Township center (Amtsort)	12	1,500	135	8,100
County seat (Kreistadt)	21	3,500	400	24,000
District city (Bezirksstadt)	36	9,000	1,200	75,000
Small state capital (Gaustadt)	62	27,000	3,600	225,000
Provincial head city (Provinzhauptstadt)	108	90,000	10,800	675,000
Regional capital city (Landeshauptstadt)	186	300,000	32,400	2,025,000

⁸Edward Ullman, "A Theory of Location for Cities," *American Journal of Sociology*, XLVI, May 1941, p. 837.

by Brian J. L. Berry and William L. Garrison,¹² and southern England compared with southwestern Wisconsin by John E. Brush and Howard E. Bracey.¹³

The American Middle West is considered to approach as near as possible the ideal area in which to study the application of the central place theory. Here in a homogeneous area the functional and spatial hierarchy of a uniformly agricultural region, principally unaffected by large manufacturing developments and its accompanying urbanization, may be examined and evaluated.

¹²Brian J. L. Berry and William L. Garrison, "The Functional Bases of the Central Place Hierarchy," Economic Geography, XXXIV, April, 1958, pp. 145-54.

¹³John E. Brush and Howard E. Bracey, "Rural Service Centers in Southwestern Wisconsin and Southern England," Geographical Review, XLV, October, 1955, pp. 559-69.

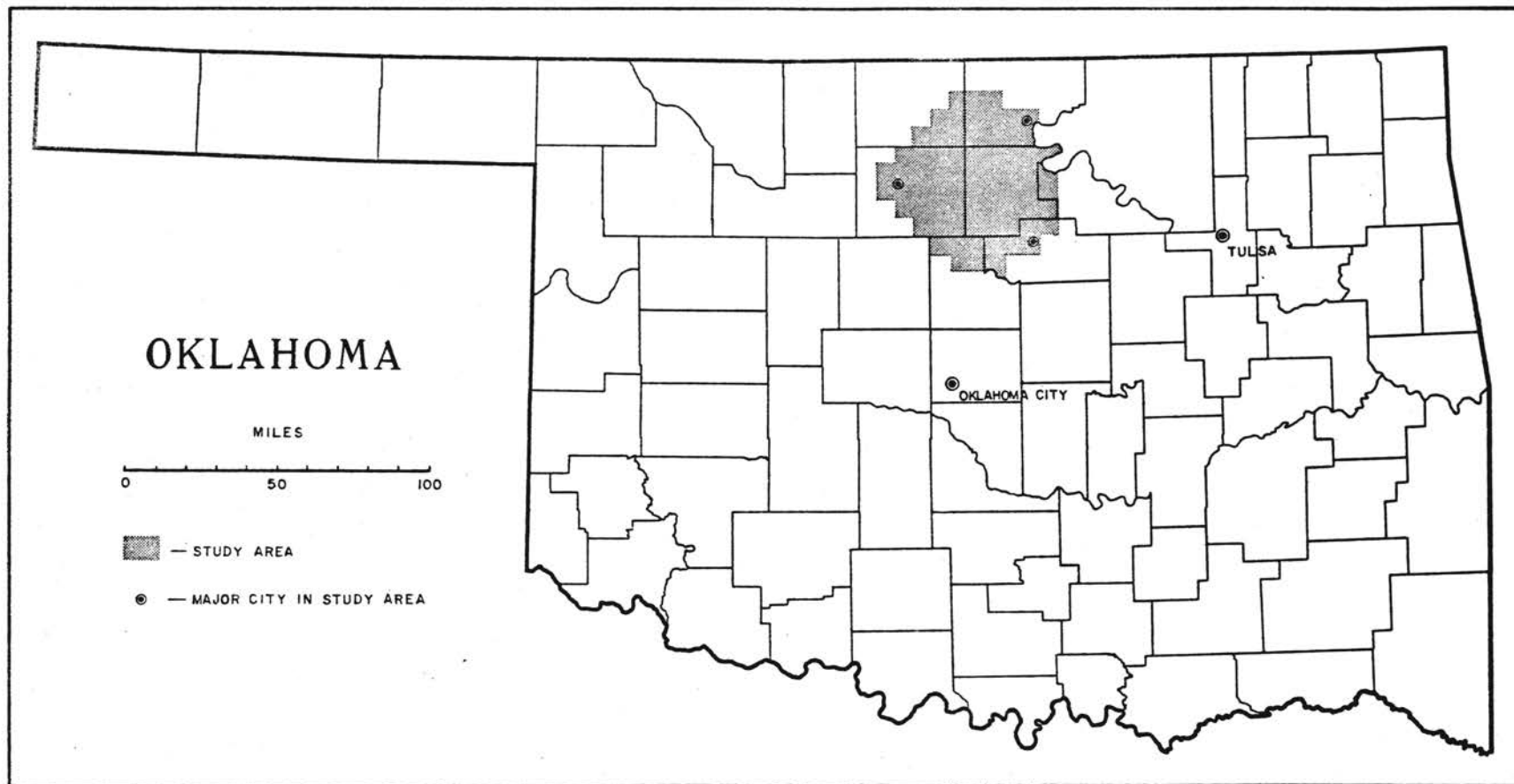
CHAPTER II

SIGNIFICANT CHARACTERISTICS OF THE STUDY AREA

In order to make application of Christaller's theories to a local region in Oklahoma an area was required that would be in close proximity to the Oklahoma State University so that field work could be conducted by the author while pursuing other aspects of his education. The area of study had to be large enough so that it would contain a representative number of cities and towns in order to examine their relationships in a hierarchy of cities.

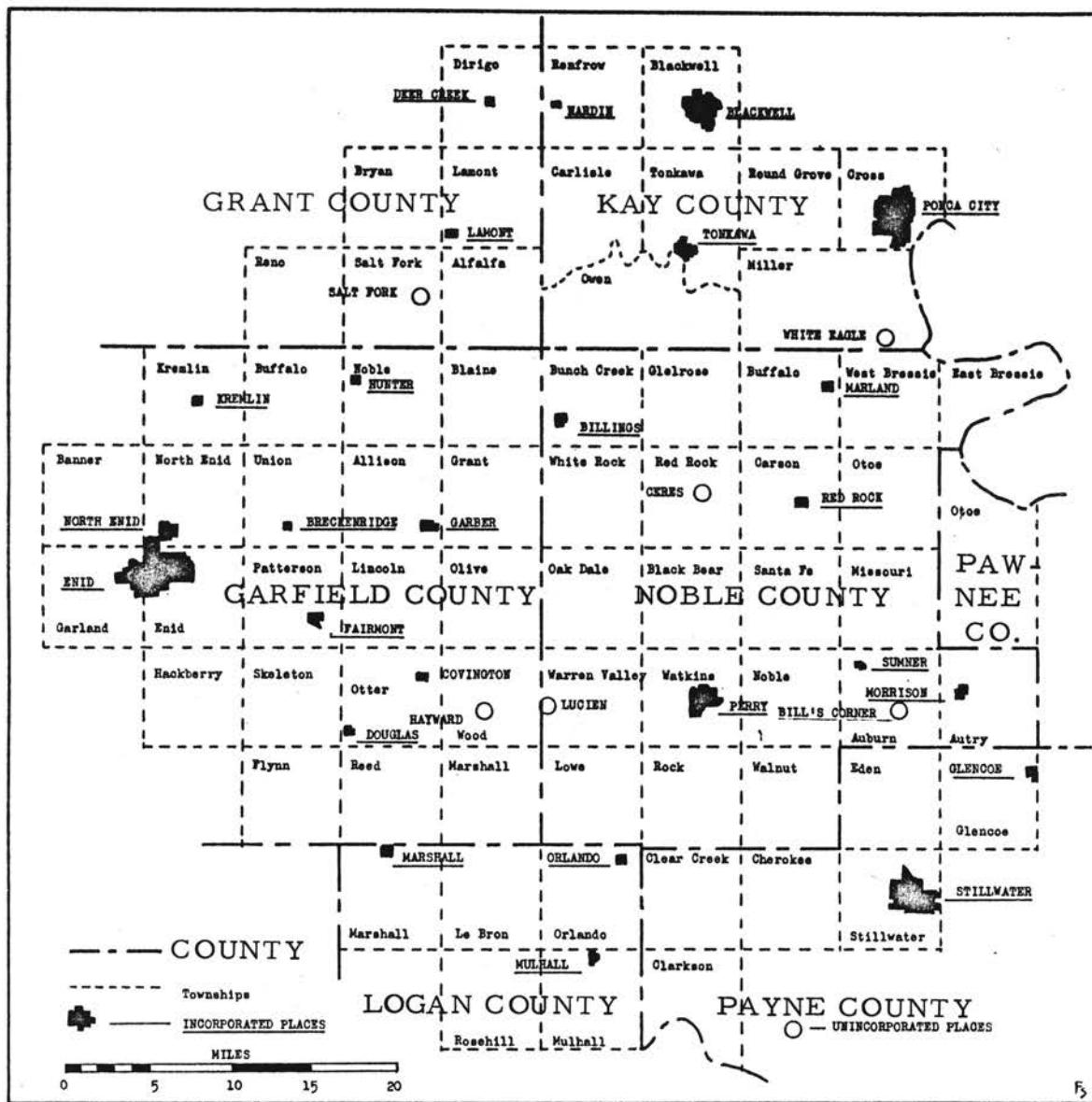
Location of Study Area

Originally a triangular area was planned for the study. This area was so designed that the three largest cities in the immediate vicinity of the University would fall at each point of this triangular region. These cities are Enid, Ponca City and Stillwater, all in Oklahoma. Initial observations indicated that the study area was quite small, and it was therefore expanded to its present size. The method of determining the present study region was accomplished by drawing a circle whose circumference passed through each of the selected cities. The area was then enlarged outside of the circumference of this circle to include complete civil township areas. See Fig. 1 and 2. This method gave a



STUDY AREA LOCATION IN OKLAHOMA

Fig. 1



IDENTIFICATION MAP OF AREA

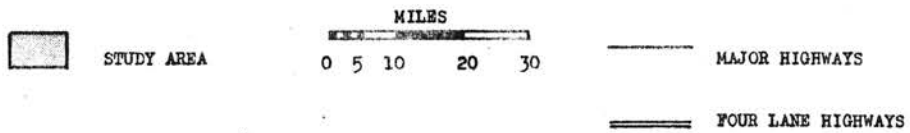
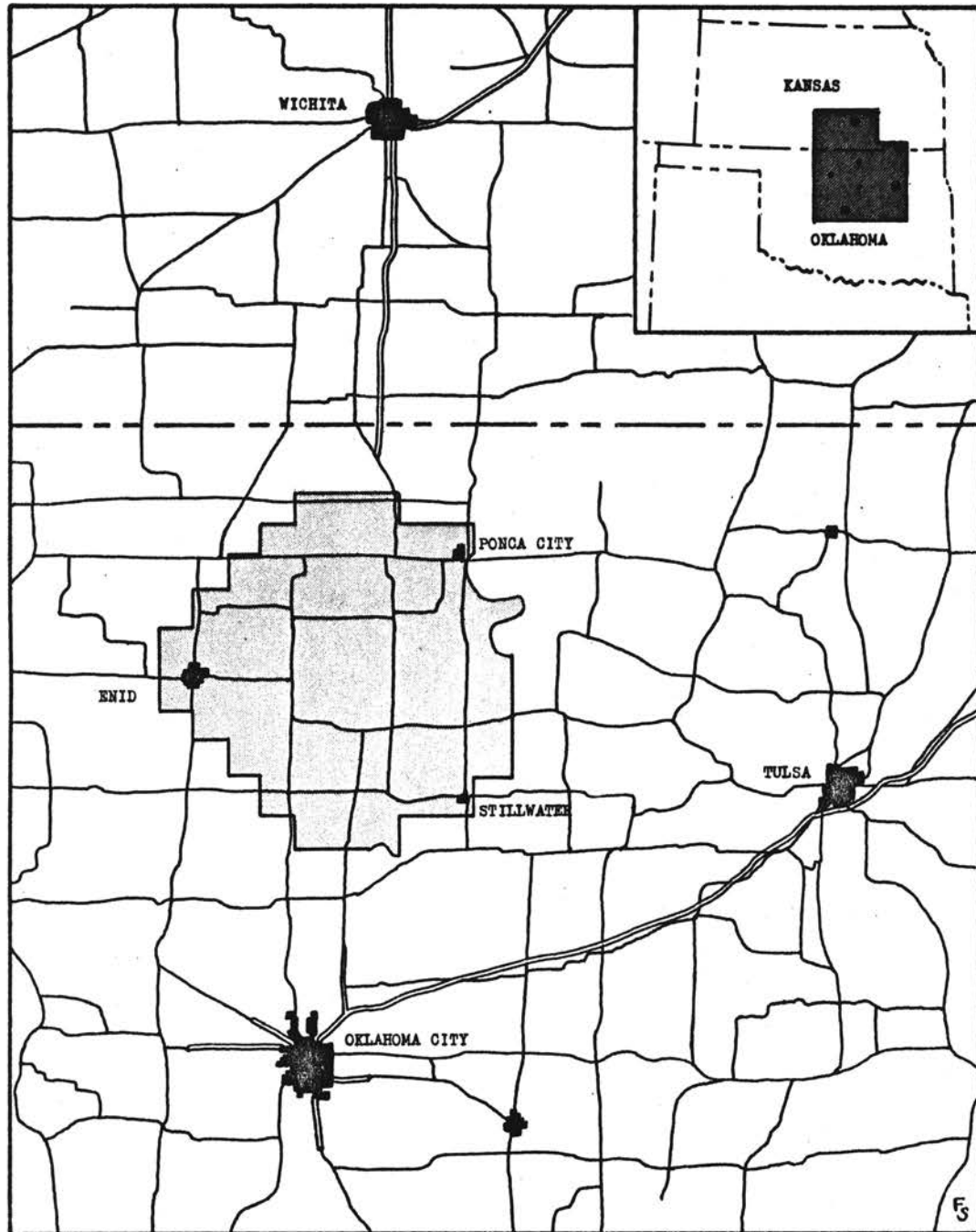
Fig. 2

regional area of 2,514.9 square miles containing twenty-six incorporated places ranging from populations of 38,859 (Enid) down to 27 at Sumner.

The regional location of the study area is in the north central part of the state of Oklahoma. This area is approximately centrally located between three larger major centers, Oklahoma City and Tulsa, Oklahoma and Wichita, Kansas. (See Fig. 3).

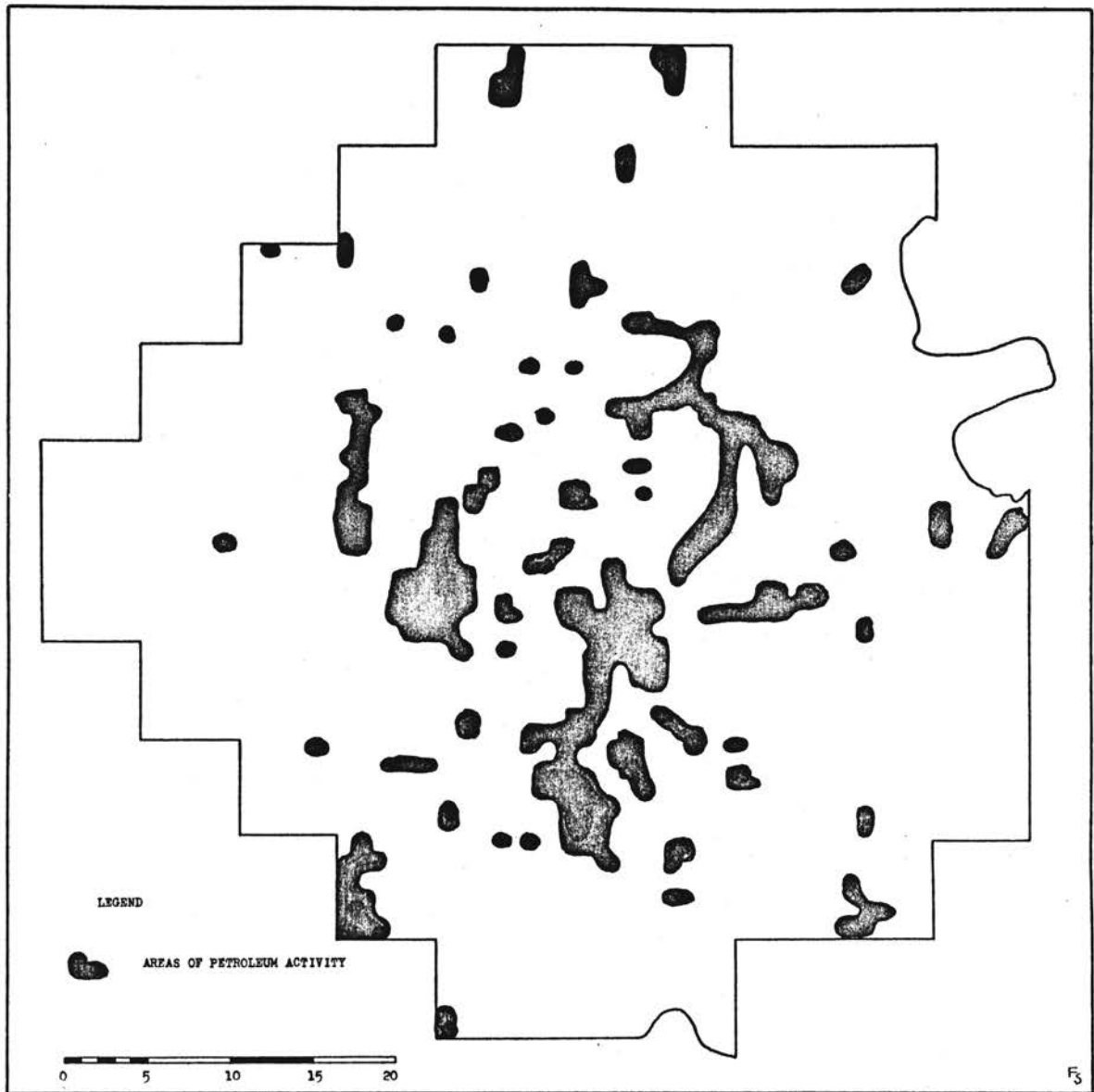
This region being in the Central Plains region, contains relatively flat topography, with the greatest relief in the eastern and southeastern parts. The area is one of extensive tillage agriculture and cattle grazing with most cultivated land being devoted to wheat. Wheat farming predominates in the western part of the region while mixed wheat farming and grazing are the major land utilizations of the eastern and southeastern parts of the region. Other activities include petroleum production with oil and gas wells dispersed throughout most of the region, but mainly concentrated in a north-south belt through the central area.(Fig. 4).

The study area is bounded on the northeast by the Arkansas River and for a short distance on the south by the Cimmaron River. The Salt Fork of the Arkansas River and Black Bear Creek are the major streams within the area and neither materially affect transportation or other activities within the area. The region is not completely homogeneous, as would be most desired for a central place study, but is considered to be a satisfactory location for a study of this nature.



REGIONAL LOCATION OF STUDY AREA

Fig. 3



PETROLEUM PRODUCTION REGION

Fig. 4

Distribution of Population

The population of the region is not uniformly distributed. Of a total population within the study area of 134,606 (according to the 1960 U.S. Census reports), 111,128 persons are living within the incorporated places of the area. Of this number, 87,235 are living within the three largest cities of this area. It should be pointed out, however, that much of the hinterland of these cities, approaching two-thirds, is outside the study area and therefore cannot be wholly considered.

Population of all incorporated central places is shown by Table II. Symbolic size representations are also shown for these cities in Fig. 5. Distribution of population outside the incorporated places is indicated by Table III and Population Density Map, Fig. 6, which indicates the population per square mile by civil township area. It should be noted that township population (less the incorporated places) is most dense adjacent to the larger central places and grades downward as the distance from major centers increases. Another indication of the settlement pattern of the study area may be seen in the location of individual dwellings outside the incorporated central places. In this map, settlement locations can be readily seen, with traces of many of the major highways easily apparent by concentrations of dwellings paralleling the transportation arteries away from the larger centers. (Fig. 7).

TABLE II
POPULATION OF INCORPORATED PLACES

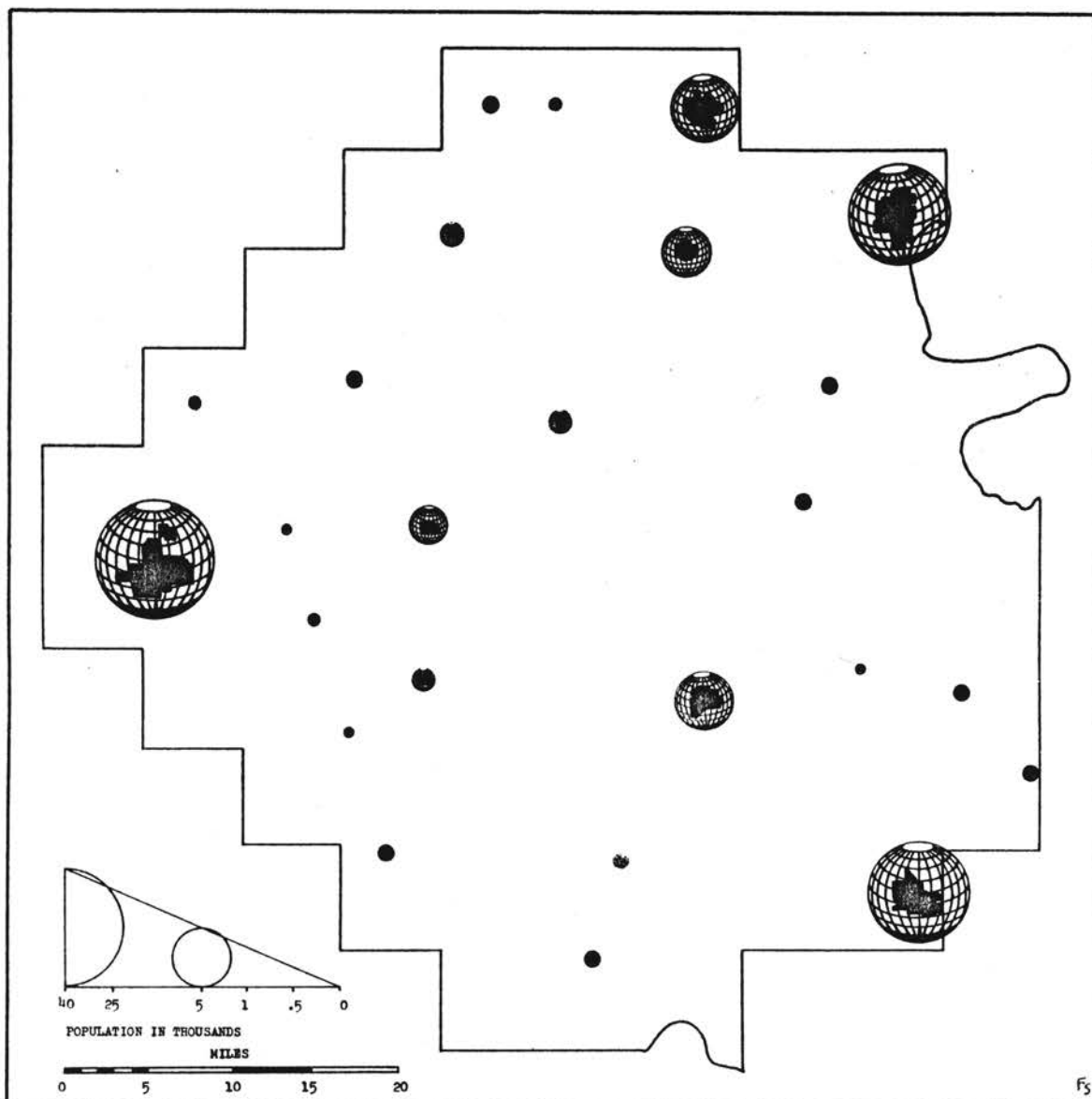
LOCATION	<u>POPULATION BY DATE OF CENSUS REPORT</u>			
	1960*	1950**	1940**	1930**
<u>GARFIELD COUNTY</u>				
Breckenridge	42	67	80	76
Covington	687	769	780	927
Douglas	74	114	140	163
Enid	38,859	36,017	28,081	26,399
Fairmont	115	134	153	169
Garber	905	957	1,086	1,356
Hunter	203	279	291	336
Kremlin	128	143	146	124
North Enid	286	219	166	165
<u>GRANT COUNTY</u>				
Deer Creek	215	209	250	312
Lamont	543	594	577	554
<u>KAY COUNTY</u>				
Blackwell	9,588	9,199	8,537	9,521
Nardin	142	184	217	180
Ponca City	24,411	20,180	16,794	16,136
Tonkawa	3,415	3,643	3,197	3,311

TABLE II - Continued

LOCATION	POPULATION BY DATE OF CENSUS REPORT			
	1960*	1950**	1940**	1930**
<u>LOGAN COUNTY</u>				
Marshall	363			
Mulhall	253	320	406	374
Orlando	194	262	332	226
<u>NOBLE COUNTY</u>				
Billings	510	620	661	658
Marland	191	221	257	361
Morrison	256	297	333	284
Perry	5,210	5,137	5,045	4,206
Red Rock	262	253	395	375
Sumner	27	46	80	64
<u>PAYNE COUNTY</u>				
Glencoe	284	309	337	297
Stillwater	23,965	20,238	10,097	7,016

*U. S. Bureau of Census, U. S. Census of Population: 1960, Advance Reports, Final Population Counts, Oklahoma, U. S. Government Printing Office, Washington, D. C., 1960, pp. 6-11.

**U. S. Bureau of Census, U. S. Census of Population: 1950, Vol. II, Characteristics of the Population, Part 36, Oklahoma, U. S. Government Printing Office, Washington, D. C., 1952, pp 36-11 to 36-15.



POPULATION OF INCORPORATED PLACES

Fig. 5

TABLE III
CIVIL TOWNSHIP POPULATIONS,
INCORPORATED PLACES
EXCLUDED

COUNTY AND TOWNSHIP	POPULATION* (1960 CENSUS)	TOWNSHIP AREA** (Sq. Mi.)	POPULATION DENSITY (Per Sq. Mi.)
<u>GARFIELD COUNTY</u>			
Allison	187	35.5	5.3
Banner	348	35.4	9.8
Blaine	117	35.4	3.3
Buffalo	175	35.5	5.0
Enid	618	35.8	17.2
Flynn	152	33.5	4.5
Garland	2,671	35.8	74.5
Grant	148	35.4	4.2
Hackberry	227	35.5	6.4
Kremlin	199	35.2	5.6
Lincoln	310	35.5	8.8
Marshall	83	33.6	2.4
Noble	191	35.2	5.7
North Enid	2,073	35.2	58.9
Olive	198	35.6	5.6
Otter	188	35.6	5.3
Patterson	238	35.8	6.7
Reed	102	33.6	3.0
Skeleton	238	35.8	6.7
Union	238	35.7	6.7
Wood	167	35.5	4.7
<u>GRANT COUNTY</u>			
Alfalfa	135	36.1	3.7
Bryan	146	36.3	4.0
Dirigo	214	36.0	6.0
Lamont	195	36.1	5.4
Reno	161	36.1	4.4
Salt Fork	192	35.9	5.3

TABLE III - Continued

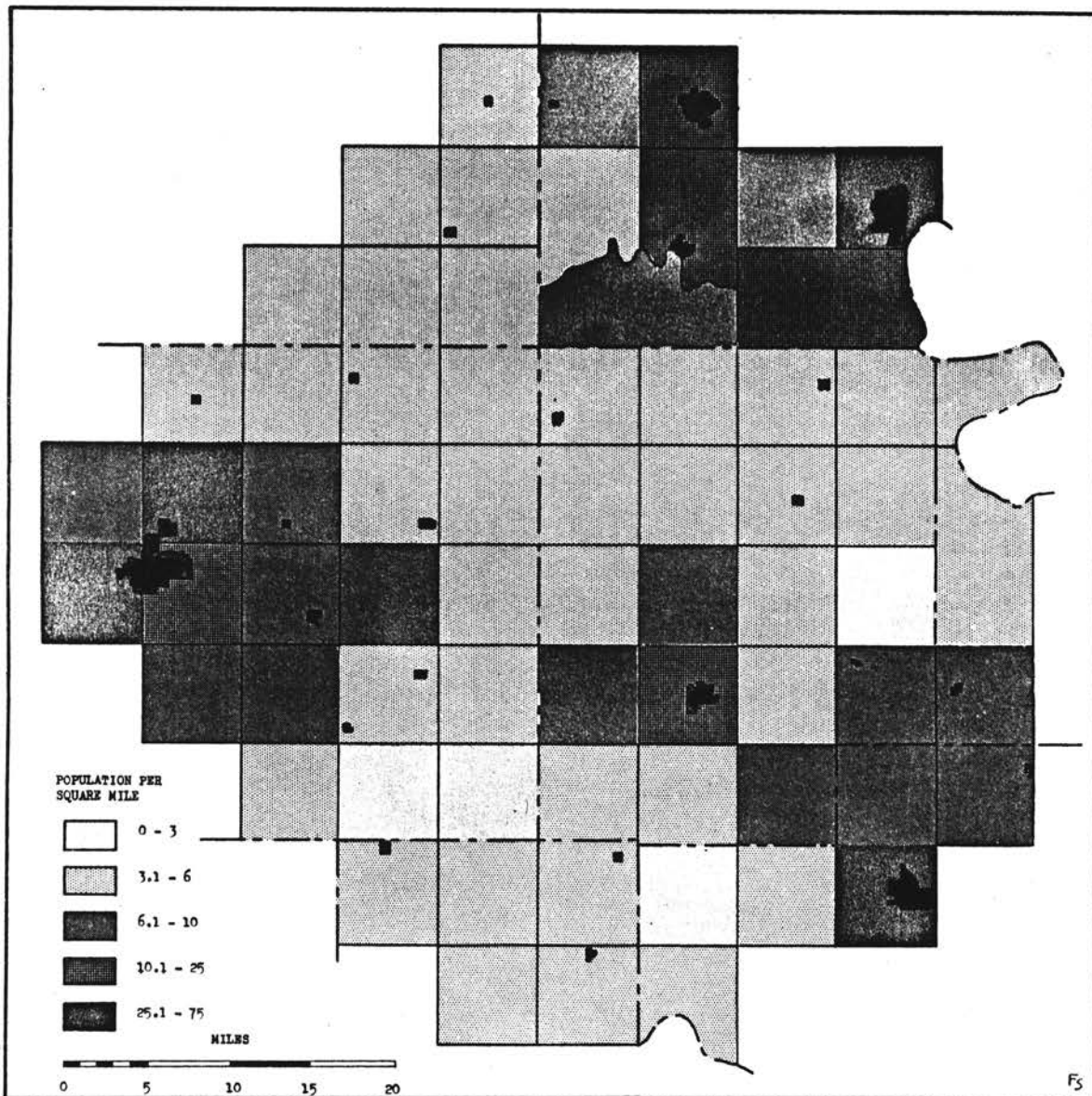
<u>COUNTY AND</u> <u>TOWNSHIP</u>	<u>POPULATION*</u> <u>(1960 CENSUS)</u>	<u>TOWNSHIP</u> <u>AREA**</u> <u>(Sq. Mi.)</u>	<u>POPULATION</u> <u>DENSITY</u> <u>(Per Sq. Mi.)</u>
<u>KAY COUNTY</u>			
Blackwell	768	36.3	21.2
Carlisle	260	43.9	6.0
Cross	2,563	35.9	71.4
Miller	1,345	64.2	20.9
Owen	329	54.2	6.1
Renfrow	274	36.2	7.6
Round Grove	299	36.1	8.3
Tonkawa	495	46.3	10.7
<u>LOGAN COUNTY</u>			
LeBron	132	37.9	3.5
Marshall	193	38.0	4.8
Mulhall	167	35.8	4.7
Orlando	214	38.1	5.6
Rosehill	157	36.1	4.5
<u>NOBLE COUNTY</u>			
Auburn	271	36.2	7.5
Autry	225	36.0	6.3
Black Bear	221	36.2	6.1
Buffalo	127	35.9	3.5
Bunch Creek	187	35.5	5.3
Carson	158	36.2	4.4
East Bressie	86	28.9	3.0
Glenrose	212	36.0	6.0
Lowe	175	33.9	5.2
Missouri	54	36.3	1.5
Noble	143	36.1	3.9
Oakdale	130	35.9	3.6
Otoe	196	36.3	5.4
Red Rock	184	36.3	5.1
Rock	135	35.9	3.8
Santa Fe	112	36.0	3.1
Walnut	277	35.6	7.8
Warren Valley	299	36.1	8.3

TABLE III - Continued

<u>COUNTY AND</u> <u>TOWNSHIP</u>	<u>POPULATION*</u> <u>(1960 CENSUS</u>	<u>TOWNSHIP</u> <u>AREA**</u> <u>(Sq. Mi.)</u>	<u>POPULATION</u> <u>DENSITY</u> <u>(Per Sq. Mi.)</u>
<u>NOBLE COUNTY</u> - Continued			
Watkins	420	36.3	11.6
West Bressie	163	35.5	4.6
White Rock	145	36.0	4.0
<u>PAWNEE COUNTY</u>			
Otoe	201	59.1	3.4
<u>PAYNE COUNTY</u>			
Cherokee	172	35.7	4.8
Clarkson	133	33.4	4.0
Clear Creek	91	35.8	2.5
Eden	295	35.9	8.2
Glencoe	273	36.4	7.5
Stillwater	1,286	<u>35.9</u>	35.8
	Total	2,514.9	

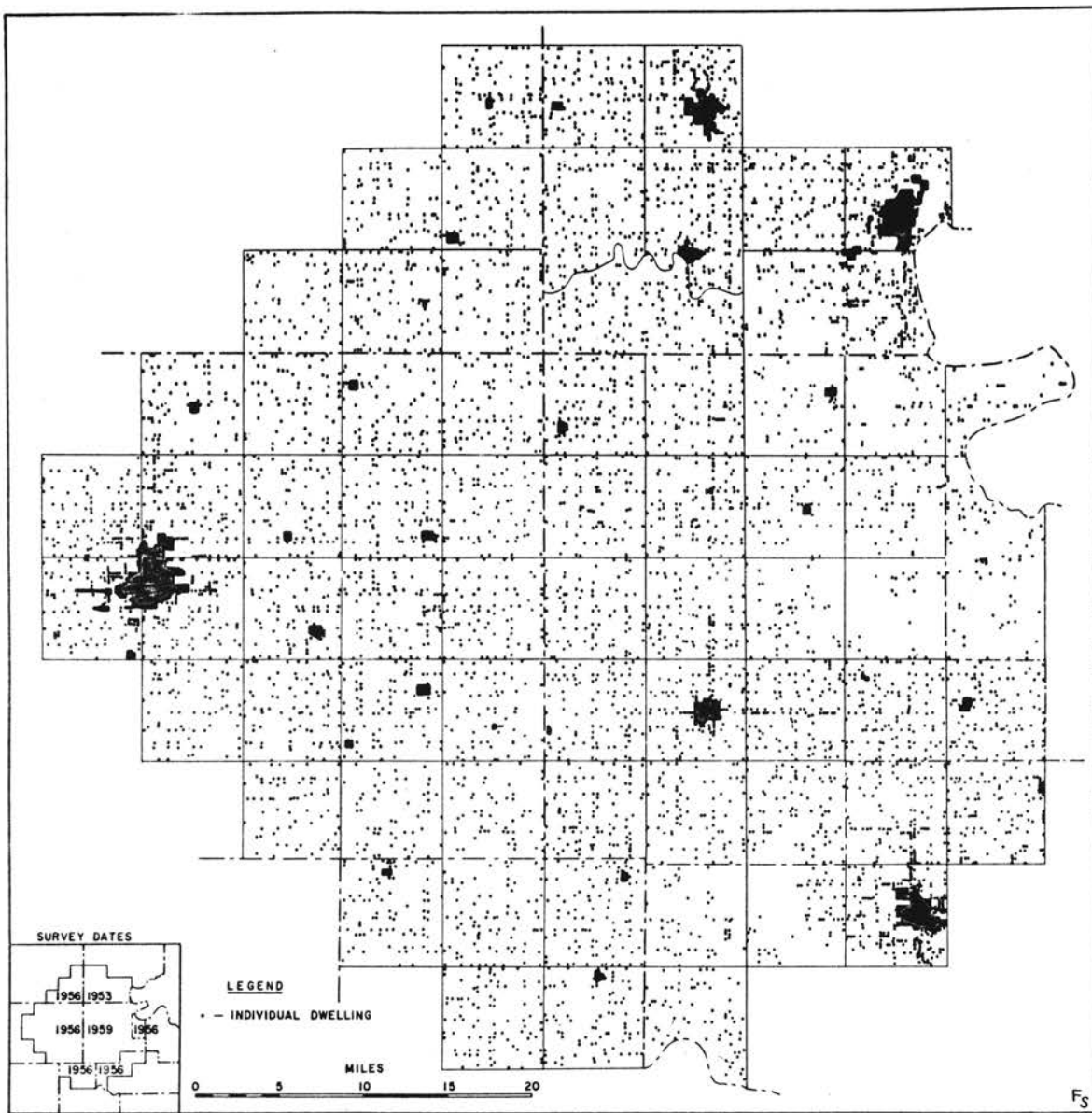
*U. S. Bureau of Census, U. S. Census of Population: 1960, Advance Reports, Final Population Counts, Oklahoma, U. S. Government Printing Office, Washington, D. C., 1960, pp. 6-11.

**U. S. Bureau of Census, Areas of the United States, 1940, U. S. Government Printing Office, Washington, D. C., 1942, pp. 218-221.



POPULATION DENSITY OF CIVIL TOWNSHIPS,
EXCLUDING INCORPORATED PLACES

Fig. 6



SETTLEMENT PATTERN

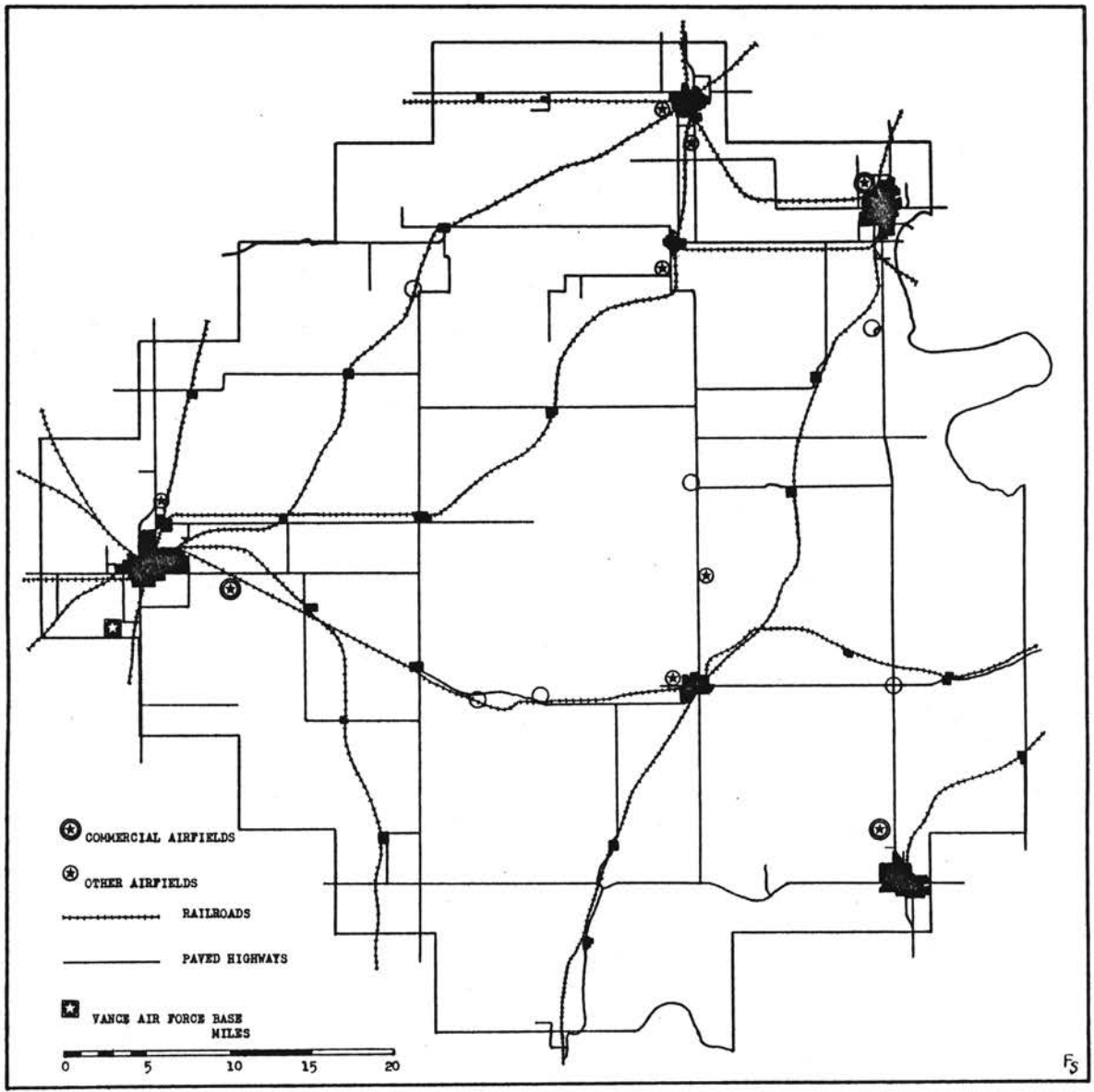
Fig. 7

Transportation Network of Study Area

Oklahoma was surveyed by a rectangular grid system. Most civil townships, unless size and shape are influenced by major streams, contain thirty-six square miles, more or less, composed of thirty-six square mile sections. Each of these sections is bounded on all sides by a road that follows the section line where topographic features do not interfere. Oklahoma's major highways, for the most part, have followed these same section lines. (Note the rectilinear pattern of the paved roads within the study area, Fig. 8). Sumner (population 27) is the only incorporated place not served by a paved highway.

Railroads, which are more restricted by their nature, follow more direct routes between the central places with minor deviations for topography. All incorporated places are served by railroads, with Enid being the most active. The city is like a hub with railroads radiating outward as spokes in ten different directions. Stillwater is the other extreme with only one railway line entering the town from the northeast, and terminating in the city.

The three larger cities of the study area, Enid, Ponca City and Stillwater, are served by commercial airline service. The three next smaller cities in this area, Blackwell, Perry and Tonkawa, also have small municipal airfields. Also included within the area is Vance Air Force Base, a military installation whose airfield is not significantly connected with the transportation network of this area.



TRANSPORTATION NETWORK

Fig. 8

In evaluating the map of transportation, Fig. 8, it must be recognized that roads are common throughout the entire region, following almost every section line. These roads are generally of simple dirt construction, occasionally some are graveled, which causes them to be traveled only when necessary. During wet periods these roads are extremely slick and troublesome. Paved roads are generally well distributed throughout the entire area with the exception of the central region of the study area, which is approximately equi-distant from each of the three major centers.

CHAPTER III

MEASURES OF CENTRAL PLACE IMPORTANCE

The importance of agglomerated settlements can be evaluated by several means. Christaller utilized the number of telephones per thousand population as a supplement to his population based hierarchical pattern. Brush used the number of retail functions. Berry and Garrison considered the number of types of functions in a central place. Central place importance in this study area will be analyzed by methods similar to some of these approaches.

Population as a Measure of Central Place Importance

Population is a commonly accepted measure of the importance of a central place. Specific area studies generally consider population along with other regional characteristics in evaluation of a region.

Christaller, in his study of the population characteristics, determined that distinct breaks or gaps should exist in the progression from small to large centers in a region. This grouping of cities by population characteristics enabled him to establish, with some basis, his theory of the hierarchy of cities. Brush (1953) did not find clear cut breaks in the size arrangement of the agglomerated settlements in southwestern Wisconsin. Instead, he found that when a graph was

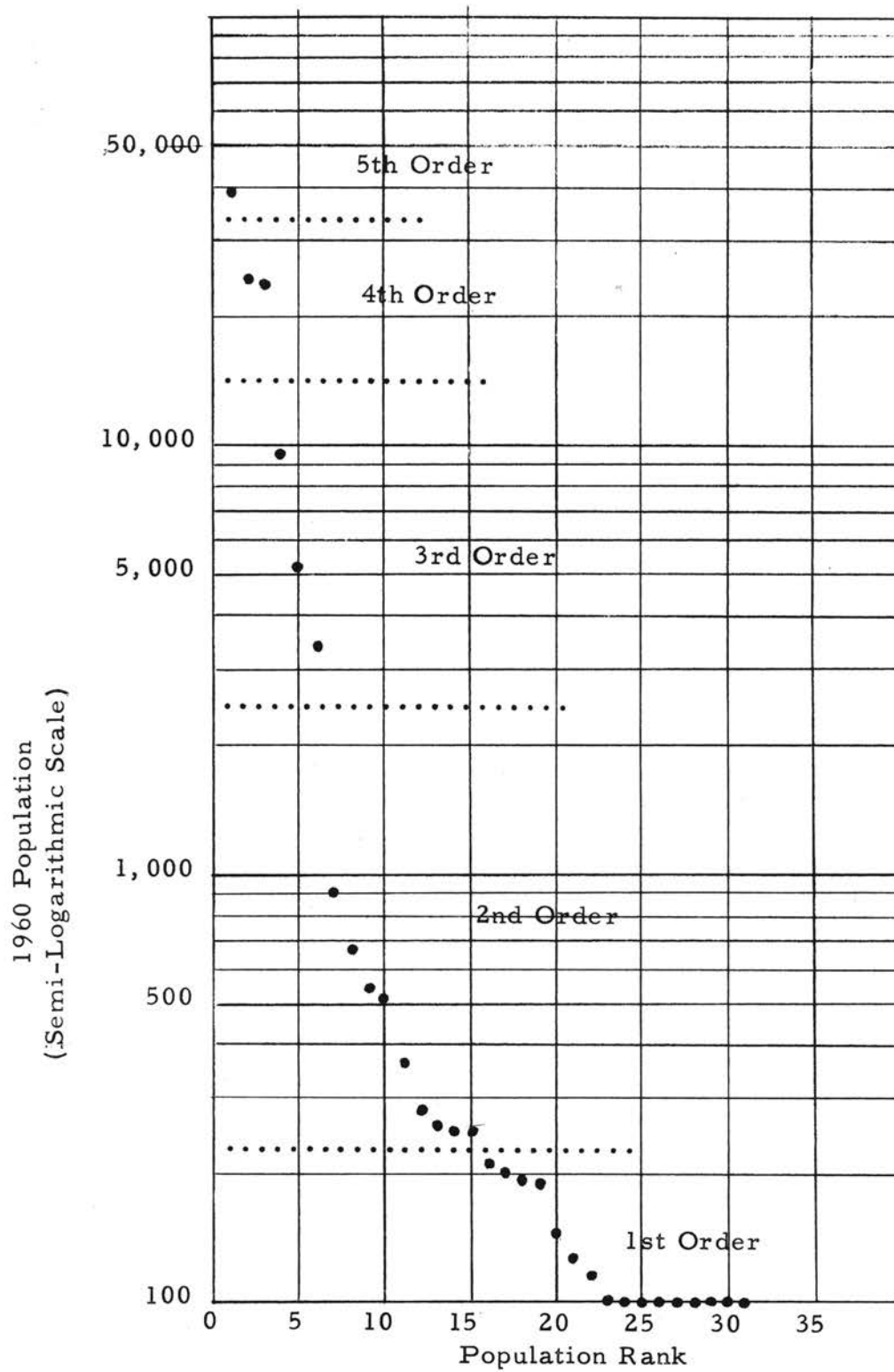
constructed with the populated places arranged according to population and rank, the arrangement was a somewhat smooth curve, or continuum, formed by the progression, with no distinct groupings.¹

A test of Christaller's procedures was made by the use of population to rank and classify the central places as a part of this Oklahoma study. Twenty-six incorporated places and six unincorporated places were identified within the study area. (See Fig. 3 and Table II). Each of these six unincorporated places is estimated by the author to have a population of less than seventy-five persons, which ranks them with the smaller of the incorporated places.

Enid and North Enid, being situated directly adjacent to each other, function as a single central place. For the purpose of this study the separate identification of North Enid is dropped and the combined places are considered throughout as a single central place, designated as Enid. This action reduces the total number of identified places to thirty-one.

As would be normally expected of a small region, distinct size groupings by population are evident. Less distinct separation of groups is found between the smaller places, but nevertheless groupings can be readily found. The classification of the orders of cities by population was accomplished by observation of groupings when plotted on a semi-logarithmic graph. The observed groupings are indicated on Fig. 9.

¹Brush, p. 383.



POPULATION RANK OF AGGLOMERATED SETTLEMENTS

Fig. 9

Distinct size groupings are identified throughout this study by numerical orders, with the smaller size places being classified as the first order. This system of identification for the area seems more valid than attempting to fit identifying names to the distinct groups.

The study area is more sparsely populated than southern Germany. The average size of the classes of central places in this study area also falls below that of southern Germany. See Table IV.

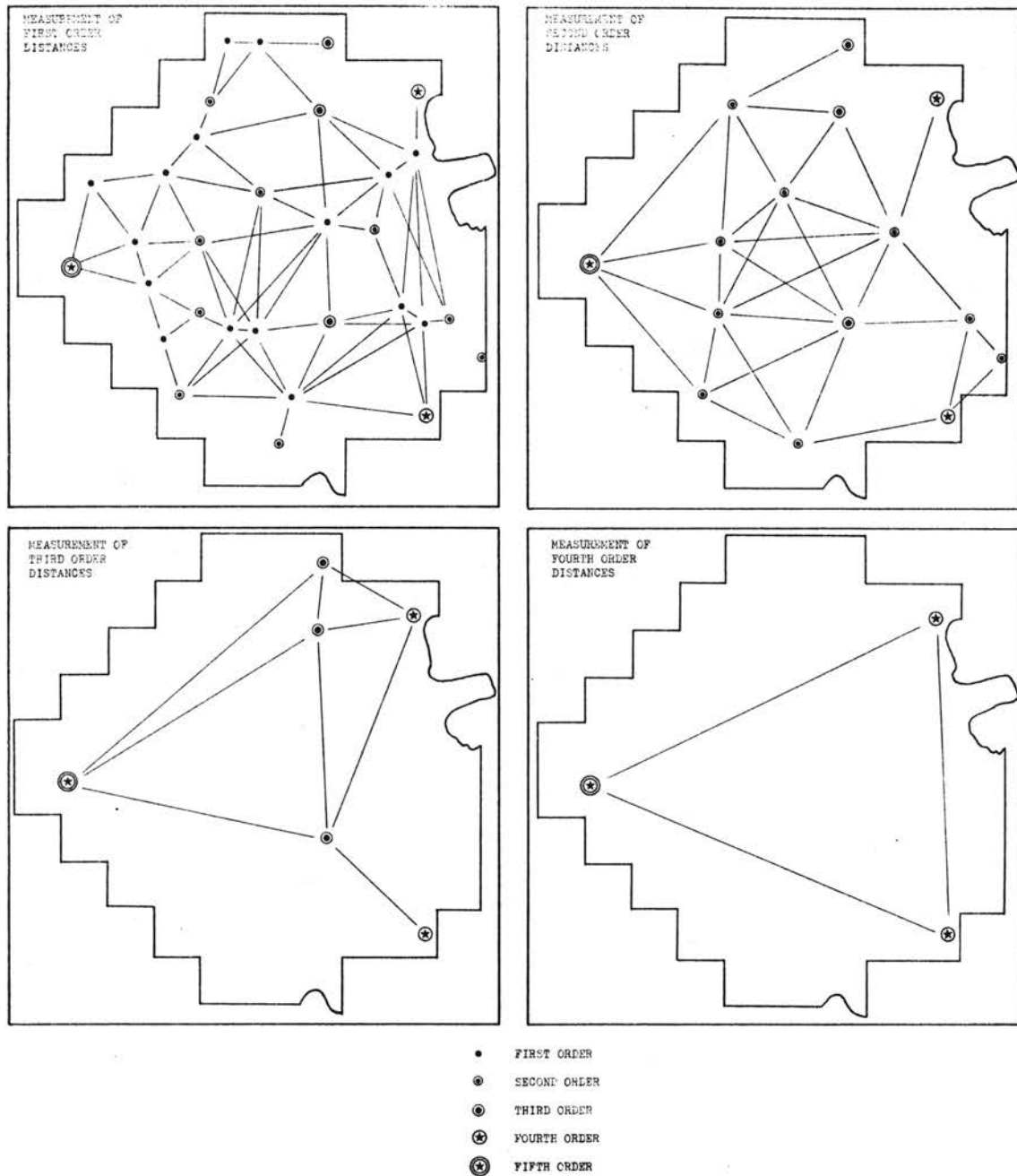
Application of Christaller's hierarchial distribution, as discussed on page 5, was made to the study area by measuring and determining the average distance between the central places of each order. Distances were measured between adjacent central places of equal or larger size. Theoretical distance was obtained by first assuming the actual average distance between centers of the smallest order to be equal to the theoretical distance for this order and then multiplying this theoretical distance times $\sqrt{3}$ to obtain the theoretical distance of the next higher order, etc. Fig. 10 illustrates the measurements made for this test.

The results obtained by actual measurements seem to closely follow the computations of theoretical distance obtained using Christaller's method of $\sqrt{3}$ increase over the preceding lower order. This method would be termed by Lösch as the $K = 3$ method.² Both the average population size of the central place orders and the average distances between orders vary from Christaller's findings in southern Germany, but

²Lösch, pp. 130-31.

TABLE IV
CENTRAL PLACE DISTRIBUTION IN STUDY AREA,
CLASSIFICATION BASED ON POPULATION

Central Place Classification	Places in Classification	Average Distance Apart in Miles		Population Range	Average Population
		Actual	Theoretical		
First Order	16	9.5	9.5	0 - 215	133
Second Order	9	16.1	16.4	253 - 905	451
Third Order	3	25.1	28.4	3,415 - 9,588	6,071
Fourth Order	2	47.0	49.1	23,965 - 24,411	24,188
Fifth Order	1	....	....	39,145	39,145



METHOD OF OBTAINING DISTANCE MEASUREMENTS BETWEEN ADJACENT CENTERS OF EQUAL OR LARGER SIZE, BASED ON POPULATION

Fig. 10

regional differences would be expected to cause such variations.

While the results of this test do seem to follow the Christaller progression, it is apparent that population numbers alone are not a completely valid method of classifying central places. The population of any one place is dependent on too many variables, such as size of families, number of retired persons, and the nature of the actual places. Stillwater, with the presence of Oklahoma State University, is an example. The population is increased by around ten thousand by the presence of the university students and their families. Of these persons the majority are not permanent residents of Stillwater.

Brush ascertained that population alone does not provide a good measure of the functional classification of central places.³ The status of central places should be measured by the functions that they perform. In his study of southwestern Wisconsin, Brush used this approach, classifying the central places by the number of retail units in the agglomerated settlements and the magnitude of specific central services. This seems to be a good approach. Chapter IV will analyze the central place hierarchy of this study area by types of functions.

Berry and Garrison extended their study to identify the types of functions found in the central places.⁴ Places were ranked by the number of identified activities. By this approach they determined that

³Brush, pp. 384-85.

⁴Berry and Garrison, pp. 149-50.

a hierarchy of central places does exist in the region of their study, Snohomish County, Washington.

Sales Tax Returns as a Measure of Central Place Importance

If the importance of a central place is expressed in the number of functions and their relative size, then an indication of this importance might be simply obtained by examination of sales tax returns. The average number of sales tax returns should indicate a good measure of the number of functions and the average monthly sales tax collections should express the relative importance of these functions. To the knowledge of the author, this approach has not previously been utilized.

To check this theory reports of Oklahoma State sales tax returns were examined and the average of the reports for the past year was utilized.⁵ This information is tabulated and compared in Table V.

The average number of monthly tax returns reported to the Oklahoma Tax Commission is closely related to the population of the larger central places. This relationship does not hold true for places under six hundred population. The amount of the average monthly sales tax collection is again in good relationship to the population for the larger places, this time down to places of over nine hundred population. The average monthly tax collection per capita does not follow a

⁵Oklahoma Sales Tax Analyst, Oklahoma State University, October 1959 through November 1960.

TABLE V

OKLAHOMA STATE SALES TAX RETURNS FROM STUDY AREA

Central Place Name	Population	Average Monthly Sales Tax Collection	Average Number of Tax Returns	Average Monthly Collection Per Capita	Average Tax Return	Population Per Tax Return
Enid	39,145	\$104,470	600	\$2.67	\$174.10	65
Ponca City	24,411	63,775	490	2.61	130.15	50
Stillwater	23,965	41,886	297	1.75	141.03	81
Blackwell	9,588	23,450	201	2.45	116.68	48
Perry	5,210	16,407	143	3.15	114.73	37
Tonkawa	3,415	7,761	100	2.27	77.61	34
Garber	905	2,636	36	2.91	73.22	25
Covington	687	1,046	23	1.51	45.48	30
Lamont	543	899	16	1.66	56.19	34
Billings	510	1,335	21	2.62	63.57	24
Marshall	363	739	15	2.04	49.27	24
Glencoe	284	336	13	1.18	25.85	22
Red Rock	262	390	9	1.49	43.33	29
Morrison	256	583	11	2.28	53.00	23
Mulhall	253	559	12	2.21	46.58	21
Deer Creek	215	445	11	2.07	40.45	20
Hunter	203	486	11	2.36	44.18	18
Orlando	194	215	8	1.11	26.88	24
Marland	191	572	9	3.00	63.56	21
Nardin	142	114	5	.80	22.80	28
Kremlin	128	1,667	8	13.02	208.38	16
Fairmont	115	88	5	1.31	17.60	23

Source: Oklahoma Sales Tax Analyst, Oklahoma State University, October 1959 through November 1960.

pattern, but extreme variations from normal are indications that factors other than population alone are the cause of these deviations. The average dollar value of each tax return in a central place bears evidence toward the importance of the functions situated there. It appears, therefore, that sales tax returns for the larger places provide a good measure of central place importance. This analysis does not hold true for the smaller places because any erratic type of function may upset the relationship. (Note the erratic character of Kremlin, population 128.)

Ponca City has a population of less than 2 per cent more than Stillwater, yet Ponca City has an average number of monthly sales tax returns of 65 per cent greater than Stillwater. Sales tax returns from the small town of Kremlin, population 128, show an abnormal behavior when compared to other towns of similar size. This abnormality can probably be connected with the large volume of farm machinery sold in this town. The average monthly sales tax collection per capita for Kremlin would indicate that the sales were made mainly to persons outside the immediate area. Stillwater, with its large student population, has a low monthly tax collection per capita. These examples seem to point up the fact that the sales tax collection returns are not always closely related to the population of the central place, but to the importance of the central place function.

The centrality of an agglomeration of functions seems best indicated by the average total monthly sales tax collection, which would

appear to be an expression of the size of the activity. This approach still fails to indicate the types of activity offered to the population, which is probably also needed as an indication of centrality.

CHAPTER IV

ANALYSIS OF THE STUDY AREA BY TYPES OF FUNCTIONS

The most significant approach for determining the status of central places appears to be that followed by Brush (1953) or Berry and Garrison (April, 1958). The types of functions available at a central place becomes a good indicator of the center's status as a trade and service center. Examination of this study area was also conducted in a similar manner.

Examination of the Central Place Functions in the Study Area.

The study area was personally surveyed by the author in a series of field trips. The small towns and the countryside were systematically explored and central place activities were classified by the type of function they offered. A single place of business that might contain several functions, such as a combination grocery, service station and garage, was classified by the separate types of services offered to the consumer. This type of place just described was classified as three functions; a food store, a service station, and an auto repair shop.

Because of the multitude of goods and services offered in the larger central places and the large area over which they are dispersed, the problem of performing an individual survey of each function was

beyond the scope of this study and the time available. Telephone directories were the source of information for the initial classification of the six larger central places. This data was then supplemented by further individual observations within these cities. It is recognized that some error may result by this method of survey but the margin of error will be small when compared to the total number of functions in each place. The smaller places of agglomerated functions were all surveyed personally by the author and the classifications made by personal observation, supplemented by numerous interviews with local inhabitants and merchants.

An attempt was made during this study to examine the functions in greater detail than is indicated by the previous studies read by the author. This detail was thought to be necessary in order to obtain an accurate classification into orders by types of functions.

The classification of functions was made with the idea of separately identifying the distinct goods and services offered to the consumer at a central place. It was recognized, for example, that shoes may be purchased in either a shoe store, a department store, or an apparel store, while certain types of shoes are often purchased in a sporting goods store or a military surplus store. It would be of no useful purpose to attempt to list and count all the places in which a pair of shoes might be purchased. For the purpose of this classification system, only an establishment with the principal business of shoe and boot sales would meet the classification of a shoe store. A complete listing of

the classified functions and their description is found in the Appendix.

Civil and government type functions were not listed in this study. Their presence seems to normally be controlled by the previous existence of a central place rather than the central place being controlled by their presence. Isolated rural churches and rural elementary schools, where found singly and not grouped with another function, were not considered in this study.

Continuous lineal development along transportation routes was noted in the larger central places, particularly Enid and Ponca City. This built up region extends well beyond the incorporate limits of the central place and contains many central place functions. When this strip development was continuous, the central functions were considered to be contiguous with the central place and therefore considered as being situated within the central place. Functions, with the exception of airports serving the central place, separated more than one mile from this continuously built up area, are arbitrarily considered as a separate place of the central function activity.

Central places were ranked according to the number of types of functions they contained. This procedure should indicate the relative rank of the center if this assumption holds true that the number of types of functions is an indication of the importance of a central place.

Table VI, pages 41 through 45, indicates the numbers and types of functions that were identified in each central place. The functions are also listed in this table in the frequency of their appearance within

TABLE VI

TYPE AND DISTRIBUTION OF FUNCTIONS IN STUDY AREA

ORDER CLASSIFICATION	5						4						3						2						1																																																																																																																																																																	
	ENID						PONCA CITY						STILLWATER						BLACKWELL						PERRY						TONKAWA						GARBER						LAMONT						BILLINGS						COVINGTON						MARSHALL						GLENCOE						MORRISON						DEER CREEK						HUNTER						MULHALL						MARLAND						KREMLIN						ORLANDO						RED ROCK						DOUGLAS						NARDIN						FAIRMONT						SUMNER						BILL'S CORNER						LUCIEN						HAYWARD						WHITE EAGLE						SALT FORK						BRECKENRIDGE						CERES					
POPULATION (1960 U. S. CENSUS)	39,145						24,411						23,965						9,588						5,210						3,415						905						543						516						687						363						274						356						215						203						253						191						128						194						262						74						142						115						27						**						**						**						**						**						42						**					
TYPES OF FUNCTIONS	186						167						155						119						109						77						47						36						34						32						28						24						20						20						19						16						16						14						12						10						8						7						6						6						5						4						4						4						4						3						3					
RANK	1						2						3						4						5						6						7						8						9						10						11						12						13						14						15						16						17						18						19						20						21						22						23						24						25						26						27						28						29						30						31					
CENTRAL FUNCTIONS																																																																																																																																																																																										
Church	58	36	35	14	10	6	7	3	4	5	6	4	4	3	3	4	3	2	3	4	1	3	3	1	3	3	1	3	3	1	3	3	4	3	2	3	4	1	3	3	1	3	3	1	3	3																																																																																																																																												
Service Station	82	58	42	21	24	16	7	6	4	3	2	2	3	2	2	4	2	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	4	2	1	3	1	1	1	1	1	1	1	1	1	1	1																																																																																																																																											
Food Store	38	34	21	16	9	5	2	2	2	3	2	3	2	3	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																																																																																																											
Grain Elevator	10	5	2	2	1	3	3	4	4	2	2	1	1	2	3	1	1	3	2	2	3	2	3	2	3	2	3	2	3	2	3	1	1	3	2	2	3	2	3	2	3	2	3	2	3	2																																																																																																																																												
School, Public, 8th Grade Level	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																																																																																																																																												
School, Public, 12th Grade Level	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																																																																																																																																											
Auto Repair	57	38	34	15	11	8	6	2	4	3	2	2	1	1	1	3	1	2	2	2	1	1	1	1	1	1	1	1	1	1	1	3	1	2	2	2	1	1	1	1	1	1	1	1	1	1																																																																																																																																												
Restaurant	54	42	33	16	11	8	5	3	2	2	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																																																																																																											
Feed and Seed Stores	10	7	4	8	2	2	2	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																																																																																																											
Barber Shop	19	13	14	9	6	2	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																																																																																																											
Express Service	3	4	3	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																																																																																																											
Hardware Store	3	3	3	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																																																																																																											
Bank	3	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																																																																																																											
Beauty Shop	51	38	20	14	11	10	5	2	2	3	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																																																																																																											
Fuel Dealer	15	6	10	9	9	6	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																																																																																																											
Blacksmith	7	6	7	2	4	4	1	1	1	2	2	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																																																																																																											
Drug Store	16	10	8	5	4	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																																																																																																										
Liquid Petroleum Gas	5	5	4	6	3	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																																																																																																										

TABLE VI - Continued

RANK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Farm Implement Dealer	13	5	6	6	4	4	2	1	1	1	1	1	.	1	1	
Tavern	25	14	13	6	6	3	1	.	.	.	.	1	1	.	.	.	.	1	.	.	.	.	.	.	1	.	1	.	.
Lumber	9	9	5	5	2	2	1	1	1	1	.	1	1	1	
Frozen Food Locker	3	1	1	1	1	1	1	1	.	.	1	1	.	1	1	
Physician	56	33	18	14	5	5	1	1	1	1*	1*	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Insurance Agency	65	54	49	15	10	3	1	3	2	1	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Laundry	15	14	15	7	6	5	2	1	1	2	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Department Store	9	6	5	5	4	2	1	.	2	.	.	.	1	.	1	.	1	.	1	.	.	.	.	.	.	.	.	.	.
Pool Hall	5	2	2	3	3	1	1	1	1	1	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Liquor Store	12	10	9	4	4	1	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Auto Dealer, New	10	10	9	7	5	3	2	.	1	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cleaners	19	14	12	5	3	3	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Clinic	5	2	1	4	2	1	.	1	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Mortician	5	4	1	2	2	2	.	2	1	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Printers	9	4	3	1	1	.	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Furniture Store	19	13	11	6	3	3	.	.	.	.	.	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Variety Store	5	5	3	1	1	1	1	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Oil Truck Line	6	1	.	1	6	1	1	1	.	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Builder and Repairs	22	18	11	7	2	6	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Grading Contractor	8	4	4	3	3	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hotel	6	10	4	8	4	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Radio and T.V. Repair	18	12	7	4	4	3	1	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Scrap Iron Dealer	1	3	1	1	2	1	2	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Appliance Store	11	6	8	3	4	3	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Florist and Nursery	8	7	6	3	3	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gift Shop	7	8	9	5	2	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Jewelry	8	5	6	4	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tire Store	18	14	17	7	6	3	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Dentist	23	15	10	3	4	2	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
School, Private	2	4	1	.	2	1	1	1	.	
Plumber	17	9	11	5	3	4	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Shoe Repair Shop	5	5	5	3	2	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Upholsterer	4	4	3	1	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Real Estate Agency	42	26	27	9	2	3	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Movie Theater	4	2	3	1	1	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Newspaper, Weekly	.	.	.	.	.	1	1	1	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Veterinarian	6	4	3	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Attorney	44	26	18	12	10	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Auction House	6	1	2	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Credit Reporting Service	2	2	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Electrical Contractor	5	7	6	4	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Motel	18	9	8	4	5	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Oil Field Service	7	3	7	12	16	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Oil Well Drilling Contractor	2	.	5	2	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Photo Studio	10	5	8	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Airport	1	1	1	2	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bus Depot	2	2	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

TABLE VI - Continued

RANK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Taxi Service	2	3	1	3	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Apparel Store	23	24	18	7	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Auto Parts	9	2	2	3	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Draperies	5	3	4	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Monument Sales	2	2	2	1	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Paint Store	10	7	4	3	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sporting Goods	10	5	5	1	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Truck Dealer	5	6	3	4	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dairy, Home Delivery	3	4	3	3	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Auto Dealer, Used	20	9	3	1	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Auto Salvage	8	5	3	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Awning Sales	5	5	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bakery, Retail	9	7	3	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Mail Order House	1	2	2	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Music Store	2	1	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Office Supplies	5	4	3	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Toy and Hobby Store	7	2	3	3	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Welding Supply Store	3	2	3	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Chiropractor	8	6	3	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hospital	3	2	1	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Optometrist	6	3	3	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ambulance Service	5	4	1	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Nursing Home	8	3	4	.	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Auto Upholsterer	2	2	1	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Painting Contractor	5	5	7	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Heating Installation	23	9	7	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Air Conditioning Installation	9	8	6	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sheet Metal Shop	8	4	5	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Signs	7	5	2	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tailor	2	2	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trailer Rentals	5	4	3	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vending Machine Service	4	3	1	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bowling Lanes	3	2	3	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Freight Truck Line	11	5	2	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Movers and Storage	11	4	3	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Newspaper, Daily	2	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dairy, Wholesale	3	4	4	4	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Food, Wholesale	14	15	8	4	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Antiques	1	3	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bicycle Store	6	4	3	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Book Store	4	1	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carpet and Rug Store	5	3	4	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fabric Store	2	1	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Office Equipment Sales	9	5	5	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sewing Machine Shop	3	1	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Shoe Store	11	7	6	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

TABLE VI - Continued

RANK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Accountant	19	9	11	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Abstractor	7	1	5	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bicycle Repair Shop	2	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Delivery Service	3	2	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Exterminator Service	4	3	3	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fur Storage	3	2	2	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Piano Tuner	3	2	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Drive-In Movie	2	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Loan Agency	11	6	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Radio Station	4	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Septic Tank Cleaners	2	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Auto Equipment, Wholesale	14	5	4	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Livestock Sales	2	1	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Structural Steel Sales	2	4	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Military Surplus Store	1	1	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Beer, Wholesale	5	4	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trading Stamp Redemption Store	3	3	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bottlers	7	6	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Record Shop	2	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Architect	3	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
College or University	1	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Engineer, Consulting	6	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Geologist	1	2	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Orthodontist	1	1*	1*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Chiroprapist	3	1*	1*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
School, Specialty Training	4	7	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bookkeeping Service	4	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Collection Agency	7	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Crop Dusting Service	1	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dancing Studio	2	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dental Laboratory	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Paper Hangers	3	5	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Skating Rink	2	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pawn Broker	3	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Airline Service	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Insurance Adjustor	10	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Equipment Rental Shop	6	1	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aircraft Dealer	1	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Flour Mill	1	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Grain, Wholesale	11	.	1	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Mobile Home Sales	2	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Water Softener Sales	3	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Janitor Supplies	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tobacco Distributor, Wholesale	1	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Radio Communications Sales	3	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

TABLE VI - Continued

RANK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Elevator Equipment	2	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Foundry	1	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bakers, Wholesale	3	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Radio and T. V. Equipment, Wholesale	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aircraft Maintenance and Service	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Clothing Manufacturer	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stamp and Coin Dealer	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Electrical Equipment, Wholesale	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Oil Refinery	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Plumbing Supplies, Wholesale	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sporting Goods, Wholesale	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tires, Wholesale	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Overhead Door Sales	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Grain Brokers	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Travel Agents	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
House Movers	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Investment Securities	4	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Restaurant Equipment	3	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cotton Gin	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Zinc Refinery	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vacuum Cleaner Manufacturer	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saddle Shop	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Liquor, Wholesale	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fence, Wholesale	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Drug Sundries, Wholesale	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hardware, Wholesale	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lumber, Wholesale	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Building Materials, Wholesale	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Candy Manufacturer	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Three Minute Car Wash	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dog Kennels	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Explosive Sales	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Food Broker	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Heating Equipment, Wholesale	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Paper Company, Wholesale	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Photo Finisher, Wholesale	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pipe Company, Wholesale	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Service Station Equipment	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Water Softener, Wholesale	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

x This level of school offered. Count of number of schools was not made.

* Two central places are served by the same person on a periodic schedule, similar to the periodic market in Korea.

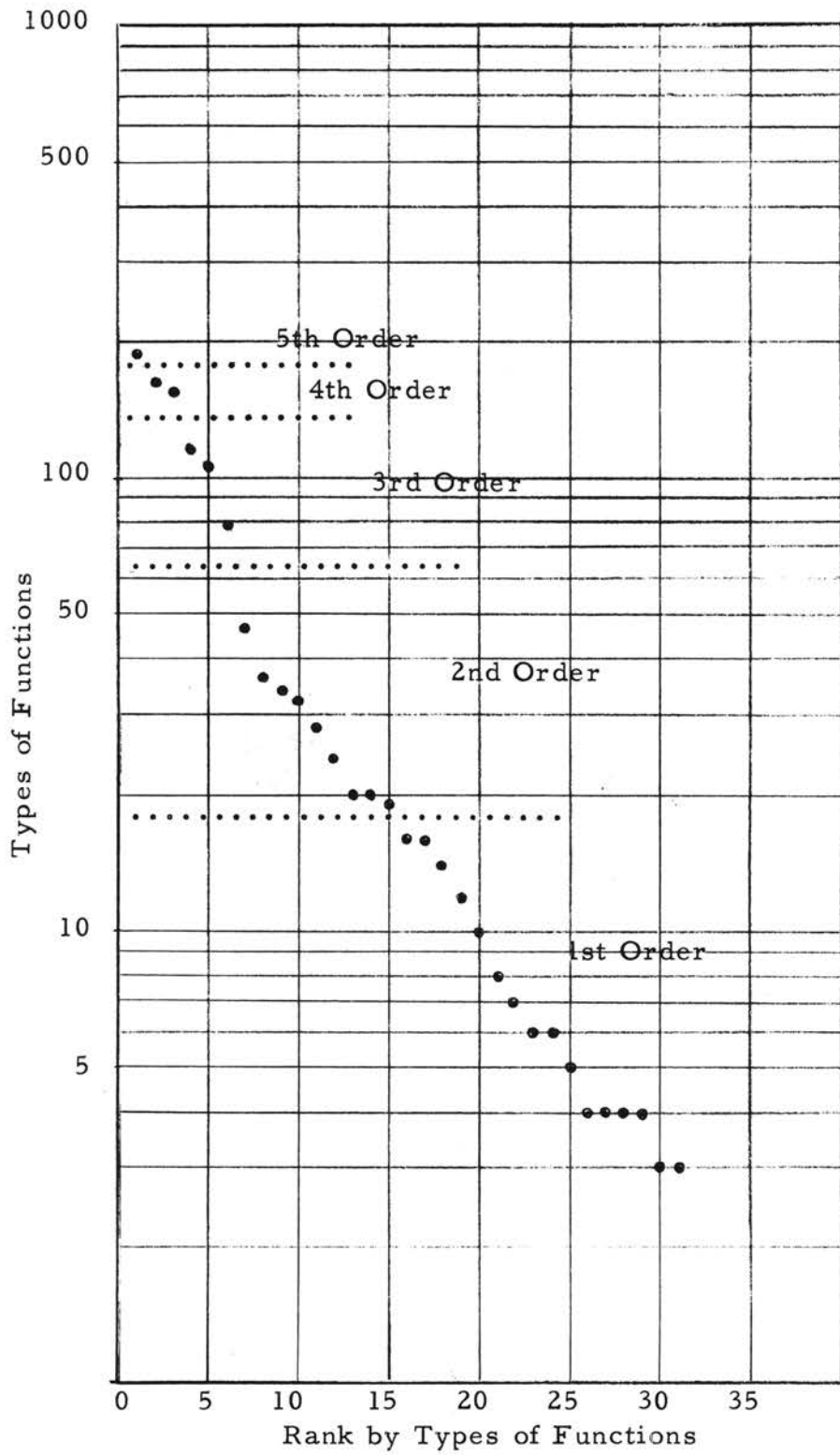
the whole study area. This procedure establishes the relative distribution of the types of functions as well as the relative rank of the central places.

Measurement Between Orders of Central
Places as Determined by Types
of Functions

Orders of central places, based on the type of functions, were again determined by use of the semi-logarithmic graph. (Fig. 11). By this procedure the orders grouped themselves in the same frequency as by the population test. In this test, based on types of functions, several of the smaller places now occupy a position in a different group. Comparison of central places is made by population rank related to the number of types of functions. (Fig. 12). Close relationship of population and types of functions exists between the larger places, but smaller places fail to maintain this same relationship, although at this lower level size distinction is rather insignificant. Measurements using the $K = 3$ system are shown in Table VII.

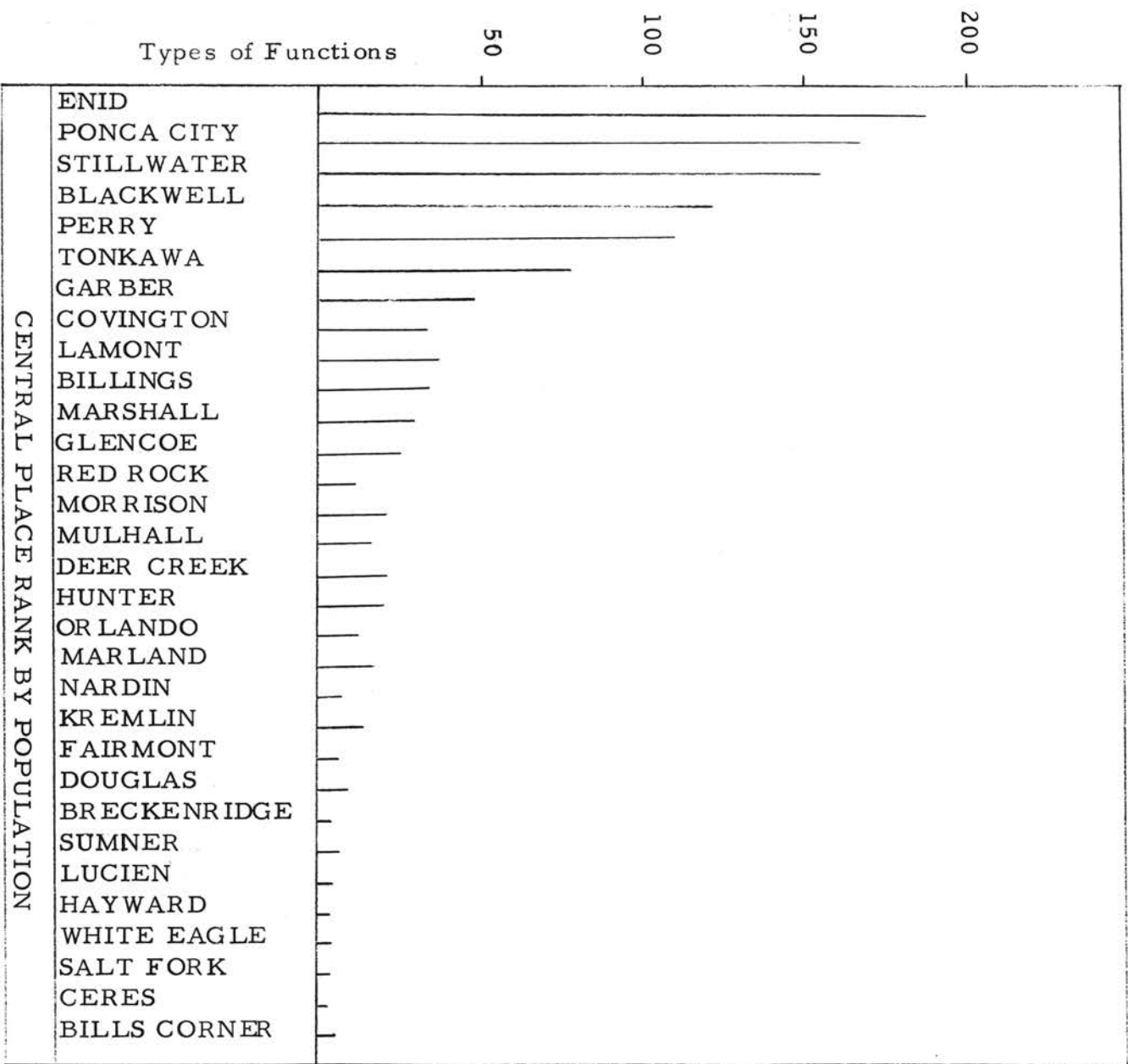
The method of measuring distance between these orders of central place functions is the same as that followed in Fig. 10. The average actual distance between places of the two lower orders varies from the population classification of orders. This results from a shift of some of the lower order places to a higher order, and vice versa, by this method of classification.

Measurements made in the manner just described follow airline



FUNCTION RANK OF AGGLOMERATED CENTRAL PLACES

Fig. 11



TYPES OF FUNCTIONS RELATED TO POPULATION RANK

Fig. 12

TABLE VII
 CENTRAL PLACE DISTRIBUTION IN STUDY AREA -
 (CLASSIFICATION BASED ON
 TYPES OF FUNCTIONS)

Central Place Classification	Places in Classification	Average Distance Apart in Miles		Range in Types of Functions
		Actual	Theoretical	
First Order	16	10.6	10.6	3 - 16
Second Order	9	16.3	18.3	19 - 47
Third Order	3	25.1	31.6	77 - 119
Fourth Order	2	47.0	54.7	155 - 167
Fifth Order	1	....	....	186

distances. Major roads in the study area follow rectangular patterns. This fact seems to necessitate another measurement of distances between order classes. In making these new measurements the only distances considered are those along connecting paved roads. Only the actual paved road distance to the adjacent center of equal or higher rank were thought to be significant, Since the paved roads are the major routes of travel in this region, these roads would channel the traffic from the complementary area to the nearest central place that provides the goods or services desired. The central places were again classified into orders based on the number of types of functions they contained. Average measurements by actual paved road distance should increase over airline distance. Measurements were checked against theoretical distances, again applying the $\sqrt{3}$ principle. Comparison of actual and theoretical distances are made in Table VIII, with 11.1 miles, the average actual paved road distance between first order places, being assumed also as the theoretical distance. These paved road measurements closely follow the theoretical distances, as did the airline distances. This fact would seem to indicate that the major road network is approaching uniformity throughout the study area.

Analysis of Function Distribution

The spatial distribution of functions is determined by many factors. The number of inhabitants in a central place, the density and distribution of the population scattered throughout the complementary area, the

TABLE VIII

AVERAGE PAVED ROAD DISTANCE BETWEEN ORDERS
(CLASSIFICATION BASED ON
TYPES OF FUNCTIONS)

Central Place Classification	Average Distance Apart (Miles)	
	Actual	Theoretical
First Order	11.1	11.1
Second Order	19.5	19.2
Third Order	28.1	33.2
Fourth Order	56.0	57.4
Fifth Order	....	....

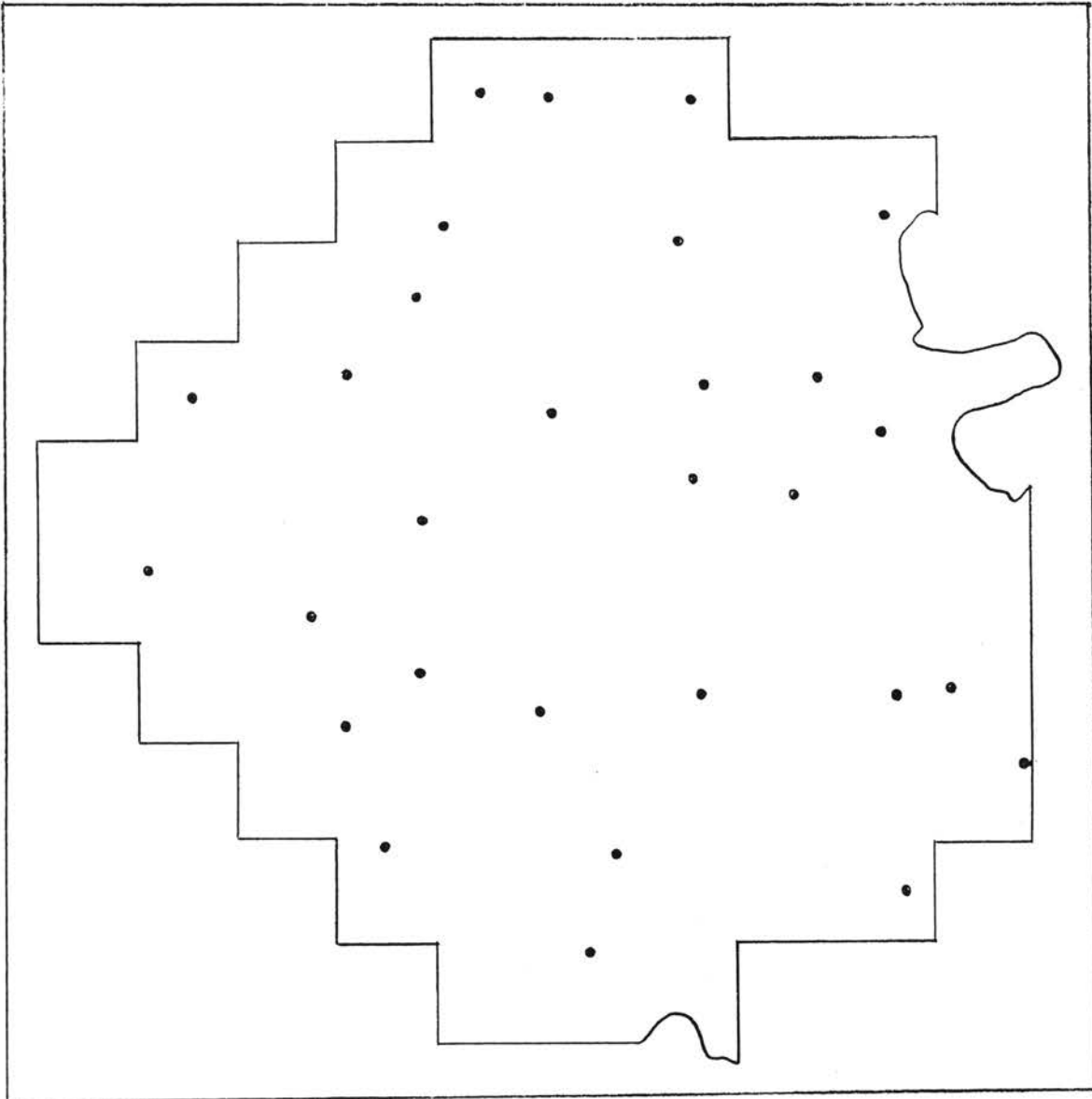
social structure, the income level, the proximity of adjacent competitive central places, and other factors are related to this distribution.

Each function, goods or service, has its own limiting range which depends on price and demand. The demand depends largely on the size and wealth of the complementary region. The more dense the population, the greater the consumption of central place goods and services. Also contributing to the range of goods and services are the means and availability of transportation and the natural endowments of the complementary region.

Food stores and service stations are found throughout the entire study area. See Figs. 13 and 14. The abundance of these functions is due to the almost universal demand for these items. Outside the populated centers these functions are found only on the major highways, more often near the intersection of two highways. The distribution of grain elevators, Fig. 15, is significant of the importance of small grain tillage agriculture throughout the study area.

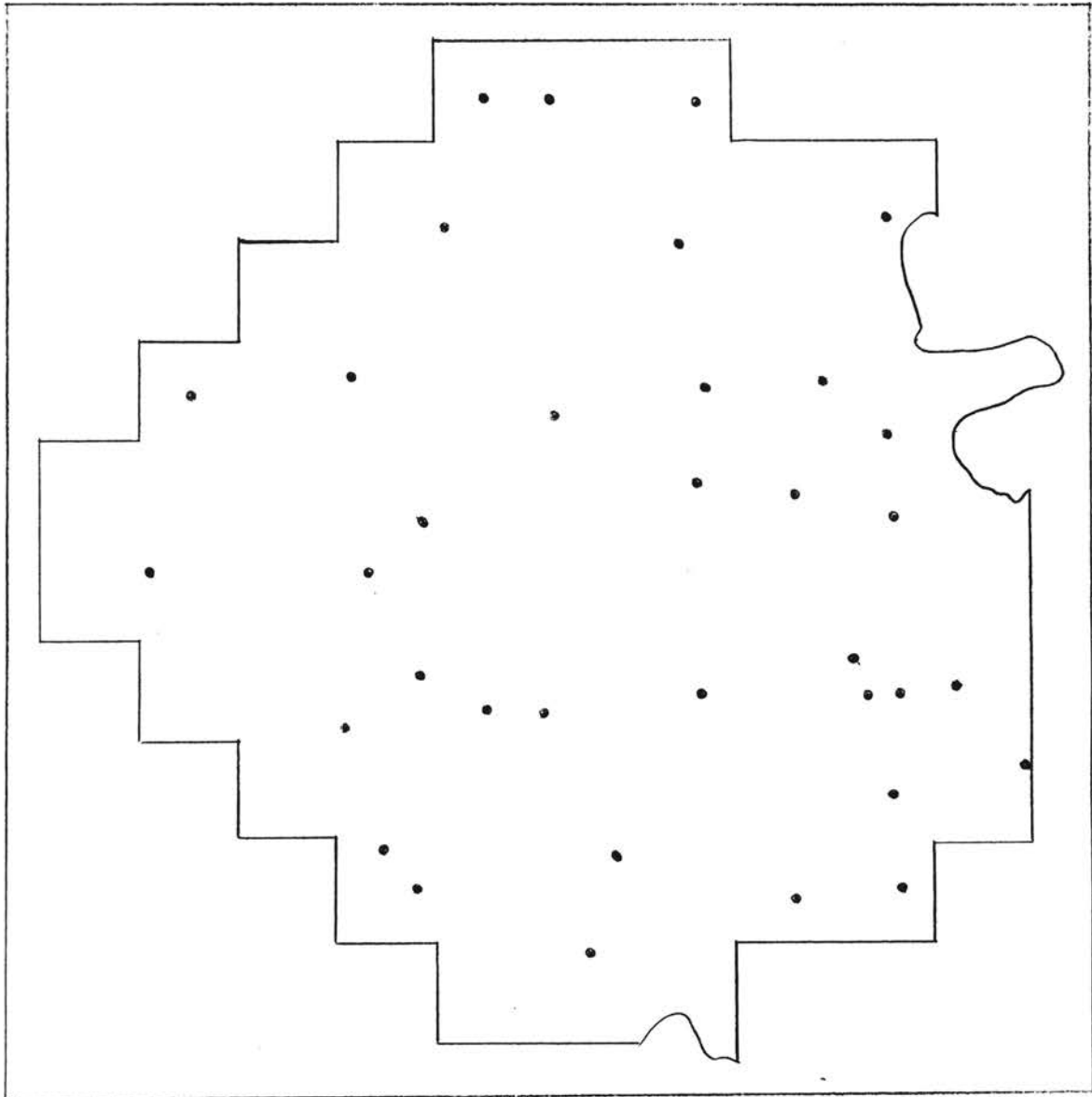
Taverns, farm implement dealers, and resorts are the only functions other than those just described, food stores, service stations and grain elevators, that were found outside the populated central places. Fig. 16 illustrates the distribution of places with one or more central place functions.

Four examples of the periodic type market, similar to the Korean periodic market, were found within the study area. Among these were one barber with a shop in each of two small towns, providing them with



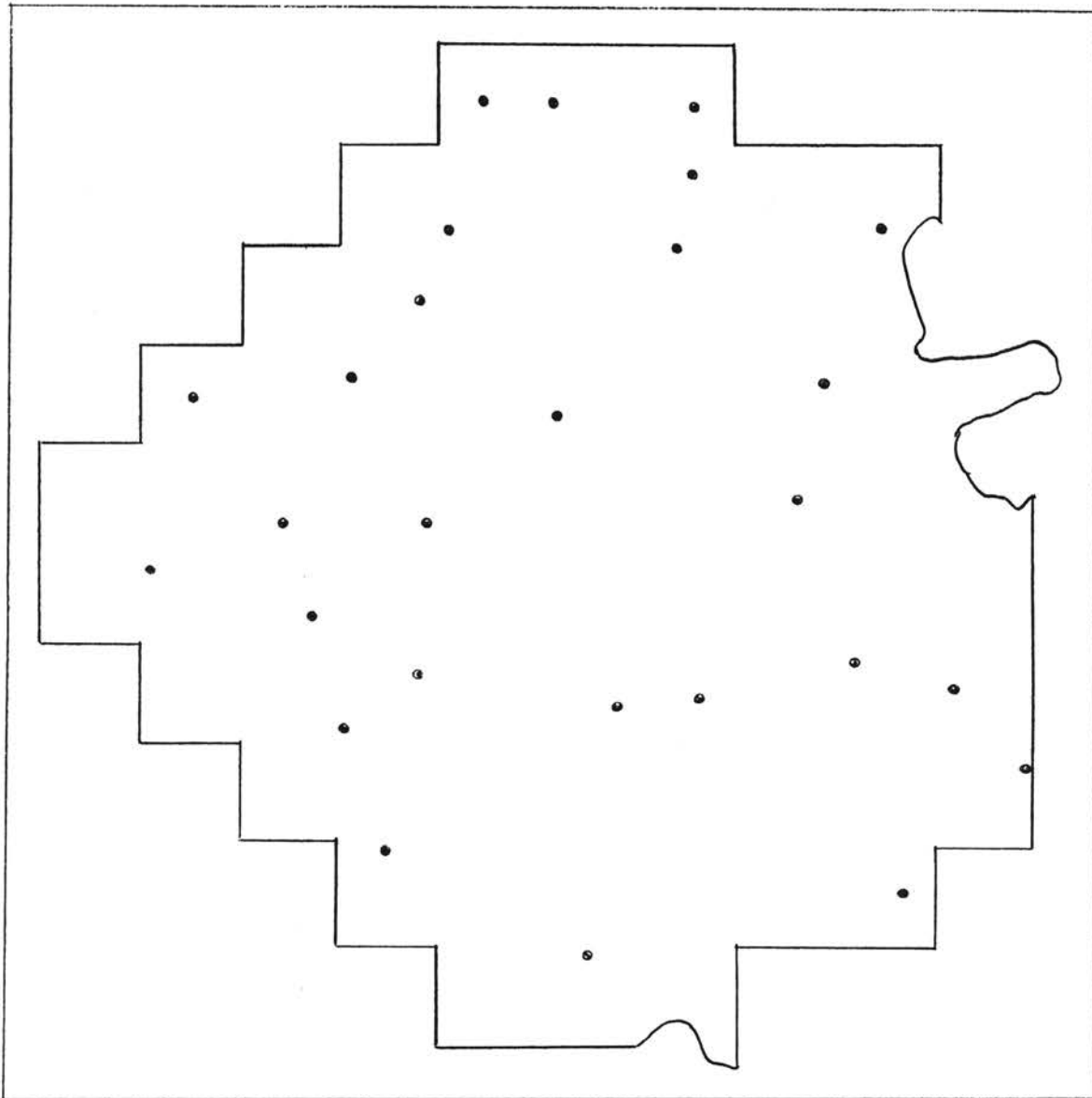
SPATIAL DISTRIBUTION OF CENTRAL PLACES
WITH FOOD STORES

Fig. 13



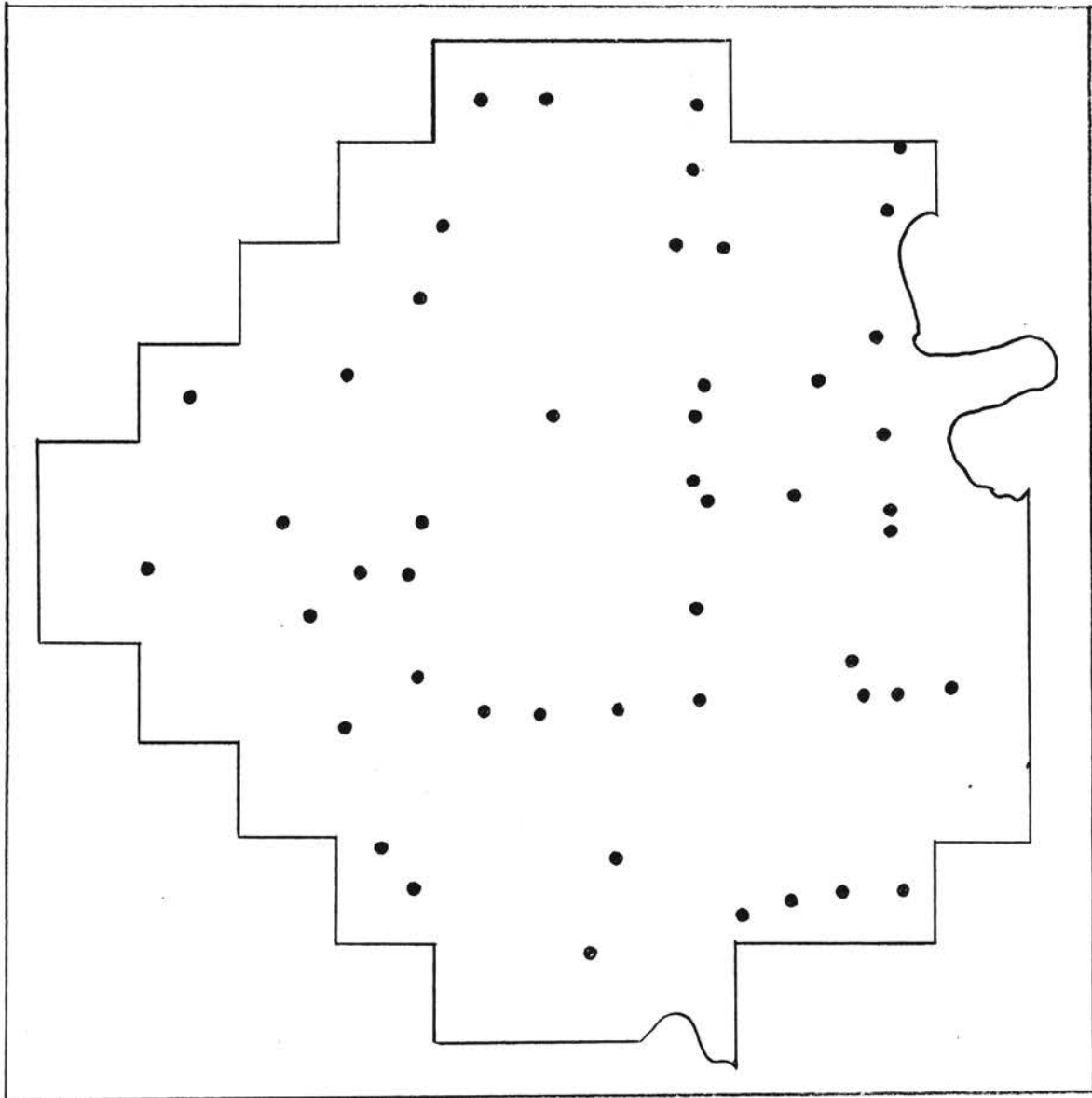
SPATIAL DISTRIBUTION OF CENTRAL PLACES
WITH SERVICE STATIONS

Fig. 14



SPATIAL DISTRIBUTION OF CENTRAL PLACES
WITH GRAIN ELEVATORS

Fig. 15



SPATIAL DISTRIBUTION OF PLACES WITH ONE OR
MORE CENTRAL PLACE FUNCTIONS

Fig. 16

only periodic service. A physician was found serving both Covington and Marshall, with offices in both places. Ponca City and Stillwater are both served by a chiropodist and an orthodontist on a periodic basis. In each case just described, the more specialized the nature of the service offered, the larger the central place served.

The more specialized types of functions found in central places are generally located in the largest central places. Exceptions to this fact may be noted in the petroleum industry and its related activities, whose distribution is influenced by the regional distribution of the resources and not by the size of the central place.

Conformity of the study area to the Christaller hexagonal pattern of distribution of central places could not be observed. The rectangular pattern of the major transportation network would seem to preclude the conformity to a hexagonal pattern. Although the spatial distribution of centers does not follow the hexagonal pattern, the average distances between orders approaches the theoretical distribution.

CHAPTER V

SUMMARY AND CONCLUSIONS

The theory that the spatial distribution of central places follows a definite hierarchial pattern originated with Walter Christaller in 1933. The theory was a conclusion of his analysis of the actual distribution and size of central places in southern Germany. His size classification of central places was based primarily on population, but consideration was made of economic factors, such as numbers of telephones, that influenced the centrality of a place. Under Christaller's theory the spatial distribution of central places follows a pattern wherein the average distance between places increases by $\sqrt{3}$ over the next lower size order.

Christaller further contended that the most significant pattern for the tributary area of a central place is the hexagon. Theoretically the circle is the most representative of the trade area around a central place, but when these trade areas are grouped together the hexagon pattern prevents voids and overlaps that would occur with a cluster of circles.

John E. Brush, Brian J. L. Berry and William L. Garrison, to list a few, have made central place studies in regions other than southern Germany, testing Christaller's theory of central place hierarchy.

They employed other methods for the measure of central place importance, which include the number of retail units, their magnitude, and the types of all central place functions.

The importance of these studies seemed to indicate that a similar type study should be made in a region of Oklahoma to examine the hierarchy of central places in this region. The selected study area, which encompasses the cities of Enid, Ponca City and Stillwater, was examined by methods similar to the other studies.

Central places were identified and grouped into orders by population characteristics and measurements made in a local test of Christaller's theory of distribution. Central places were found to adhere to a hierarchy and the average distances between distinct orders were observed to follow closely the $\sqrt{3}$ theory.

Central places were also classified by the number of types of functions they contained. To achieve this approach a survey was conducted throughout the study area and functions were identified, classified and counted. Functions were examined in great detail, possibly more than previous studies, in an effort to obtain an accurate classification. On this basis of classification into orders the same tests were again made. Again the central places were found to adhere to a hierarchy and the average distance between places was very closely related to Christaller's theory. This portion of the study is most significant as the types of central place functions found in a region seem to be a strong indication of the status of the region, its population, its people, its culture and its economic wealth.

An examination of sales tax returns was conducted as a test related to population and the number of types of functions. Comparisons of this nature are not known to have been conducted previously. This test indicates that both dollar value of tax collections and the number of sales tax returns follows the population order of the larger central places. This relationship will not always hold true for the smaller places because an erratic activity will greatly affect the relative classification of that place. The average monthly per capita tax collection and the average dollar value of each tax return are an indication of both the amount of central place activity and the possible presence of erratic functions.

Regardless of the tests conducted, the results seemed to indicate little deviation from the established order of hierarchy. Few deviations were observed and these could all probably be attributed to the economic status or the erratic functions, rather than the population, of the central place. This conclusion seems to point up the fact that the classification of central places by the number of types of functions is the best overall approach.

It is recognized that this study area is a small region for the application of the Christaller theory. Other studies should be conducted in regions surrounding this area. The resulting group of studies would thus provide a more adequate examination of the hierarchy of the Oklahoma area.

The present study seems to support the Christaller theory by the fact that a central place hierarchy does exist in the north central area

of Oklahoma and, while not following the true theory of the hexagonal pattern, the average distances between orders does follow the theory.

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APPENDIX

ALPHABETICAL LISTING OF TYPES OF FUNCTIONS
AND INTERPRETATION OF TITLES USED
THROUGHOUT THIS STUDY

- Abstractor - Person or firm who prepares title to land.
- Accountant - Person or firm, either a certified accountant or a Certified Public Accountant.
- Air Conditioning Installation - Firm that installs and/or repairs air conditioning systems.
- Aircraft Dealer - Firm making sales of aircraft.
- Aircraft Maintenance - Firm that performs maintenance and service on private aircraft.
- Airline Service - Firm providing air transportation on scheduled basis for persons and goods.
- Airport - Includes all airfields, public and private, that are utilized for the benefit of the place in which they are listed.
- Ambulance Service - Firm providing emergency ambulance service.
- Antiques - Firm that buys and sells antiques of any description. Does not include individuals who pursue this field part-time from their homes.
- Apparel Store - Firm whose principal function is the sale of a general assortment of ready-to-wear clothing articles. Does not include department stores, shoe stores, etc.
- Appliance Store - Firms that specialize in the sale of major appliances, ranges, refrigerators, washing machines, dryers, etc. Does not include firms such as furniture stores and hardware stores.
- Architect - Person or firm providing architectural services.
- Attorney - Person actively engaged in law practice.
- Auction House - Firm that sells their goods by periodic auctions or sells goods for other persons on a commission basis.

- Auto Equipment, Wholesale - Firm engaged in wholesale distribution of auto parts, supplies and equipment.
- Auto Dealer, New - Firm selling factory new automobiles.
- Auto Dealer, Used - Firm that buys and sells used automobiles. Does not include new auto dealers who also may sell used autos.
- Auto Parts - Firm that deals in new repair parts for automobiles. Does not include auto dealers.
- Auto Repair - Firm or garage that does repair on automobiles. Includes automobile dealers who provide this service.
- Auto Salvage - Firm that purchases wrecked autos for salvage and resale of serviceable parts.
- Auto Upholsterer - Firm whose principal function is the repair and reconditioning of automobile interiors.
- Awning Sales - Firm whose principal function is the sale and installation of metal, fiber and cloth awnings. Does not include those sold in a lumber yard.
- Bakery, Retail - Bakery with retail outlet for sale directly to public.
- Bakery, Wholesale - Self-explanatory.
- Bank - An establishment for the custody, loan and exchange of money.
- Barber Shop - Firm concerned with cutting men's hair.
- Beauty Shop - Firm concerned with trimming and beautification of women's hair.
- Beer, Wholesale - Self-explanatory.
- Bicycle Repair Shop - Firm that performs repair on bicycle type vehicles as a standard practice.
- Bicycle Store - Firm that sells bicycles, motorcycles and motor scooters.
- Blacksmith - Firm that performs blacksmithing, welding and machine shop operations for the public.
- Bookkeeping Service - Firm that provides bookkeeping services for other persons or firms.

- Book Store - Firm whose major function is the sale of new and used books.
- Bottlers - Firm that bottles and distributes carbonated drinks.
- Bowling Lanes - Firm that provides indoor lanes for the game of bowling.
- Building Materials, Wholesale - Wholesale dealer in building materials other than lumber.
- Builder and Repairs - Firm that does building construction and repairs on a contract basis.
- Bus Depot - A station where facilities are provided for persons who travel by bus. Does not include "bus stops" in small towns where bus makes stop only on demand.
- Candy Manufacturer - Self-explanatory.
- Carpet and Rug Store - Firm which specializes in floor coverings. Does not include furniture and hardware store that also may handle these items.
- Chiropodist - Doctor treating ailments of the feet.
- Chiropractor - A person practicing healing by adjustment of a person's joints by use of the hand.
- Church - Place of religious worship.
- Cleaners - Firm that performs dry cleaning of clothing.
- Clinic - An institution that provides medical facilities for out-patients.
- Clothing Manufacturer - Self-explanatory.
- Collection Agency - Firm that makes collection of outstanding debts on a commission basis.
- College or University - Includes Junior Colleges and private universities.
- Cotton Gin - Firm that provides service of the separation of cotton lint from the cotton seeds.
- Credit Reporting Service - Firm that provides service of checking past credit ratings of prospective buyers.

- Crop Dusting Service - Firm that provides aerial spraying service to farmers.
- Dairy, Home Delivery - Firm that provides home delivery of dairy products.
- Dairy, Wholesale - Wholesale distributor of milk and dairy products.
- Dancing Studio - Firm providing instruction in dancing.
- Delivery Service - Firm that provides service of delivery of goods within a certain area.
- Dental Laboratory - Firm producing dentures for use by dentists.
- Dentist - Person who treats teeth, makes and inserts artificial teeth.
- Department Store - Store keeping a variety of goods, arranged in various departments. General stores are treated in this classification.
- Dog Kennels - Place that breeds and trains dogs. Also provides boarding place for privately owned dogs.
- Draperies - Firm whose major function is the sale of window coverings.
- Drive In Movie - Outdoor movie theater where patrons view showing from their automobile.
- Drug Store - Firm that sells pharmaceutical drugs and sundries.
- Drugs, Wholesale - Self-explanatory.
- Electrical Contractor - Firm providing electrical installations and repairs.
- Electric Equipment, Wholesale - Wholesale distributor of electrical materials and equipment such as electric motors, wiring, circuit breakers, etc.
- Elevator Equipment - Sales and Service of elevators and related equipment.
- Engineer, Consulting - Professional engineer who provides engineering advise to persons and firms.
- Equipment Rental Shop - Firm specializing in supplying powered equipment on a rental basis.
- Explosive Sales - Firm specializing in sale of explosives.

- Express Service - Truck and rail express provided regularly.
- Exterminator Service - Firm providing for the extermination of pests, rodents, etc.
- Fabric Store - Firm specializing in sale of fabric materials and related items.
- Farm Implement Dealer - Firm selling farm equipment and machinery.
- Feed and Seed Store - Firm selling animal feed and seeds for planting purposes.
- Fence, Wholesale - Wholesale distributor specializing in fence and related items.
- Florist and Nursery - Firms selling flowers, plants, trees and shrubs.
- Flour Mill - Firm engaged in manufacturing flour and related by-products from wheat.
- Food Broker - Firm engaged in establishing sales contracts between a producer and a wholesaler.
- Food Store - Firm selling food items. Includes all grocers, fruit and vegetable markets, meat markets, delicatessens, as well as food items sold in general stores.
- Food, Wholesale - Self-explanatory.
- Foundry - Firm engaged in casting of metals.
- Freight Truck Line - Truck freight company with regularly established office and delivery service within the central place.
- Frozen Food Lockers - Firm providing rental service on frozen food lockers within their establishment.
- Fuel Dealer - Firm dealing in bulk sales of fuel oils.
- Furniture Store - Firm dealing in sale of major household furnishings including furniture, carpets and rugs, and major appliances.
- Fur Storage - Firm providing summer storage of furs and winter type garments.
- Geologist - Person or firm providing geologic analysis.

- Gift Shop - Firm dealing in a varied line of merchandise suitable for gifts.
- Grading Contractor - Firm providing grading, leveling and ditching on contract basis.
- Grain Broker - Firm engaged in establishing large volume sales contracts between producer and consumer.
- Grain Elevator - Structure used in the temporary storage of grains.
- Grain, Wholesale - Wholesale distributor of grains for food, feed or other uses.
- Hardware Store - Firm selling items of hardware, small quantity of sporting goods and firearms, small household appliances, points and related items. Hardware sold through lumber yards is not included in this classification.
- Hardware, Wholesale - Distributor of hardware type items on wholesale basis.
- Heating Installation - Firm engaged in installation and repair of heating systems.
- Hospital - Institution in which medical and surgical care are provided to sick and injured patients.
- Hotel - Place providing lodging for many patrons. Generally located near the business district of a central place and is comprised of one building unit.
- House Mover - Firm engaged in the removal and transportation intact of a building from one location to another.
- Insurance Adjustor - Firm engaged in reaching agreement on claims between persons and an insurance company.
- Insurance Agency - Person or firm engaged in the writing of insurance policies.
- Janitor Supplies - Firm specializing in sale of janitorial type supplies.
- Jewelry - Firm engaged in the sale and repair of jewelry type items.
- Laundry - Firm providing service of washing clothing or making service available for use by the consumer through facilities such as coin operated washing machines.

- Liquid Petroleum Gas - Firm providing service of refilling containers with liquid petroleum gas (Propane, Butane, etc.).
- Liquor Store - State licensed retail outlet for liquors.
- Liquor, Wholesale - Self-explanatory.
- Livestock Sales - Firm specializing in the purchase and resale of livestock.
- Loan Agency - Firm making small loans, other than real estate loans and bank loans.
- Lumber - Firm selling lumber products and related building materials such as some sand, cement, hardware and paints.
- Lumber, Wholesale - Wholesale distributor specializing in lumber and other wooden construction materials.
- Mail Order House - Place whose principal sales are through catalog orders.
- Military Surplus Store - Firm dealing in some military surplus items and various other assortment of "bargain type" goods.
- Mobile Home Sales - Firm dealing in sale of mobile homes or house-trailers.
- Monument Sales - Firm dealing in sale of monuments or grave marker stones.
- Mortician - Firm engaged in undertaking and burial of the deceased.
- Motel - Place providing lodging for transients moving by automobile.
- Movers and Storage - Firm engaged in moving and/or temporary storage of household furnishings.
- Movie Theater - Indoor theater showing motion pictures.
- Newspaper, Daily - Newspaper published daily at a central place. May only have six issues per week.
- Newspaper, Weekly - Newspaper published once weekly for distribution at a particular central place.
- Nursing Home - Institution for the care of the feeble and the aged.

- Office Equipment Sales - Firm specializing in sale of office furnishings and equipment.
- Office Supplies - Firm specializing in the sale of expendable office type supplies.
- Oilfield Service - Firm supplying field services necessary for the continued operation of oilfield activities. This includes such services as cementing, shooting, acidizing and welding.
- Oil Refinery - Firm engaged in refining crude petroleum into the finished products.
- Oil Truck Line - Trucking firm engaged in transporting petroleum, crude, or refined, by means of tank trucks.
- Oil Well Drilling - Firm that engages in oil well drilling activities.
- Optometrist - Person engaged in practice of measuring vision for the purpose of prescribing corrective glasses.
- Orthodontist - A dentist who specifically deals with irregularity of the teeth.
- Overhead Door Sales - Firm specializing in sale and installation of overhead type doors.
- Painting Contractor - Firm who engages in painting of structures on contract basis.
- Paint Store - Firm that specializes in the sale of paints and associated materials.
- Paper Hanger - Firm specializing in application of wallpaper.
- Pawn Broker - Firm loaning money on security of personal property.
- Photo Studio - Firm engaged in commercial photography.
- Physician - A licensed practitioner of medicine; may include either a doctor, physician or osteopathist.
- Piano Tuner - Self-explanatory.
- Plumber - Person or firm engaged in installation or repair, and often the sale of plumbing fixtures.

- Plumbing Supplies, Wholesale - Self-explanatory.
- Pool Hall - A recreation parlor offering the games of pool, snooker, dominos and cards.
- Printers - Firm that engages in the commercial production of printed materials.
- Radio and T.V. Repair - Firm specializing in providing service and repair to radios and television sets.
- Radio and T.V. Equipment, Wholesale - Self-explanatory.
- Radio Communication Sales - Firm specializing in sale of radio communication equipment.
- Radio Station - Federally licensed radio broadcasting station.
- Real Estate Agency - Person or firm engaged in the sale of real estate properties.
- Record Shop - Firm, other than a music store, selling phonograph records.
- Restaurant - Place serving prepared foods for consumption on the premises. Includes hamburger drive-ins, ice cream drive-ins, cafeterias, cafes and coffee shops.
- Saddle Shop - Firm specializing in the sale of saddles and related riding equipment.
- School, Private - Parochial type educational institutions.
- School, Public, 8th Grade - One or more public schools in the central place where at least the 8th grade level of education is offered.
- School, Public, 12th Grade - One or more public schools in the central place where at least the 12th grade level of education is offered.
- School, Specialty Training - Schools providing specialty type training, such as business schools and beauty colleges.
- Scrap Iron Dealer - Firm engaged in buying and selling of junk iron and other scrap metals.
- Septic Tank Cleaners - Firm engaged in the cleaning of septic tanks and cess pools.

- Service Station - Firm engaged in sale of fuel to automotive type vehicles.
- Service Station Equipment - Firm engaged in the sale of dispensing pumps and other related specialized equipment required for the operation of a service station.
- Sewing Machine Shop - Firm engaged principally in the sale and maintenance of sewing machines.
- Sheet Metal Shop - Firm engaged in the sale and fabrication of items comprised principally of sheet metals.
- Shoe Repair Shop - Firm engaged in repair of footwear and leather goods.
- Shoe Store - Firm engaged principally in the sale of footwear.
- Signs - Person or firm engaged in the painting, construction and erection of outdoor signs.
- Skating Rink - Structure providing indoor facilities for roller skating.
- Sporting Goods Store - Firm offering a large selection of equipment utilized in recreation activities.
- Sporting Goods, Wholesale - Self-explanatory.
- Stamp and Coin Dealer - Firm offering stamps and coins for sale to collectors.
- Structural Steel Sales - Firm specializing in selling structural steel building materials.
- Tailor - Person or firm engaged in the custom fabrication of clothing.
- Tavern - Place selling beer for consumption on the premises. Does not include pool halls and domino parlors.
- Taxi Service - Firm providing individual transportation for hire.
- Three-minute Car Wash - Firm specializing in speedy washing of automobiles.
- Tire Store - Firm offering a variety of tires. Includes some service stations that carry stocks of new tires.
- Tires, Wholesale - Self-explanatory.

- Tobacco, Wholesale - Wholesale distributor of cigarettes, cigars and other tobacco type products.
- Toy and Hobby Store - Firm specializing in sale of children's toys and games and handicraft or hobby type supplies.
- Trading Stamp Redemption Store - Firm providing goods in exchange for a collection of trading stamps.
- Trailer Rentals - Firm providing automobile type trailer on a rental basis.
- Travel Agency - Firm that engages in making travel arrangements and ticket sales.
- Truck Dealer - Firm engaged in the sale of new trucks.
- Upholsterer - Person or firm engaged in the repair and recovering of household furniture.
- Vacuum Cleaner Manufacturer - Self-explanatory.
- Variety Store - Firm handling a miscellaneous assortment of small items, often termed as a 5 and 10 Cent Store.
- Vending Machine Service - Firm engaged in ownership and operation of coin operated machines situated in other business establishments.
- Veterinarian - A person engaged in treating diseases or injuries of animals.
- Water Softener Sales - Firm engaged principally in the sale of devices to reduce mineral content of water.
- Welding Supply Store - Firm selling supplies and equipment used in welding.

VITA

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