The Correlation Between a Natural Geographic Region And Its Cultural Landscape— Study Area: The North Canadian River Watershed In Oklahoma

RONALD R. FRIEDMAN, University of Oklahoma, Norman

. . . the region as a cultural area (is) an assemblage of such forms as have interdependence and is functionally differentiated from other areas. (C. O. Sauer)

The problem involved here is the determination of the correlation of a natural geographic region and its cultural landscape. This study is so constructed as to present in the context of an experimental design, a geographic area analysis by the application of standard statistical procedures. Emphasis is placed on the use of ratio-rank correlations which are measures of the relationships of a series of variables. In the case of this study the variables will be represented by the dynamic elements of the cultural landscape.

The natural geographic region selected for the study is the watershed of the North Canadian River in Oklahoma. This region covering an area of 5,930 square miles runs from the northwest to the southeast beginning just east of Fort Supply and ending at the South Canadian River near Eufaula. The North Canadian moves in a narrow river basin from its western extremity to a point about midway downstream. At some places the valley is less than ten miles in width. Just east of Oklahoma City the river valley widens to include its major sub-basin, the Deep Fork.

The North Canadian River passes through four major topographic regions. Beginning in the west on the High Plains the river passes into the Gypsum Hills Region between Woodward and Seiling. At about 98 degrees west longitude near El Reno the river valley enters the fertile lands of the Redbed Plains which are sometimes referred to as the Low Plains. A little east of Midwest City the North Canadian flows into the Sandstone Hills section which is the last of the major topographic regions. Elevations range from 1906 feet at Woodward to 617 feet at Eufaula.

The region had a total population of 544,756 in 1950, with 410,484 (75.4%) being urban and 134,272 (24.6%) rural.

For a sample analysis of the watershed's cultural landscape nineteen urban places were used (Table I). These cities represented all the incorporated settlements as of 1950 with a population of at least 2,500. Their total population is two-thirds of the total for the watershed.

TABLE I

URBAN PLACES

North Canadian River Watershed	Population 1950	Control Group— Not in Watershed	Population 1950
1. Bethany	5,705	20. Antlers	2,506
2. Bristow	5,400	21. Ardmore	10,734
3. Chandler	2,724	22. Atoka	2,653
4. Del City	2,504	23. Blackwell	9,199
5. Edmond	6,086	24. Broken Arrow	3,262
6. El Reno	10,991	25. Claremore	5,494
7. Eufaula	2,540	26. Cushing	8,414
8. Henryetta	7,987	27. Drumright	5,028
9. Holdenville	6,192	28. Durant	10,541
10. Midwest City	10,166	29. Elk City	7,962
11. Nichols Hills	2,606	30. Healdton	2,578
12. Okemah	3,454	31. Hobart	5,380
13. Oklahoma City	243,504	32. Hugo	5,984
14. Okmulgee	18,317	33. Kingfisher	3,345
15. Seminole	11,863	34. McAlester	17,878
16. Shawnee	22,948	35. Pawnee	2,861
17. Watonga	3,249	36. Ponca City	20,180
18. Wewoka	6,747	37. Tulsa	182,740
19. Woodward	5,915	38. Vinita	5,518

To act as a control in this study nineteen similar urban places in Oklahoma were selected (Table I). This group of cities is not part of any single state watershed region.

Within each group of urban places eleven representative variables were determined and used for the study of regional relationships (Table II). Each one was then ranked according to its position within its own group of cities and also for its place within the combined 38 urban places (Table III). By doing this all variables assumed three representative values, giving a total of thirty-three measurable items.

TABLE II

VARIABLES*

URBAN PLACES	VARIABLES										
Watershed Group	A %	B %	C %	D %	E %	F %	G %	H Total	I Med.	J Med.	K %
1. Bethany	44.5	30.4	30.2	76.4	6.9	0.3	120.3	5,705	2,250	23.8	5.0
2. Bristow	42.0	53.5	25.8	81.1	14.3	8.3	—10.7	5,400	1,992	32.9	13.2
3. Chandler	33.4	52.0	29.3	86.5	3.6	14.3	—0.5	2,724	2,000	34.3	13.6
4. Del City	51.0	22.0	30.2	95.4	9.6	1.0	100.0	2,504	3,529	24.4	0.7
5. Edmond	38.3	37.1	28.7	75.8	7.3	0.4	52.1	6,086	2,000	27.5	10.0
6. El Reno	42.2	48.6	26.6	76.7	6.5	9.1	9.0	10,991	2,602	32.3	9.9
7. Eufaula	29.5	29.5	26.4	83.5	2.8	24.0	7.8	2,540	1,575	33.2	13.2
8. Henryetta	54.1	52.6	21.1	70.4	36.7	1.3	15.7	7,987	2,491	30.8	10.5
9. Holdenville	33.2	54.5	24.9	83.3	4.9	8.3	6.6	6,192	1,625	35.4	15.6
10. Midwest City	39.9	15.2	24.4	78.6	6.0	0.8	100.0	10,166	3,785	25.9	1.5
11. Nichols Hills	5.8	7.1	20.3	93.4	9.5	3.2	176.6	2,606	10,000	37.2	4.8
12. Okemah	31.5	57.1	28.9	78.2	2.3	2.4	--9.4	3,454	1,618	33.9	13.7
13. Oklahoma City	34.9	32.8	36.7	66.1	11.6	9.3	17.8	243,504	2,804	30.5	7.0
14. Okmulgee	40.5	44.5	26.9	74.5	20.1	22.2	14.1	18,317	1,820	29.3	10.5
15. Seminole	46.9	43.8	21.9	83.7	6.0	6.5	2.7	11,863	2,403	27.7	5.8
16. Shawnee	38.7	43.0	27.5	72.6	8.8	5.3	4.1	22,948	2,062	30.1	10.5
17. Watonga	32.8	53.1	27.9	82.9	5.4	22.5	14.9	3,249	1,350	29.8	12.8
18. Wewoka	39.6	43.1	27.9	83.4	6.0	20.3	—34.6	6,747	2,421	29.9	8.8
19. Woodward	34.3	43.4	30.5	72.4	6.6	0.1	9.4	5,915	2,461	30.7	10.4
Mean	37.2	41.2	27.3	79.7	9.2	8.4	31.4	19,942	2,673	30.5	9.3
Control Group											
20. Antlers	34.7	58.6	26.1	84.5	8.6	13.4	—23.0	2,506	1,490	33.0	14.2
21. Ardmore	32.0	40.8	27.8	80.0	8.3	13.0	5.9	10,734	2,063	32.0	10.6
22. Atoka	30.0	53.2	29.3	81.7	3.3	15.0	4.1	2,653	1,833	31.9	11.2
23. Blackwell	50.9	47.0	26.1	80.1	34.4	0.5	7.8	9,199	2,723	30.8	10.6
24. Broken Arrow	45.8	51.6	25.7	79.8	17.5	1.5	57.3	3,262	2,480	32.5	11.0

25.	Claremore	34.4	51.3	29.7	71.1	8.0	11.3	32.9	5,494	1,867	29.3	13.7
26.	Cushing	46.7	47.5	25.1	80.3	14.9	5.4	9.2	8,414	2,725	31.7	11.0
27.	Drumright	54.1	52.1	17.5	87.9	14.3	1.6	16.8	5,028	2,556	32.3	10.5
28.	Durant	32.4	43.4	24.4	77.3	7.3	6.6	5.1	10,541	1,471	29.8	11.1
29.	Elk City	45.4	45.2	23.6	75.2	9.4	4.3	58.6	7,962	2,684	29.6	9.7
30.	Healdton	53.4	47.2	21.7	87.0	3.2	0.1	24.7	2,578	3,000	30.5	8.5
31.	Hobart	32.8	47.9	26.4	57.2	6.1	6.4	3.9	5,380	2,111	32.9	12.0
32.	Hugo	36.1	52.8	25.4	84.0	7.1	15.9	1.3	5,984	1,388	32.4	13.3
33.	Kingfisher	31.7	47.5	27.4	82.3	5.9	12.6	—0.2	3,345	2,092	31.7	12.7
34.	McAlester	36.4	48.5	30.8	70.5	8.9	14.3	44.2	17,878	2,017	31.3	9.3
35.	Pawnee	31.9	44.3	24.7	84.7	2.5	26.0	4.3	2,861	1,618	29.2	12.8
36.	Ponca City	39.0	65.1	30.9	78.8	35.1	4.7	20.2	20,180	3,283	30.4	6.7
37.	Tulsa	30.0	29.1	35.4	69.1	17.2	10.0	27.6	182,740	3,042	31.2	6.9
38.	Vinita	35.0	49.3	28.5	73.0	6.4	7.3	—2.9	5,518	1,637	33.0	13.6
	Mean	38.6	48.5	26.6	78.1	11.5	8.9	15.7	16,434	2,215	31.3	11.0

*See key for description of variables (pp. 5-7)

TABLE III

COMBINED RANKS OF VARIABLES*

URBAN PLACES	VARIABLES											
	A	B	C	D	E	F	G	H	I	J	K	Mean
1. Antlers	16	37	23	32	16	29	37	37	6	35	2	25
2. Ardmore	8	9	16	20	17	28	23	9	14	21	18	17
3. Atoka	4	33	9	24	34	32	26	33	15	28	14	23
4. BETHANY	29	5	6	13	22	3	2	21	38	18	35	17
5. Blackwell	34	17	23	21	3	5	21	12	20	28	14	18
6. BRISTOW	27	34	25	23	8	21	36	24	8	26	8	22
7. Broken Arrow	31	27	26	19	5	9	6	29	31	14	16	19
8. CHANDLER	13	28	9	34	33	30	32	32	3	24	5	22
9. Claremore	15	26	8	6	18	26	9	23	10	27	3	16
10. Cushing	32	19	28	22	7	16	19	13	16	8	16	17
11. DEL CITY	35	3	6	38	11	7	3	38	37	3	38	20
12. Drumright	37	29	38	36	8	10	14	26	12	12	20	22
13. Durant	9	12	32	15	19	19	24	10	28	26	15	20
14. EDMOND	21	8	12	12	19	4	7	18	35	24	25	17
15. Elk City	30	16	33	11	13	13	5	15	30	10	27	18
16. EL RENO	28	23	20	14	24	23	20	8	12	11	26	19
17. EUFAULA	2	25	21	29	36	37	21	36	5	34	8	23
18. Healdton	36	18	35	35	35	1	11	35	23	6	30	24
19. HENRYETTA	37	30	36	4	1	8	15	14	20	13	20	18
20. Hobart	10	21	21	1	26	17	28	25	8	19	13	17
21. HOLDENVILLE	12	35	29	27	22	21	34	17	2	31	1	21
22. Hugo	19	31	27	31	21	33	30	19	11	37	7	24
23. Kingfisher	6	19	18	25	30	27	31	28	16	20	12	21
24. McAlester	20	22	4	5	14	30	8	6	18	23	28	16
25. MIDWEST CITY	25	2	31	17	27	6	3	11	36	2	37	18
26. NICHOLS HILLS	1	1	37	37	12	12	1	34	1	1	36	15
27. OKEMAH	5	36	11	16	38	11	35	27	4	32	3	20
28. OKLAHOMA CITY	17	6	1	2	10	24	13	1	23	7	31	12
29. OKMULGEE	26	15	19	10	4	35	17	5	31	29	20	19
30. Pawnee	7	14	30	33	37	38	25	31	33	32	10	26
31. Ponca City	23	38	3	18	2	14	12	4	25	4	33	16
32. SEMINOLE	33	13	34	30	27	18	29	7	34	17	34	25
33. SHAWNEE	22	10	17	8	15	15	26	3	26	22	20	17
34. Tulsa	3	4	2	3	6	25	10	2	19	5	32	10
35. Vinita	18	24	13	9	25	20	33	22	16	30	5	19
36. WATONGA	11	32	14	26	31	36	16	30	28	38	10	25
37. WEWOKA	24	11	14	28	27	34	38	16	27	16	29	24
38. WOODWARD	14	7	5	7	23	1	18	20	22	15	24	14
MEAN (WATERSHED)	20	17	18	20	20	18	19	19	21	19	21	19
Mean (Control)	19	22	20	19	18	21	20	20	18	20	16	19

*See key for description of variables (pp. 5-7)

Five of the basic variables used are modified forms of the urban typology developed by sociologists Shevky and Bell (1955) in their study of the census tracts in Los Angeles and the San Francisco Bay region. Their typology consisted of the elements of social rank, urbanization and segregation. The social rank contained the occupation ratio of skilled labor and the education ratio. They considered these as part of the distribution of skills. Indicators of urbanization were the ratios of fertility, women in work and single family dwellings. This was tied in theory to the productive activity of the urban population. The ratio of segregation was used to analyze the composition of the people. With these variables the sociologists produced a study in time. They were primarily interested in the changing character of the various census tracts.

In contrast this study for the most part is more restricted to a single point in time. Of greater interest is the determination of the relationship of the cultural landscape and the natural region. This is done by taking each variable in turn and comparing it with every other variable to find the degree of correlation. The results are measures of the relative association between variables. If a significant difference of coefficient values are found between the two groups of cities an assumption can be made in regard to the regional relationships. Also each variable can be tested as to its difference in value between the two groups.

The variables were given a rank value for each of the urban settlements in such order as to scale them to give uni-dimensionality. All were placed in the direction of desired elements for urban places. For the purpose of this report the desirable elements had to be dichotomized into variables that show the degree of urbanization and those that show the quality of the urban place. The degree of urbanization is reflected in such variables as manufacturing and women in the labor force. Quality is measured by items like median income and the growth ratio. Thus by taking a mean of ranks for the eleven variables it is possible to see which city is more urban both in degree and quality. The results of the mean ranks for Tulsa and Oklahoma City show that they were the highest with the average of the former being 10 and the latter city 12 (Table IV).

TABLE IV

COMBINED RANKS

HIGH-LOW

	VARIABLES	WATERSHED GROUP	RANK	CONTROL GROUP	RANK
A.	Occupation				
	High Rank	Nichols Hills	1	Tulsa	3
	Low Rank	Henryetta	37	Drumright	37
B.	Education				
	High Rank	Nichols Hills	1	Tulsa	4
	Low Rank	Okemah	36	Ponca City	38
C.	Women in Labor force				
	High Rank	Oklahoma City	1	Tulsa	2
	Low Rank	Nichols Hills	37	Drumright	38
D.	1-Family dwellings				
	High Rank	Oklahoma City	2	Hobart	1
	Low Rank	Del City	38	Drumright	36
E.	Manufacturing				
	High Rank	Henryetta	1	Ponca City	2
	Low Rank	Okemah	38	Pawnee	37
F.	Segragation				
	High Rank	Woodward	1	Healdton	1
	Low Rank	Eufaula	37	Pawnee	38
G.	1940-50 growth				
	High Rank	Nichols Hills	1	Elk City	5
	Low Rank	Wewoka	38	Antlers	37
H.	1950 Population				
	High Rank	Oklahoma City	1	Tulsa	2
	Low Rank	Del City	38	Antlers	37
I.	Income				
	High Rank	Nichols Hills	1	Antlers	6
	Low Rank	Bethany	38	Pawnee	33
J.	Median age				
	High Rank	Nichols Hills	1	Ponca City	4
	Low Rank	Watonga	38	Hugo	37
K.	Persons over 65 yrs.				
	High Rank	Holdenville	1	Antlers	2
	Low Rank	Del City	38	Ponca City	33
L.	Mean of variables				
	High Rank	Oklahoma City	12	Tulsa	10
	Low Rank	Seminole	25	Pawnee	26

The following is a summary of the variables used in the study as derived from the Bureau of Census statistics.

I. Social Status

A. Occupation ratio-rank
The higher the resultant ratio the lower the rank order.
Method - "Craftsmen, Foremen, and Kindred Workers" plus "Operatives and Kindred Workers" plus "Laborers, except Mine" divided by "Employed" total minus "Occupation not reported."

B. Education ratio-rank.

The higher the resultant ratio the lower the rank order.
Method - Total persons 24 years and over with only 8 years of school divided by "Persons 25 years and over" minus "School years not reported."

II. Urbanization Components

C. Women in the labor force ratio-rank.
The higher the resultant ratio the higher the rank order.
Method - Total females "14 Years and over" in labor force divided by the total females.

D. Single family detached-dwelling unit ratio-rank. The higher the resultant ratio the lower the rank order.
Method - Total of "1-dwelling units, detached (includes trailers)" divided by all dwelling units.

E. Manufacturing ratio-rank
The higher the resultant ratio the higher the rank order.
Method - Total employed in manufacturing divided by total employed.

III. Segregation

F. Segregation ratio-rank.
The higher the resultant ratio the lower the rank order.
Method - Total non-white divided by the total population.

IV. Growth and Size

G. 1940-50 growth ratio-rank.
The higher the resultant ratio the higher the rank order.
Method - Difference in population 1940 to 1950 divided by the total 1940 population.

H. 1950 population-rank.
The larger the population the higher the rank order.

V. Others

I. Income median-rank.
The higher the median the higher the rank order.

J. Age median-rank.
The higher the median the higher the rank order.

K. Persons over 65 years of age ratio-rank.
The higher the resultant ratio the higher the rank order.

NOTE: The highest rank order possible is 1.
The lowest rank order possible within each group is 19.
The lowest rank order possible for the two groups combined is 38.
All variables are for 1950 unless otherwise indicated.

Using the Pearson Product Moment Coefficient of Correlation (r) it is possible to obtain a measure of the association between variables. This measure is expressed in an absolute number which indicates the degree to which two variables are related. The values of (r) range from -1.00 to 1.00 with the former being representative of a perfect negative correlation and the latter showing a perfect positive correlation. No correlation is represented by 0.00. Due to the size of the sample in this study, certain limitations are imposed on the significant value of (r). In the use of r at the 5% level of probability, the value of (r) must exceed 0.325 before an inference can be made when the correlation is not 0.00. This will make it true in 95 cases out of 100.

PEARSON PRODUCT MOMENT COEFFICIENT OF CORRELATION

Formula

$$r = \frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{[N\Sigma X^2 - (\Sigma X)^2][N\Sigma Y^2 - (\Sigma Y)^2]}}$$

X — Variable "A"

Y — Variable "B"

N — Number of urban places in sample

Assuming that there is a greater degree of association between the various variables of the urban places in the watershed than those of cities not in a particular region, then there is evidence of correlation of the natural region and its cultural landscape.

Since this study is still in progress only preliminary conclusions can be drawn as to the correlation of the natural geographic region and its cultural landscape. Results of the Pearson Product Moment Coefficient of Correlation (r) have not yet been thoroughly analyzed. Inspection of some values of (r) show that this correlation may exist. It may be noted that use of Pearson's method for this study requires computation of 528 values of (r). The author is indebted to the University of Oklahoma for use of the IBM 650 computer, which, as a research tool, is a great time saver.

The difference in means of the variables for each group of cities shows that some definite correlation does exist. In the case of the growth ratio it is found that the urban places of the watershed are growing twice as fast as those cities selected at random. Significant differences are found also for median income, education, manufacturing, median age and persons over 65 years of age. Other variables show these tendencies, but are not great enough to eliminate possible correlation due to chance.

KEY TO TABLES

A Occupation Ratio-Rank
B Education Ratio-Rank
C Women in Labor Force Ratio-Rank
D Single Family Detached-Dwelling Ratio-Rank
E Manufacturing Ratio-Rank
F Segregation Ratio-Rank
G 1940-50 Growth Ratio-Rank
H Population 1950 Size-Rank
I Income Median-Rank
J Age Median-Rank
K Persons over 65 years Ratio-Rank

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