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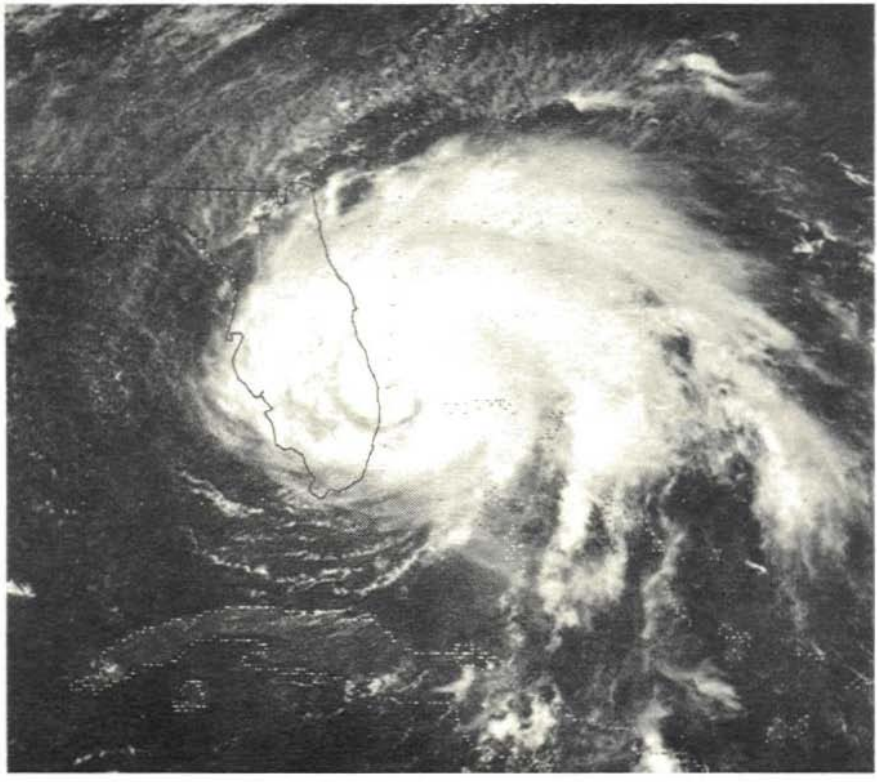

The Florida Geographer is the official publication of The Florida Society of Geographers, and is distributed without cost to members of the Society. Two numbers per year will be published, pending receipt of an adequate number of acceptable manuscripts.

The Florida Geographer is a state-wide journal, with broad coverage of geographical topics relating to the state and its several regions. No restrictions are placed on the content of articles, providing that they deal with some aspect of the geography of Florida, i.e., local studies within the state, matters of the state generally, or the relation of Florida to other areas.

Manuscripts are solicited from all who feel they have research worthy of dissemination. No specific format requirements are presently in force, although the editor would prefer manuscripts to be typed double-spaced following the general format of the articles in the present number. However, authors should not be dissuaded from submitting manuscripts because of format considerations; the editor is willing to undertake extensive revisions. As this number demonstrates, we are able to reproduce maps, charts, and tables.

We would like to publish an original map on the cover of each number, so a special request is made to all who have maps of the state or regions of the state which would be of interest to the Society's membership.

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About the Cover...

The satellite photoprint from the *GOES* system shows Hurricane David at 3:00 P.M. on September 3rd, 1979. The eye can be seen just east of Martin and St. Lucie Counties. The photoprint was made available by the U. S. Department of Commerce, National Oceanic and Atmospheric Administration.

THE FLORIDA

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CONTENTS

SPATIAL ATTRIBUTES OF SOCIAL AREA DIMENSIONS IN MIAMI, FLORIDA SMSA: 1970

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Modernization in developed societies results in a sifting and sorting of urban populations into relatively homogeneous neighborhoods. As cities develop, systematic relationships between geographical space and social space emerge. Three classical models have been developed to describe these sorting-out processes. In 1925 Burgess suggested that growing cities exhibit a concentric zone pattern of land use types. Each zone is viewed as expanding its territory outward by invading the next outer zone.[1] Hoyt added to the Burgess model by noting the general presence of a sector or wedge pattern. He stated that high-class residential areas develop in distinct sectors of the city and migrate outward through time from the central business district in segmented concentric bands. The inner zones are filled in as available housing filters down to the next lower class.[2] Harris and Ullman added the concept of multiple nuclei in which discrete districts occur around several foci in a city rather than around a single central business district.[3]

Facturial ecology studies conducted during the last twenty years suggest that these three models are complementary, rather than contradictory. Typically, a set of social indicator variables is selected for factor analysis.[4] Social area analysis (SAA) studies focus on three composite variables (factors) that usually emerge from these investigations. The first is regarded as a measure of social rank (or socio-economic status) and is most frequently associated with variables measuring income, rent, occupational class, and educational levels. The second is a measure of family status (or family cycle stage) and is most often defined by variables representing degree of female participation in the labor force, fertility, and the prevalence of single or milti-family dwellings. The third component usually suggests ethnicity (or ethnic status) and is associated with some indicator of minority status.[5] Empirical evidence from SAA studies suggests that the Burgess, Hoyt, and Harris and Ullman models each describe a separate aspect of social and residential differentiation within cities. Social rank is said to exhibit a sector or wedge pattern, family status a concentric zonal distribution, and ethnic status a multiple nuclei characteristic.[6]

This paper attempts to determine the spatial patterns of social dimensions for the Miami SMSA.[7] Three hypotheses are tested: (1) social rank most consistently fits the sector pattern suggested by Hoyt; (2) family status is most closely associated with the concentric zone pattern as stated by Burgess; and (3) ethnicity fits best the multiple nuclei pattern suggested by Harris and Ullman. First, the results of a factor analysis will be discussed. Second, two-way analyses of variance and T-tests will be used to test the validity of the three hypotheses. Finally, a distance continuum variable will be correlated with each of the three social area dimensions as a further test of the Burgess model.

Factor Analysis to Establish Social Area Dimensions

A factor analysis was performed for 242 census tracts in the Miami SMSA using eight variables (Table I).[8] These variables are similar to those most frequently encountered in SAA studies.[9] An oblique rotation was used, so that the variable clusters could be accurately defined.[10] The three factors which emerged are not strongly intercorrelated with each other (the strongest correlation was r = -.15). Thus, each factor represents an independent social dimension of the Miami population.

TABLE 1

OBLIQUE FACTOR STRUCTURE MATRIX FOR MIAMI, FLORIDA SMSA-1970

Variables	Factors (loadings)		
	I	II*	III
Occupation[1]	.859	-.151	-.403
Education[2]	.880	-.022	-.032
Income[3]	.836	-.133	.108
Fertility[4]	-.453	-.386	.445
FLFPR[5]	-.508	.149	.703
OUHS[6]	.272	-.270	.813
Negro[7]	-.710	-.445	.254
Cuban[8]	-.171	.886	.011

Source: U.S. Bureau of the Census, *Census of Population and Housing: 1970*, Census Tracts, Miami, Final Report PHC(1)-129 (Washington, D.C.: U.S. Government Printing Office, 1972).

*The signs of the loadings for Factor II have been reversed to facilitate its interpretation.

[1] Occupation = percent of all persons 16 years of age and older employed as (1) professional, technical and kindred workers, plus (2) managers and administrators, except farm, plus (3) sales workers.

[2] Education = median school years completed for persons 25 years of age and older.

[3] Income = median family income.

[4] Fertility = child/woman ratio = number of children less than 5 years of age per 1,000 women in the 15 to 44 year age class.

[5] FLFPR = percent of women 16 years of age and older participating in the labor force.

[6] OUHS = percent of all housing units in one unit structures.

[7] Negro = percent of total population that is Negro.

[8] Cuban = percent of total population that is of Cuban stock (born in Cuba or born in the U.S. with at least one parent born in Cuba).

The first factor represents *social rank*. Census tracts strongly characterized by this factor are represented by high occupational status, high educational levels, high income, and a low percentage of blacks in their populations. The second factor is representative of tracts characterized by a larger than average proportion of Cubans in the population and is therefore a measure of *ethnicity*. Because blacks are often characterized by lower incomes and a generally disadvantaged position, their characteristics are normally inversely associated with the social rank dimension, rather than through a separate factor (as was the case with the Cubans).

The third factor is broadly interpreted as an aspect of *family status*. It is probably most representative of aspiring middle-class suburban households where wives normally work outside the home. This dimension is characterized by single family dwelling units, high female labor force participation rates, and moderate fertility. Most studies have found that female labor

force participation is *negatively* correlated with the family status factor, with middle-class mothers staying home to care for their young children.[11] This was not the case in Miami, however. (SAA studies of several other cities have likewise found the family status factor troublesome to interpret.[12])

Spatial Analysis of the Social Area Dimensions

Factor scores for each of the 242 census tract units used in this study serve as inputs for analyses of variance and T-tests. Parting from tradition, we subjectively delineated a set of five sectors and five concentric zones (Fig. 1). These will serve as frames of reference for testing the validity of the Burgess, Hoyt, and Harris and Ullman models with respect to social rank, family status, and ethnicity. In most similar studies sectors and zones have been constructed geometrically based on *a priori* knowledge. The only exception of which we are aware is a study of Brisbane, Australia by Timms, in which nine sectors were defined along the city's major arterial roads.[13] Five sectors radiating from the city's CBD were defined for this investigation using five of Miami's main transportation arteries as edges.[14] Although Hoyt envisioned his sectors as being centered along major trasport routes, familiarity with the Miami area suggests that these selected routes usually separate, rather than unify, neighborhoods.[15] The selection of these boundaries was based on a visual interpretation of the maps of factor scores displayed in Figures 2, 3, and 4. The five concentric zones have been delineated through use of ten minute isochrones centered about the CBD.[16] Isochrones were used under the assumption that driving time was more important than linear distance in affecting levels of interaction with the CBD.

Social Rank

It was hypothesized that social rank will exhibit a sectoral or wedge pattern in Miami. The distribution of standardized factor scores for this social area dimension was mapped (Fig. 2) and a two-way analysis of variance was conducted to rest for the appearance of wedge, zone, and multiple nuclei patterns (Table 2).[17] Because an analysis of variance test indicates whether or not a significant difference exists between sectors and zones in the aggregate, but does not indicate specifically within which wedges or zones these differences exist, T-tests for each possible pair of sectors and each pair of zones was also performed (Table 3).[18] Social rank in Miami varies significantly by both zones and sectors (Table 2). In addition, interaction

TABLE 2

TWO-WAY ANALYSIS OF VARIANCE FOR SOCIAL RANK IN MIAMI, FLORIDA SMSA-1970

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Critical value of F at α = .05	F / Critical F
Zones	35.04	4	8.76	15.86*	2.37	6.69
Wedges	44.93	4	11.23	20.34*	2.37	8.58
Interaction	28.62	12	2.38	4.32*	1.75	2.47
Residual	122.06	221	.55			
Total	242.28	241	1.00			

* = significantly different at α = .05

TABLE 3

T-TESTS FOR DIFFERENCES BETWEEN ZONES AND WEDGES
FOR SOCIAL RANK IN MIAMI, FLORIDA SMSA-1970

SOCIAL RANK BY ZONES

Zones	Zones 1	2	3	4	5	Zone Means
1	0					-1.23
2	*	0				- .12
3	*	*	0			.40
4	*	N	*	0		- .16
5	*	N	*	N	0	- .15

SOCIAL RANK BY WEDGES

Wedges	Wedges 1	2	3	4	5	Wedge Means
1	0					.36
2	*	0				-.58
3	*	N	0			-.21
4	N	*	*	0		.34
5	N	*	*	N	0	.69

0 = diagonal elements
* = significant difference at α = .05
N = not significantly different at α = .05

exists between zones and sectors, which also suggests a multiple nuclei pattern.[19] Since the zones and sectors used in this study contain the same number of degrees of freedom, their F-values can be compared directly. However, the degrees of freedom for interaction are different. Therefore, the three calculated F-values have been divided by the critical values of F needed to achieve a .05 level of significance to obtain a better estimate for purposes of comparison. When this is done it is clear that the level of interaction is lower than the main effects of the zone and wedge patterns. Furthermore, the wedge effect is somewhat stronger than the zonal pattern.

The highest ranking social status wedges are those numbered one, four, and five, with wedge number five being especially distinctive (Table 3 and Fig. 2). The fifth wedge, extending south of the CBD, includes such high land-value districts as Brickell, Key Biscayne, Coconut Grove, and Gables Estates. The wedge with the lowest social rank is number two, which includes such depressed areas as Opa Locka, West Little River, Model City, and River North.[20]

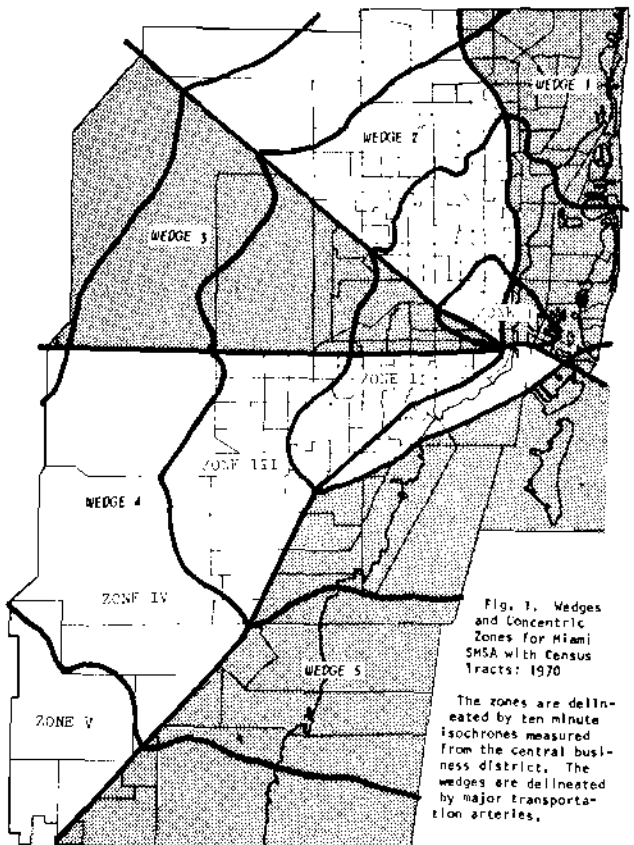


Fig. 1. Wedges and Concentric Zones for Miami SMSA with Census Tracts: 1970

The zones are delineated by ten minute isochrones measured from the central business district. The wedges are delineated by major transportation arteries.

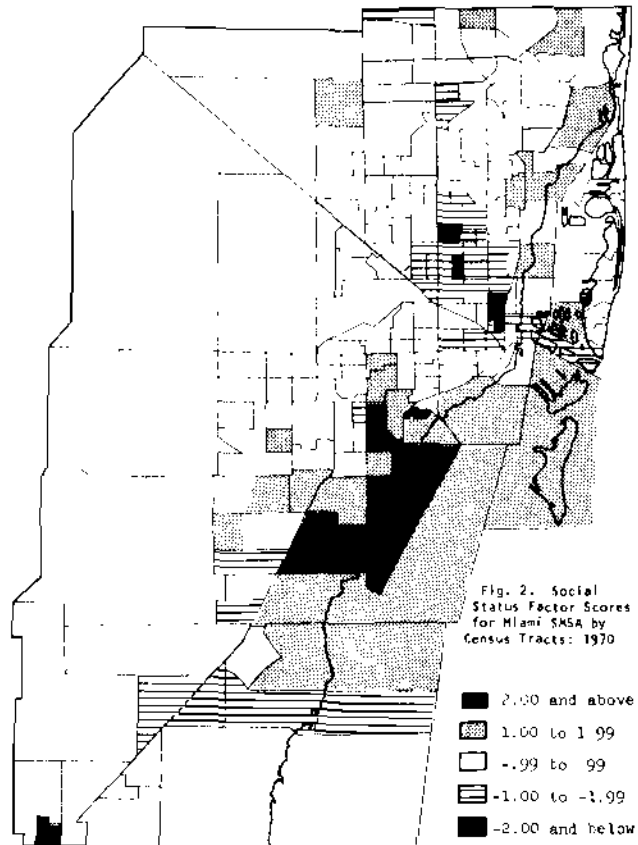


Fig. 2. Social Status Factor Scores for Miami SMSA by Census Tracts: 1970

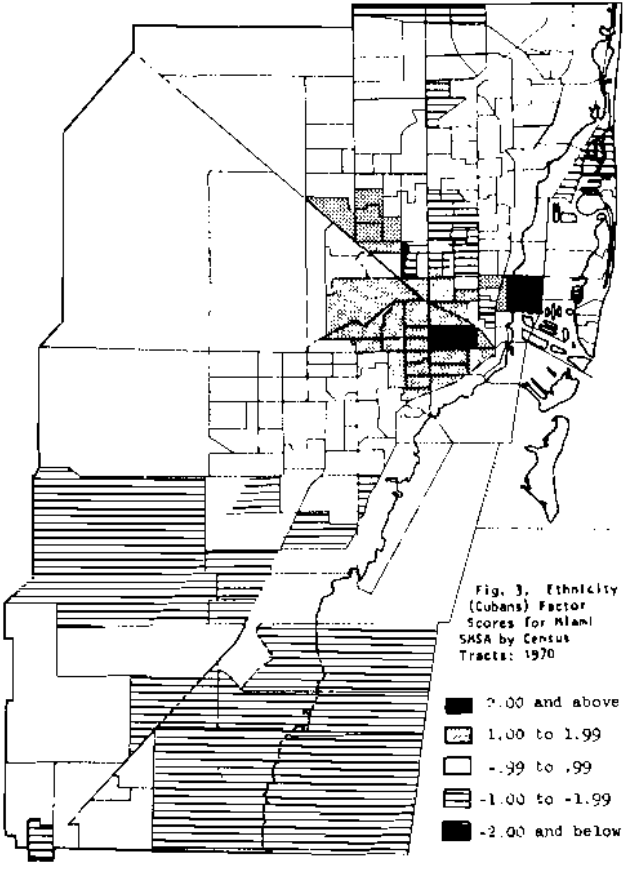


Fig. 3. Ethnicity (Cubans) Factor Scores for Miami SMSA by Census Tracts: 1970

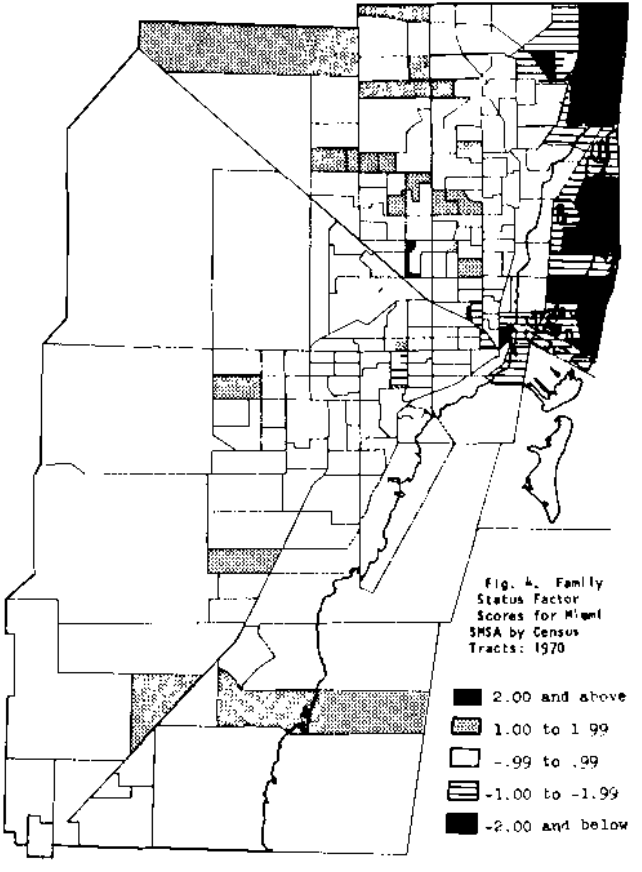


Fig. 4. Family Status Factor Scores for Miami SMSA by Census Tracts: 1970

The zone with the highest social rank is number three, the middle zone. Johnston similarly has noted that in Toronto, Ontario, and cities in Australia and New Zealand there is considerable evidence that the most prestigious suburbs are not on the urban periphery but rather in intermediate zones between the CBD and the fringe.[21] This is also the case in Miami.

Most studies dealing with the spatial distribution of social status have found that status exhibits a wedge pattern. Anderson and Egeland found this to be true in Akron, Dayton, Indianapolis, and Syracuse;[22] as did Schwirian and Matre with eleven Canadian cities[23] and Schwirian and Smith with San Juan, Puerto Rico.[24] Several investigators of other cities have found that social rank varies by both zones and wedges. This was found in investigations dealing with Chicago,[25] Rome,[26] and Brisbane.[27] Our research shows Miami follows this pattern.

Ethnicity (Cubans)

Above we hypothesized that Miami's Cuban population would exhibit a multiple nuclei pattern. Timms in Brisbane found this pattern associated with ethnicity,[28] as did Murdie in Toronto.[29] Eichelberger[30] and Woodbury[31] characterized the population of Miami's Cubans as being a combination of n nucleated and wedge patterns.

Both the wedges and the zones in Miami display significant differences with respect to the Cuban population (Table 4). Cubans are concentrated in the first zone and third wedge (Table 5 and Fig. 3), an area west of the CBD known as Little Havana. A second node appears in sector two, zones two and three (the suburban community of Hialeah).

TABLE 4

TWO-WAY ANALYSIS OF VARIANCE FOR ETHNICITY (CUBANS) IN MIAMI, FLORIDA SMSA-1970

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Critical value of F at $\alpha = .05$	F / Critical F
Zones	28.50	4	7.12	12.11*	2.37	6.69
Wedges	30.22	4	7.56	12.85*	2.37	5.42
Interaction	41.74	12	3.48	5.91*	1.75	3.38
Residual	129.97	221	.588			
Total	242.34	241	1.01			

*= significantly different at $\alpha = .05$

Family Status

Family status, we hypothesized, will exhibit predominately a concentric zone pattern. Most studies have found this to be true. Timms confirms this in Brisbane;[32] McElrath in Rome;[33] Murdie in Toronto;[34] and Berry and Horton in Chicago.[35] Both zones and wedges display significant differences in Miami (Table 6); however, contrary to the studies just mentioned, the differences between wedges is much stronger.

TABLE 5

T-TESTS FOR DIFFERENCES BETWEEN ZONES AND WEDGES
FOR ETHNICITY (CUBANS) IN MIAMI, FLORIDA SMSA-1970

ETHNICITY BY ZONES

Zones	Zones 1	2	3	4	5	Zone Means
1	0					.97
2	N	0				.16
3	*	*	0			- .09
4	*	*	*	0		- .85
5	*	*	*	N	0	- .79

ETHNICITY BY WEDGES

Wedges	Wedges 1	2	3	4	5	Wedge Means
1	0					- .02
2	N	0				.10
3	*	*	0			1.22
4	N	N	*	0		- .02
5	*	*	*	*	0	.56

0 = diagonal elements
* = significant difference at α = .05
N = not significantly different at α = .05

TABLE 6

TWO-WAY ANALYSIS OF VARIANCE FOR FAMILY
STATUS IN MIAMI, FLORIDA SMSA-1970

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Critical value of F at α = .05	F / Critical F
Zones	19.10	4	4.78	8.80*	2.37	3.71
Wedges	98.54	4	24.64	45.38*	2.37	19.15
Interaction	6.87	12	.57	1.06	1.75	.60
Residual	119.96	221	.54			
Total	242.92	241	1.01			

* = significantly different at α = .05

There is a general increase in the mean family status scores for zones as distance increases away from the CBD to zone number four (Table 7 and Fig. 4), then there is a decline in the fifth zone. As for the wedges, there is a progressive decrease moving counterclockwise from the second to first sectors. Very low values are encountered in the first sector, which is largely accounted for by the presence of an elderly population living in multi-family dwellings on Miami Beach. The highest values are found in the middle-class suburbs of wedges two and four.

TABLE 7

T-TESTS FOR DIFFERENCES BETWEEN ZONES AND WEDGES
FOR FAMILY STATUS IN MIAMI, FLORIDA SMSA-1970

FAMILY STATUS BY ZONES

Zones	Zones 1	2	3	4	5	Zone Means
1	0					- .55
2	N	0				- .13
3	*	N	0			.07
4	*	*	*	0		.67
5	*	*	N	N	0	.38

FAMILY STATUS BY WEDGES

Wedges	Wedges 1	2	3	4	5	Wedge Means
1	0					- 1.14
2	*	0				.48
3	*	*	0			.10
4	*	N	N	0		.33
5	*	*	N	*	0	- .01

0 = diagonal element
* = significant difference at α = .05
N = not significantly different at α = .05

The Question of a Distance Continuum

Although Burgess illustrated his ecological urban growth model through a set of concentric zones, some of his statements appear to suggest the presence of a distance continuum effect.[36] In fact, several authors of SAA studies have operationally defined their distance variable as being scaled along a continuum, rather than discrete zones.[37] To test for the effects of a distance continuum, straight line distances[38] between the CBD and each of the census tracts were correlated with the factor scores for social rank, ethnicity, and family status. All three coefficients were statistically significant at the .05 level;[39] but this seems to have been due more to the large number of census tract units used rather than truly meaningful relationships. The only notable exception of the three was the correlation coefficient between distance and ethnicity ($r = -.449$). Thus, approximately 20.1% of the variability of the Cuban distribution is inversely related to distance from the CBD, which reconfirms the strength of the concentration in the area surrounding and including Little Havana.[40]

Summary and Conclusions

The factor analysis of eight variables for 242 census tracts in Miami produced three factors. These are generally consistent with the three social area analysis dimensions of social rank, ethnicity (in this case Cubans), and middle-class family status (with high female labor force participation rates).

The spatial attributes of the three SAA dimensions are less clear. Although social rank exhibits significant differences between both zones and wedges, as well as interaction effects, it is most clearly represented by a wedge pattern, as suggested by Hoyt. This supports the hypothesized pattern and is similar to the findings of most SAA studies in other cities. Family status, on the other hand, does not reflect a hypothesized zonal tendency. Instead, it exhibits a strong wedge pattern, unlike the results of most other social area investigations. This exceptional situation is related, at least in part, to the historical development of Miami Beach as a combination resort and retirement complex. The distribution of Cubans (ethnicity) was hypothesized to exhibit a multiple nuclei pattern. While the results do not totally refute this hypothesis, they do indicate a somewhat more complicated combination of wedge, zone, and nuclei components. This reflects the concentration of Cubans in two nodes (Little Havana and Hialeah) and a tendency for this population to diffuse outward toward the western periphery within sectors.

The notion of a distance continuum effect on the three SAA dimensions also was tested. Although there is a statistically significant correlation in each case, only ethnicity is interpreted as being meaningful. There is a moderate inverse relationship between the degree of concentration of the Cuban population and distance from Miami's central business district. Thus, not only is there a difference in the distribution of Cubans among zones (as indicated by the analysis of variance test), but this difference is a result of a decline in concentration along a continuum as distances from the CBD are increased. Even though there are also differences among zones for both social rank and family status, a distance continuum effect was not found to exist.

Although many SAA studies have preceeded this one, this investigation makes three contributions. First, the zones and sectors have been delineated less arbitrarily than in other studies, which have generally utilized simple geometric shapes. Major transportation arteries and isochrones appear to be most consistent with the distributions displayed in the three factor score maps. These have been selected as boundaries. This may be an important consideration, since the way zones and sectors are drawn can effect whether significant zonal or sectoral differences exist. Perhaps this is why both significant wedge and zone patterns have been found for all three SAA dimensions, and a multiple nuclei distribution for two out of the three. This suggests that a strict, mutually exclusive, interpretation of the zone, wedge, and multiple nuclei hypotheses is inappropriate. Rather, elements of all three can exist at the same time for a particular dimension. However, as in the case of Miami, one pattern may be more prevalent than the other two with respect to a given dimension.

Second, the reliability of social area analysis and the zone, sector, and multiple nuclei models have been tested in the context of a city where they have not been comprehensively applied before. In fact, there has been only one other SAA study that has dealt with any cities in the Southeastern United States, and that investigation used 1950 census data. The study established social area dimensions through use of factor analysis, but it did not map or analyze the spatial attributes of these dimensions.[42]

A third contribution of this study is in testing the effects of both a distance continuum and discrete concentric zones. Discrete zones are more appropriate for social rank and family status, we found, whereas a distance continuum effect is more operative in the residential patterns of Cubans.

* * *

1. E. W. Burgess, "The Growth of the City," *Proceedings of the American Sociological Society* 18 (1923): 85-89, and E. W. Burgess, "The Growth of the City," in *The City*, ed. R. E. Park, E. W. Burgess, and R. D. McKenzie (Chicago: University of Chicago Press, 1925), pp. 47-62.

2. H. Hoyt, *The Structure and Growth of Residential Neighborhoods in American Cities* (Washington, D. C.: Federal Housing Administration, 1939).

3. C. D. Harris and E. L. Ullman, "The Nature of Cities," *Annals of the American Academy of Political Science* 242 (1945): 7-17.

4. For the best review of this body of literature see D. Timms, *The Urban Mosaic: Towards a Theory of Residential Differentiation* (Cambridge: Cambridge University Press, 1971).

5. For an elaboration of the details of social area analysis see: E. Shevky and M. Williams, *The Social Areas of Los Angeles: Analysis and Typology* (Los Angeles: University of California Press, 1949); E. Shevky and W. Bell, *Social Area Analysis: Theory, Illustrative Application and Computational Procedures* (Stanford California: Stanford University Press, 1955; and Timms, *Urban Mosaic*, pp. 123-210.

6. R. A. Murdie, "The Social Geography of the City: Theoretical and Empirical Background," in *Internal Structure of the City: Readings on Space and Environment*, ed. L. S. Bourne (New York: Oxford University Press, 1971), 279-90.

7. This paper represents a partial sequel to an article which the two senior authors published earlier. T. D. Boswell and A. A. Adedibu, "The Social Structure of Nine Florida SMSA's for 1970," *The Florida Geographer*, 12 (1978): 1-8.

8. In Actual fact there were 115 census tracts, hut many were split into 2 or more parts. Thus, it was possible to derive variables for a total of 244 areal units. We left out two census tracts (numbers 114 and 115) which were located in predominantly rural areas.

9. One of the main advantages of the SAA technique is that compared to more general factorial ecologies it provides a standard set of variables which facilitates comparisons. Timms, *Urban Mosaic*, p. 206.

10. N. H. Nie et al., *Statistical Package for the Social Sciences* (New York: McGraw-Hill Book Col, 1975), pp. 468-514.

11. See Timms, *Urban Mosaic*, pp. 148-176.

12. For instance see K. P. Schwirian and M. Matre, "The Ecological Structure of Canadian Cities," in *Comparative Urban Structure: Studies in the Ecology of Cities* ed. K. P. Schwirian (Lexington, Mass.: D. C. Heath and Co., 1974), pp. 309-323; and T. R. Anderson and L. L. Bean, "The Shevky-Bell Social Areas: Confirmation of Results and a Reinterpretation," *Social Forces*, 40 (1961): 119-24.

13. Timms, *Urban Mosaic*, pp. 240-41.

14. These five arteries are: (1) the Miami River and its southeastern extension into Biscayne Bay just north of Virginia Key, (2) U. S. Highway 1 South (South Dixie Highway), (3) U. S. Highway 41 (Tamiami Trail and S.W. 8th Street), (4) U. S. Highway 27 (Okeechobee Road) and the Miami Canal and (5) Interstate Highway 95.

15. Hoyt, *Structure and Growth*, pp. 117-119.

16. The isochrones were taken from Metropolitan Dade County Planning Department, *Profile of Metropolitan Dade County: Conditions and Needs* (Miami, Florida: Community Improvement Program, Office of the County Manager, October, 1972), p. 61.

17. A .05 level of significance has been arbitrarily selected for the statistical tests used in this paper. The type of two-way analysis of variance used is the classical experimental model ANOVA developed for unequal cell frequencies by Nie, et al., *Statistical Package*, pp. 398-433.

18. Two-tailed T-tests were utilized. An F-test was conducted in each case as a test for unequal sample variances. If the sample variances were judged not to be significatntly different, a pooled variance estimate procedure was used. If significant differences in the sample variances did exist, a separate variance estimate technique was used. Ibid, pp. 267-75.

19. Murdie states that a significant level of interaction can be used as a test of the multiple nuclei concept. R. A. Murdie, *Factorial Ecology of Metropolitan Toronto, 1951-1961: An Essay on the Social Geography of the City*, University of Chicago, Department of Geography, Research Paper, No. 116 (Chicago, 1969), p. 155.

20. Metropolitan Dade County Planning Department. *Profile*, p. 102.

21. R. J. Johnston, "On Spatial Patterns in the Residential Structure of Cities," *Canadian Geographer* 24 (1970): 361-67.

22. T. R. Anderson and J. A. Egeland, "Spatial Aspects of Social Area Analysis," *American Sociological Review* 26 (1961): 392-99.

23. Schwirian and Marre, "Ecological Structure."

24. K. P. Schwirian and R. Smith, "Primacy, Modernization, and Urban Structure: The Ecology of Puerto Rican Cities," in *Comparative Urban Structure: Studies in the Ecology of Cities*, ed K. P. Shwirian (Lexington, Mass.: D. C. Heath and Co., 1974), pp. 324-38.

25. B. J. L. Berry and F. E. Horton, *Geographic Perspectives on Urban Systems: With Intergrated Readings* (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1970), pp. 369-375.

26. D. C. McElrath, "The Social Areas of Rome: A Comparative Analysis," *American Sociological Review* 27 (1962): 376-91.

27. Timms, *Urban Mosaic*, pp. 229-44.

28. Ibid., p. 241-44.

29. R. A. Murdie, *Factorial Ecology*, pp. 158-66.

30. F. P. Eichelberger, "The Cubans in Miami: Residential Movements and Ethnic Group Differentiations" (unpublished M.A. Thesis, Department of Geography, University of Cincinnati, 1974), pp. 57-62.

31. K. D. Woodbury, "The Spatial Diffusion of the Cuban Community in Dade County, Florida" (M. A. thesis, Department of Geography, University of Florida, 1978).

32. Timms, *Urban Mosaic*, p. 241.

33. McElrath, "Social Areas of Rome."

34. Murdie, *Factorial Ecology*, p. 161.

35. Berry and Horton, *Geographic Perspectives*.

36. Timms, *Urban Mosaic*, pp. 218-19.

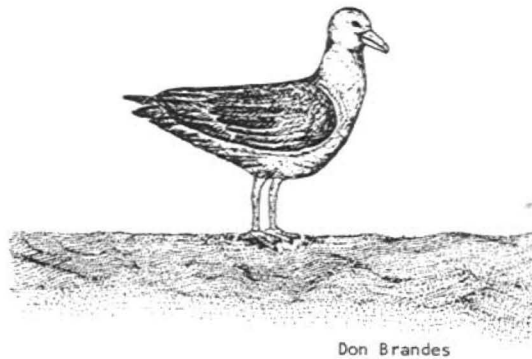
37. For instance see: Anderson and Egeland, "Spatial Aspects," Schwirian and Matre, "Ecological Structure," p. 320; and Schwirian and Smith, "Primacy," p. 330.

38. Straight line distances, rather than isochrones, were used here because of the difficulty that would be involved in estimating driving times to each of the 242 census tracts used in this investigation.

39. The coefficients for the correlations between distance and social rank, ethnicity, and family status were .208, -.449, and .236, respectively.

40. Johnston ("Spatial Patterns") has suggested logic for testing for a distance effect within zones. A careful study of the maps in Figures 2, 3, and 4 did not indicate that this task would be worth the effort in our investigation. Clearly, there are some differences within zones of the sectors for the social rank and ethnicity SAA dimensions. We know this through the two analyses of variance which indicated significant levels of interaction in both cases. Still, with the exception of ethnicity, there does not appear to be a consistent distance continuum effect.

41. This study dealt with ten cities. The two Southern cities involved were Atlanta, Georgia and Birmingham, Alabama. Maurice D. Van Arsdol, Jr., Santo F. Camilleri, and Calvin F. Schmid, "The Generality of Urban Social Area Indexes," *American Sociological Review* 23 (1958): 277-84.



Don Brandes

GEOGRAPHIC TECHNIQUES FOR DIFFERENTIATING ARCHAEOLOGICAL SITES IN NORTH-CENTRAL FLORIDA[1]

Storm L. Richards

North-Central Florida is the highland region which lies south of the Santa Fe River and north of a line drawn east-west through Belleview in southern Marion County. The area is characterized by grassy shrubs, sand pine scrubs, sandhill communities, pine flatwoods, xeric, mesic, and hydric hammocks, hardwood swamps, cypress domes, wet prairies, freshwater marshes, and numerous lakes, streams, ponds, and sinkholes.[2] These numerous environmental zones offered the early inhabitants of North-Central Florida a variety of natural resources, including well-drained soils suitable for agriculture. The region was occupied from as early as 9000 B.C. by aboriginal peoples until well into the historic period.[3]

The overall density and distribution of population of a region is determined to a large degree by the nature and availability of the natural resources being exploited. Factors such as the availnbility of game have a strong bearing on the size of hunting territories and on the distribution of permanent and transient bases. The attractions of fishing and shellfish collecting and the difficulties of overland travel through bush or forest may result in concentration of population alongside bodies of water (Fig. 1).

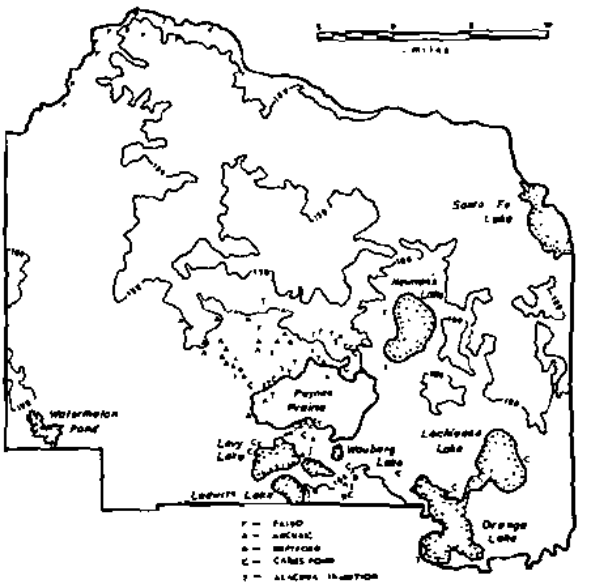


Fig. 1. Prehistoric settlement sites, Alachua County, Florida.

TABLE 1

FREQUENCY DISTRIBUTION OF ARCHAEOLOGICAL SITES IN NORTH-CENTRAL FLORIDA*

Period	Variable	N	Mean	Standard Deviation	Minimum Value	Maximum Value	Standard Error	Sum	Variance	Cumulative Variance
Paleo	Elevation	57	37.33	8.99	15.0	50.0	1.19	2,128.0	80.86	24.08
Archaic	Elevation	115	100.79	40.55	60.0	190.0	3.78	11,590.0	1,644.55	40.23
Deptford	Elevation	10	111.50	46.25	60.0	180.0	14.62	1,115.0	2,139.16	41.48
Cades Pond	Elevation	20	89.75	32.26	65.0	175.0	7.21	1,795.0	1,040.72	35.94
Alachua	Elevation	71	101.12	39.08	60.0	180.0	4.63	7,180.0	1,527.28	38.64
Paleo	Distance	57	230.18	151.39	0.0	328.0	20.05	13,120.0	22,918.90	65.77
Archaic	Distance	115	2,469.98	2,632.02	328.0	11,152.0	245.44	284,048.0	6,927,506.91	106.56
Deptford	Distance	10	1,968.00	1,499.10	328.0	4,264.0	474.06	19,680.0	2,247,310.22	76.17
Cades Pond	Distance	20	1,344.80	1,100.27	328.0	4,592.1	246.02	26,896.0	1,210,603.12	81.82
Alachua	Distance	71	984.00	694.69	328.0	3,608.0	82.44	69,864.0	482,591.09	70.60

*Elevation and distance to water are computed in feet.

It is possible to speak of North-Central Florida as a discrete geographical and cultural area. The aboriginal cultures remained more or less homogeneous at any given time, allowing an intensive study of a large area and permitting generalizations to be made about this region. The purpose of this study was to attempt to show a relationship of settlement location with two variables which were unlikely to change over time and which might influence site selection: elevation and distance to water. Data on these variables were subjected to statistical testing by means of frequency distribution, arithmetic means, standard deviation, standard error, and regression analysis. Data were gathered for the five time periods recognized for the aboriginal cultures: Paleo-Indian Period, Archaic Period, Deptford Period, Cades Pond Period, and the period of the Alachua Tradition.

Paleo-Indian Period

Little is known about Florida's first inhabitants, the Paleo-Indians. These people were probably wandering hunters who exploited many of the now extinct animals which abounded in the northern half of the state. They hunted manatee, deer, camel, and mastodon along the rivers and lakes of North Florida. Because of their antiquity, their nomadic way of life, and the fact that they had few material items such as pottery or permanent housing, little is known of the details of Paleo-man. Few campsites have been discovered. Those that are known are at Silver Springs and on the south side of Paynes Prairie. River crossings and bog areas where hunters could ambush and kill large animals are considered to be areas of concentration of Paleo-Indian artifacts. Early cultural materials of the same era have also been found in the Santa Fe River, Oklawaha River, Suwannee River, and Withlacoochee River.[4] Paleo-Indian sites are found both at stream and spring sites, and on high ground, overlooking springheads, streams, large swampy basins, and lakes along streams.

A statistical summary of the data on Paleo-Indians in North-Central Florida shows interesting patterning (Table 1). Nonrandom distribution marks this cultural period more than that of any other occupation.[5] All Paleo-Indian sites are found in close association with major running water sources, with over 29 percent located in river bed deposits. This association can be explained by early man's need to locate near drinking water.

A simple linear regression of elevation and distance to water sources was calculated. Interpretation of this regression showed causality, which may at first sight seem only logical in terms of physical geographical principles. Elevation would naturally increase as one travels away from a major water source, but here one is speaking of occupational preference in a variety of ecological zones of either high or low elevation. The R^2 of the regression equation is 0.853 and the F ratio is 310.05 with degrees of freedom 1, 56. The F ratio is significant at the 0.01 level (Table 2).

Archaic Period

The Archaic population in North-Central Florida required quantities of chert, which were only obtainable in selected areas, for artifact production. This is demonstrated geographically and culturally in an area historically known as one of the few locales in Florida capable of producing quality materials for lithic artifacts.

The Archaic period is the best represented time period in the total sample numbering some 115 sites. These are distributed throughout Alachua County in varied geographical contexts. The single most intensive study is made of the period at the Simonton Ranch property in Marion and Alachua counties.[6] Such sites are usually identified by quantities of flaked chert. Elevations range from 60 to 190 feet, with a mean value of 100.79 feet; over 51 percent are located at 85 feet or less.

REGRESSION FOR ELEVATION AND DISTANCE TO WATER SOURCE

Period	Multiple R	R Square	RSQ Change	Simple R	B	Beta
Paleo-Indian Period (Constant)	0.924	0.893	0.853	0.924	179.941 24.706	0.924
Archaic Period (Constant)	0.813	0.661	0.661	0.813	41.057 69.901	
Deptford Period (Constant)	0.502	0.252	0.252	0.502	50.798 81.021	0.502
Cades Pond Period (Constant)	0.243	0.059	0.059	0.243	23.410 80.152	0.243
Alachua Tradition (Constant)	0.060	0.004	0.004	-0.060	-11.146 104.471	-0.060

Archaic populations have the greatest variation in distance to major water sources, ranging from 328 to 11,152 feet. Over 52 percent of all Archaic sites surveyed, however, fell within the first four classes from 328 feet to 1,312 feet.

A regression analysis of elevation and distance proved significant in terms of the value of R^2. The derived R^2 was 0.661 and the F ratio was 220.44 (at 1 and 114 degrees of freedom), both being statistically significant at an alpha of 0.01.

Deptford Period

The early Deptford population is poorly defined in North-Central Florida and lacks representation and information, especially in terms of site locations. There is little doubt, however, that a hunting-gathering-collecting economy was its subsistence base and that ceremonialism to some extent had begun by middle or late Deptford period. Archaeological evidence has been interpreted by some that Deptford people were basically coast oriented and only migrated inland seasonally to exploit resources not found on the Gulf coast. Among these resources could have been quality chert. At the end of the era, Deptford peoples began moving inland to more sedentary villages where soil was better suited to their agricultural practices. Rudimentary forms of agriculture were introduced into north Florida by A.D. 200. This brought about a gradual change to sedentary life.

The R^2 between distance to water and elevation is 0.25 and the F ratio is at 1 and 9 degrees of freedom, and the F value (2.69) is not statistically significant at the 0.01 alpha level.

Cades Pond Period

The next major cultural element to invade North-Central Florida was that of the Cades Pond. The bulk of the Cades Pond diet was foods taken from aquatic and swamp habitats, although probably there was small scale horticulture as well. Analysis of the well-preserved food remains from Melton Village gives solid evidence of the forms of Cades Pond subsistence, characterized by a dependence on hunting, fishing, and collecting utilizing a wide variety of animal species, especially from marsh-aquatic environments; and a spring-summer-fall and possible year-round occupation.[7]

All of the sites occur within less than one mile of major water sources, including Paynes Prairie, Lake Lochloosa, Orange Lake, and Newman's Lake. There appears to be a diversity in soil and vegetative zones in which these sites occur. The elevation range of Cades Pond sites is from 65 to 175 feet, with 55 percent of the sites located at an elevation of 80 feet or less.

The types and variety of hydrological systems in the close vicinity of Cades Pond sites give substantial evidence, along with the archaeological data, that these people depended on resources close to a variety of water sources. Ninety-five percent of the sites are located in some type of habitat associated with wet areas. Fifty-five percent of the sites are in hydric hammocks, 30 percent in marshes and sloughs, 5 percent in cypress vegetation, and 5 percent in hammocks.

Regression analysis of elevation and distance to water sources yielded an R^2 of 0.06, which is not significant at the 0.01 level. The F ratio is 1.15 with 1 and 19 degrees of freedom.

Alachua Tradition

The importance of aquatic habitation is readily discernable in the Cades Pond period. Equally visible, however, is the importance of another type of geographic setting for the people of the Alachua Tradition. Within 980 feet of the center of the densest distribution of Alachua sites there are less than approximately 250 acres of aquatic habitats; the remainder is hammock.[8]

The Alachua Tradition has a wide distribution. The elevation ranges from 60 to 180 feet above sea level, the mean elevation is 101.12 feet, the standard deviation 39.08, and the standard error of the mean 4.63. Slightly over 50 percent of the sites are located 75 feet above sea level or less. Thirty-three percent of the sites are found at an elevation of 75 feet.

Mean distance to water sources is 984 feet; 57.7 percent of the sites are located within 656 feet away from water sources. None of the sites surveyed occurred near running water systems, and only 5 percent were found near river branches. Almost 31 percent of the sites are found near prairies and 12 percent occur near at least two water sources.

The elevation to distance-to-water R^2 of this period dropped to 0.004. The degrees of freedom were 1 and 70. An F value is reported at 0.025, significant at 0.01 level.

Summary

Statistical testing failed to provide conclusive proof of clustering of archaeological sites in a particular area. These tests did not show geographic restriction of a particular type of site to only one microenvironment. Those areas considered preferable for living changed through time. This may have been a conscious selection by particular cultural groups exploiting different habitats.

During the earliest cultural period man chose to live near running water at low elevations. Later, a trend toward selecting higher elevations and areas with a variety of available water sources developed. The distances to water sources and the type of water sources did not remain consistent for any successive time periods; for instance, Paleo cultures located at low elevations adjoining running water. Archaic cultures situated at varying distances from lakes and ponds and at a variety of elevations. Deptford groups also located at diverse elevations but at a greater distance from water sources than did Paleo, Cades Pond, or Alachua Tradition sites. Cades Pond cultures established at a uniform elevation near a variety of water sources including streams, rivers, hydric hammocks, marshes, and sloughs. Alachua Tradition cultures located near lakes and ponds at a greater mean elevation than Paleo, Archaic, and Cades Pond sites.

Paleo-Indians probably required selected areas when hunting. River crossings afforded the opportunity to kill large animals. For this reason Paleo cultures are found near rivers in hydric hammocks. The Archaic population in North-Central Florida required quantities of chert (which were only obtainable in selected areas) for artifact production. Cades Pond culture located almost exclusively in aquatic habitats which could support larger populations because more resources were available. During the Alachua Tradition agriculture was introduced into North-Central Florida. A majority of Alachua Tradition living sites were situated on lands still agriculturally productive.

This sequent occupance study examined five groups with differing cultural traditions utilizing resources from the North-Central Florida environment. The environment remained constant, but the livelihood patterns of the inhabitants changed through time, and as they did, site of settlement also changed. Culture, then, more than environment, explains settlement location among these groups.

* * *

1. This is a summary of a thesis presented to the University of Florida under the supervision of David L. Niddrie, Department of Geography.

2. Center for Wetlands, map of vegetation and land use of the St. Johns River Water Management District (Gainesville, Florida: Center for Wetlands, University of Florida, 1977).

3. Jerald T. Milanich, "The Aboriginal Cultures of North Central Florida." Miscellaneous Project Report Series No. 3 (Gainesville, Florida: Department of Social Sciences, The Florida State Museum, University of Florida, February 1976).

4. Ben I. Waller, "Paleo-Indian and Other Artifacts from a Florida Stream Bed," *The Florida Anthropologist* 22, nos. 1-4 (1969): 37; Wilfred T. Neill, "The Association of Suwannee Points and Extinct Animals in Florida," *The Florida Anthropologist* 17, no. 1 (1964): 17-22.

5. Storm L. Richards, "Geographic Techniques for Differentiating Archaeological Sites in North-Central Florida" (M.A. thesis, Geography, University of Florida, 1978), p. 42.

6. Jerald T. Milanich, "Archaeological Resources of the Simonton Ranch Property," a report submitted to David Reaves, Planner, Simonton Ranch Project, July 1974.

7. Stephen L. Cumbaa, "An Intensive Harvesting Economy in North-Central Florida" (M.A. thesis, Anthropology, University of Florida, 1972).

8. Jerald T. Milanich, "The Alachua Tradition: Extension of Wilmington-Savannah Peoples into Central Florida," *The Florida Anthropologist* 22, nos. 1-4 (1969): 17-23.

CORRECTION

The equation on page 12 of the article by Joyce McJunkin and Ronald Schultz, "The Market Pattern of Fresh Winter Vegetables from Florida," *The Florida Geographer* 13-1 (1979), should read:

$$VEGT = B_0 \cdot POP^{\beta_1} \cdot INC^{\beta_2} \cdot ED^{\beta_3} / (DIST^{\beta_4} \cdot UR^{\beta_5})$$

SITE ASPECTS OF LARGE-GROUP ART SHOWS

Donald Brandes

This study is the second of two treating the geography of art shows. The first discussed the frequency of art shows by locale and season of the year, along with the concomitant transhumance of artists who follow the show circuit.[1] This study considers the specific site aspects of art shows with respect to their economic success, success measured as the artist's ability to make sales.

The desire of artists to sell their products has produced several marketing mechanisms. Gallery exhibitions are one important means, but their cost and space limitations restrict the number of artists and art pieces which can be accomodated. Gallery commissions usually run about 30 percent of the article's sale price, and occasionally reach 50 percent. Many artists cannot afford such high commissions and consequently avoid galleries. Some artists sell their merchandise out of their own private studio/gallery, but usually cannot make an adequate volume of sales in that manner alone.

The most popular art marketing mechanism is the large group show, in which normally about 50 to 350 artists congregate hoping the appeal of the show will attract potential buyers to view their works. These shows tend to be scattered in many different locations and have various site and situation attributes.

I have attended art shows in various locations under differing organizational and administrative conditions, and have wondered which shows are likely to yield the greatest profit. This study is an attempt to investigate formally those circumstances and examine the importance of show site as a factor in determining the show's sales potential. Data are derived from my own personal business records for art shows which I, or members of my family, attended over a two-year period. The sample consists of sixty-eight organized group art shows which combined to make 154 show days. The lengths of individual shows vary from one to six days. Most of the shows occurred in Florida, six took place in Southern Georgia and one was in Eastern Tennessee. One-man showings or sales made from personal contacts are not included.

TABLE I

WAYS OF CLASSIFYING ART SHOWS

1. SITE
   - CLOSED PUBLIC STREET
   - PUBLIC PARK
   - COLLEGE CAMPUS
   - SHOPPING MALL
   - PARKING LOT
   - RENTED CIVIC CENTER
2. ORGANIZER
   - NON-PROFIT
   - PROFIT
3. SPECTATOR ADMISSION
   - FREE
   - FEE
4. INDIVIDUAL SHOW OR PART OF TOURING SERIES
5. SIZE OF CITY
   (PERMANENT POPULATION WITHIN 10 MILE RADIUS)
   - SMALL TOWN (UNDER 5,000)
   - LARGE TOWN (5,000-25,000)
   - SMALL CITY (25,000-100,000)
   - LARGE CITY (OVER 100,000)
6. EXHIBITOR FEE
   - COMMISSION
   - FLAT RATE FEE
   - COMBINATION
   - FREE
7. VALUE OF FEE

Various attributes of art shows might be used to classify, categorize, or otherwise distinguish between different shows by types. Table 1 lists seven classifying systems. It is possible to classify the same show seven times, each time by a different set of criteria. Thus a given show might be classed as (1) an outdoor show in a park, (2) put on by a non-profit organization, to which (3) spectators were admitted free. The show was (4) part of a touring series which took place (5) in a small city. The artist payed (6) a flat fee for his exhibit space of (7) a certain amount. Limitations in the data prohibited evaluation of three of the seven categories. The matter of a show being an individual local production or part of a touring series could not be evaluated because there were none of the touring series type in my sample. Likewise, the effects of the exhibitor fee category could not be studied because the sample contained no commission or combination of commission and fee type shows, and very few free shows. Furthermore, there were only four shows at which the spectators were charged for admission to the show. Exclusion of these parameters from the study is, however, justified because they provide little significant information to distinguish between individual shows. Of the four remaining, two (show fees and size of city) are continuous quantitative variables. Pearson correlations were calculated between each and the gross sales value per day for each of the sixty-eight shows. The r value for size of city paired with gross sales per day is -.07 (r^2 = .005): not statistically significant. The r value for show fee per day is .32 (r^2 = .10). Although these values may technically be statistically significant, they are not sufficiently high to warrant their use as a dependable guide to find profitable shows.

TABLE 2
TYPE OF SHOW SITE & MEAN GROSS SALES

	1	2	3	4	5	6
SITE	STREET	CAMPUS	PARK	CIV.CEN.	MALL	PARK. LOT
$/DAY	133.74	74.00	59.53	43.81	40.60	21.57
SHOWS	9	10	27	1	18	3
DAYS	17	17	48	3	62	7

TABLE 3
TYPE OF SHOW ORGANIZER & MEAN GROSS SALES PER DAY

	1	2
ORGANIZER	NON-PROFIT	PROFIT
$/DAY	79.26	38.08
SHOWS	44	24
DAYS	81	73

TABLE 4
PERCENT OF PROFIT AND NON-PROFIT ORGANIZERS RESPONSIBLE FOR EACH SHOW SITE TYPE

	STREET	CAMPUS	PARK	CIV. CEN.	MALL	PARK. LOT
NON-PROFIT	100	100	81	0	17	33
PROFIT	0	0	19	100	83	67

The remaining two categories (site and organizer) were grouped by type with total gross sales supplied for each type. Sites were divided into six types (Table 2). Art shows held in temporarily closed public streets yield much higher sales values than shows at any other site. Other publicly owned locations rank second and third, and various types of privately owned locations rank fourth, fifth, and sixth. The shows were also classed according to organizer (Table 3). Shows which were organized by non-profit groups such as local art associations or civic booster groups produced twice the sales values as shows organized by commercial promotors. The actual success of the show is probably most dependent upon the efforts, competency and objectives of the organizers. As it works out, the organizer's background is closely related to the choice of site (Table 4).

Street shows are organized exclusively by non-profit organizations. Commercial promoters simply cannot obtain permission to close the streets for their private use. Furthermore, it is only those non-profit organizations with the most clout which manage to get streets closed for their use. Thus, the most well organized groups, which have managed to obtain the most community cooperation and participation, are the producers of the most successful large group art shows, and their preferred location is a temporarily closed public street.

Other non-profit organizers, which cannot or do not obtain public streets as show sites, seem to lack the overall ability to promote a successful show. A show occurring in a park will usually not be as successful as a street show, even though most park shows are also promoted by non-profit organizers.

Shows occurring on college campuses are promoted exclusively by non-profit on-campus organizations. Those organizations apparently do their jobs well and thus the artist can expect moderately good sales in such locations, assuming the prices of the goods are within reach of student budgets.

Commercial promoters usually are unable to obtain the use of streets, parks, and other public land for their shows. Consequently, "promoter shows" are usually held in shopping malls, parking lots, or civic centers. The worst feature of the promoter show, from the artist's viewpoint, is that the promoter usually puts little or no money into advertising. The shopping mall show relies on the attraction of the mall to draw people past the art exhibits. Unfortunately for the artist, the mall patrons usually come for purposes other than purchasing art. When they accidently discover an art show in progress, they glance curiously at the exhibits and walk on. If the show is held in a shopping center parking lot, visitors linger for an even shorter time.

Shows held in civic centers actually deter visitors. In an effort to recover the cost of renting the civic center, or perhaps simply because of the opportunity to control entrance, most promoters will charge admission for spectators to enter the show area. This practice reduces the number of show visitors and decreases the amount of money available to spend on art.

It may be seen that type of show site is an effective indicator of the probable sales generated by art shows. Once I made this observation I began to apply it in making my decisions about which shows to attend. I have been able to substantially improve my sales record during the past year. There are, however, too many exceptions to the above generalizations to hope always to choose profitable shows on that basis alone. Some street shows are ineptly organized or poorly advertised, while some mall shows are well publicized and consequently quite profitable. Further improvements in the process of deciding which art shows should yield high sales will probably have to rely on knowledge of the local territory. It remains, however, that lacking other direct information, site is an excellent indicator of the sales potential of a large-group art show.

* * *

1. Donald Brandes, "Seasonal Fluctuations of Art Show Location and Frequency," The Florida Geographer 15-1 (1979): 18-23.

AN APPLICATION OF DIFFUSION THEORY TO COMMERCIAL LAND USE CHANGES AROUND THE JACKSONVILLE, FLORIDA, INTERNATIONAL AIRPORT

Afolabi A. Adedibu

The application of diffusion theory to explain land-use changes has been suggested by researchers, but apparently not tested empirically.[1] The purpose of this paper is to apply diffusion theory to the analysis of commercial land-use changes in order to evaluate its theoretical and methodological applicability. It is assumed that changes in commercial land use originate from a core that serves as initiator; here, the area proximal to the Jacksonville, Florida, International Airport is used as an example of such a core. It is hypothesized specifically that airport-related land uses change according to a diffusion process. Changes in land use may occur adjacent to the airport and expand outward. Or changes may begin with the airport and "hop" to another area along the major routes serving the airport.[2]

The following assumptions are contemplated:

1. Airports hinder the use of proximal land for purposes other than airport-related uses.[3]

2. Airports require good road systems which allow easy movement to and from the airports.[4] The traffic generated along these road systems invites commercial activities to serve the airport users and employees. Those commercial activities will be close to the airports.

3. Establishments that locate around an airport must have a symbiotic relationship to the airport. In other words; the commercial activity that moves close to the airport is complementary to the airport activities; those uses that are not complementary will be repelled from the airport.

4. Following the construction of an airport, commercial land will change the function of the area proximal to the airport; the airport serves as the initiator of all the changes.

5. Characteristics of land near airports (topography, accessibility, government regulations, ownership, and location of each parcel) have equal effects on each parcel.

6. The land close to the airport meets most requirements for change to commercial uses but resistance created by the law of supply and demand may slow the process of change.

7. Commercial land-use changes may occur at the initial opening of the airport, then slow down and then rise again as demand calls for the changes.

8. Hierarchical diffusion may occur in case another initiator of change develops during the diffusion process. For example, the intersection of an airport road and a major interstate highway can generate another origin where commercial land-use changes may be initiated.

9. The intensity of commercial land-use changes depends on the demand for activities generated by the airport and modified by the characteristics of each parcel of land. These characteristics serve as barriers to the demand for commercial land.

The Research Methodology

The development of change of pattern can often be regarded as a random, or stochastic process.[5] A stochastic process is one that develops over time according to some probablistic rules which indicate that future behavior of phenomena cannot be predicted with certainty. There are a number of stochastic models which can be used to attempt simulation of a change process when such a process has a random element that is based on the assignment of probabilities. Among these models is the Monte Carlo simulation model which is used in this study.

The Monte Carlo Simulation Model

In the early 1950s Hägerstrand adapted the Monte Carlo simulation technique to geographical space in order to analyze the diffusion of innovation through time and space.[6] A variation of this technique involving computer simulation was used for the present study.[7] The program requires that the parameters indicating the contact or change structure should be well defined. These parameters include the characteristics of land detailed in assumption #5 above. Besides these characteristics, the Mean Demand Field dictates the change process.

Mean Demand Field

A Mean Demand Field (MDF) can be defined as a probability field in which the probability of any parcel of non-commercial land changing to commercial use can be indicated. It differs from a Mean Information Field (MIF) which has been used in other diffusion studies.[8] In the MIF, as information is passed from a "knower" to a "non-knower," the probability field shifts to include the high probability of "new knowers" now telling other "non-knowers." In analogous fashion, the MDF probabilities will also shift once a parcel of land is changed to a commercial use. Since the commercial activities are attracted to the airport, the higher probabilities of land-use changes to commercial uses will affect the closest non-commercial parcels. It should also be emphasized that the MDF contains a random assignment element just as the MIF. Probabilities become variable because of the site and situation characteristics, including the relative location of the individual land parcels.

Data Collection

Data used in this research were derived from tax records, field survey, and field interviews. The initial data collection was accomplished in the Duval County Property Appraiser's Office, where information on ownership of land, use of each parcel of land, and actual date the parcel changed ownership are kept. The ownership of land and the use of the parcel were derived from the appraiser's record. The date that land changed ownership came from the deed records.

A portion of the data collected from the tax record, such as ownership and the use of the parcel, and all data obtained from the interviews are nominal scale data which cannot be utilized in the Monte Carlo model. In the light of this, those data were converted to an ordinal scale. Nominal data are those in which a number is used as a label for a class of category while all members in that category have the same defining number. Ordinal data, on the other hand, measure situations where numbers are assigned to phenomena utilizing the rank order system. Some of the conversions were based on observation of the location of each parcel after the field survey had been done and individual owners interviewed. For example, the accessibility characteristics for each parcel were determined visually from the base map of the study area. If a parcel devoted to commercial activities was located on a major road serving the airport or was within the airport property, it was assigned a value of 5. The rating decreased to 0 with no feasible accessibility. All variables (ownership, accessibility, zoning, topography, and relative location of each parcel to the airport) used in the study were scaled from 0-5. The higher the score, the better the location for commercial activities.

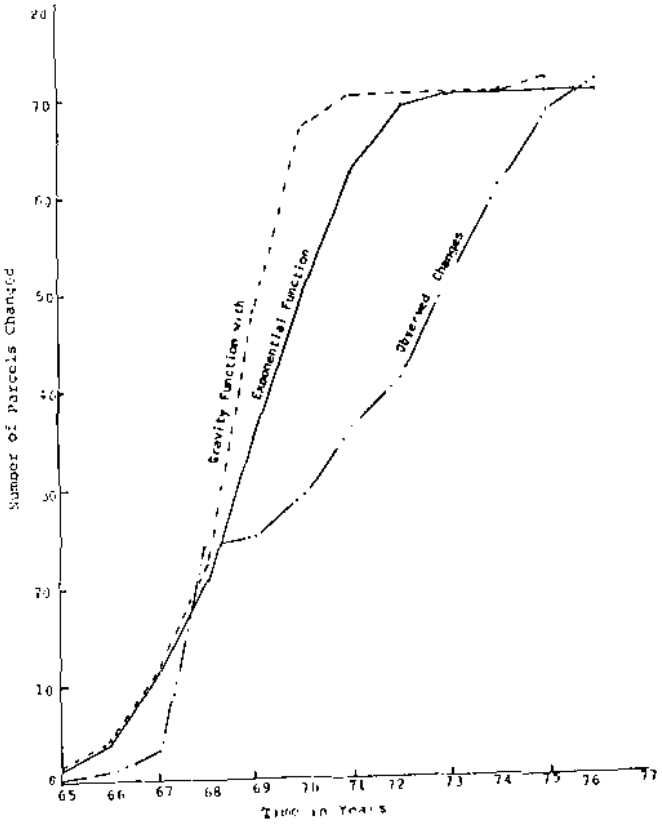


Fig. 1. Exponential and Gravity Changes with Characteristics Compared with the Observed Changes

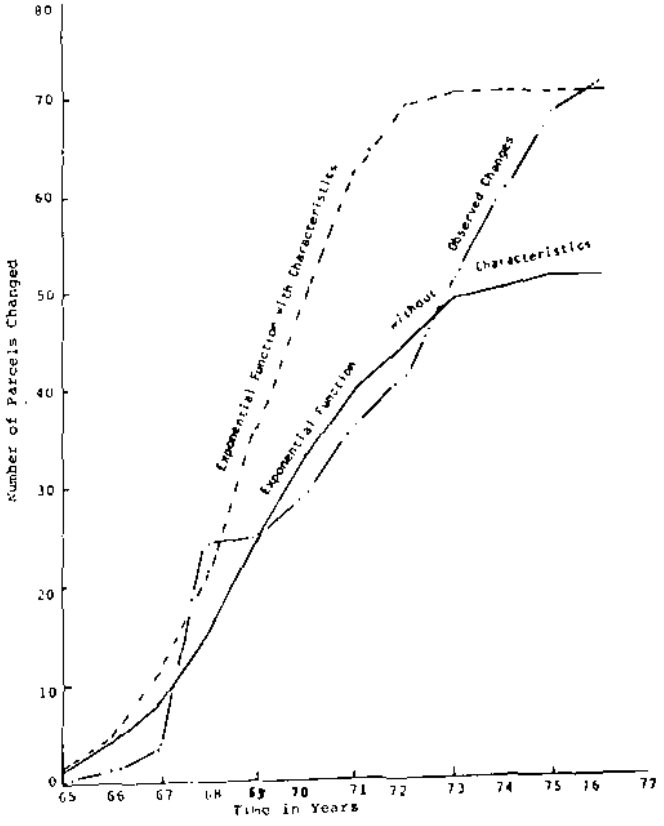


Fig. 2. Observed Changes Compared with Exponential Change Function with Characteristics and without Characteristics

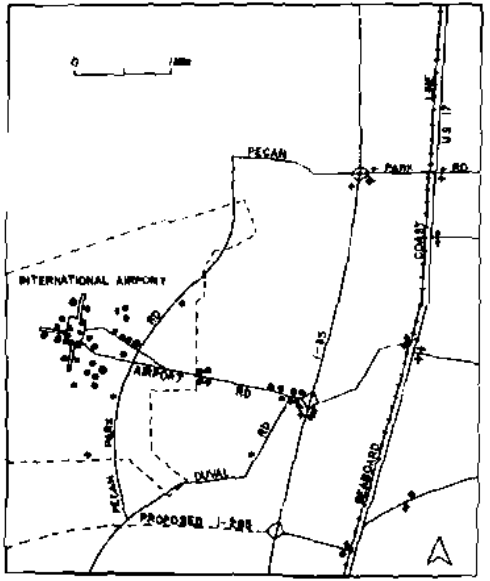


Figure 3

SPATIAL DISTRIBUTION OF THE SIMULATION EXPONENTIAL FUNCTION WITH CHARACTERISTICS

LEGEND

1965–1968	1971–1972
1967–1968	1973–1974
1969–1970	1975–1976

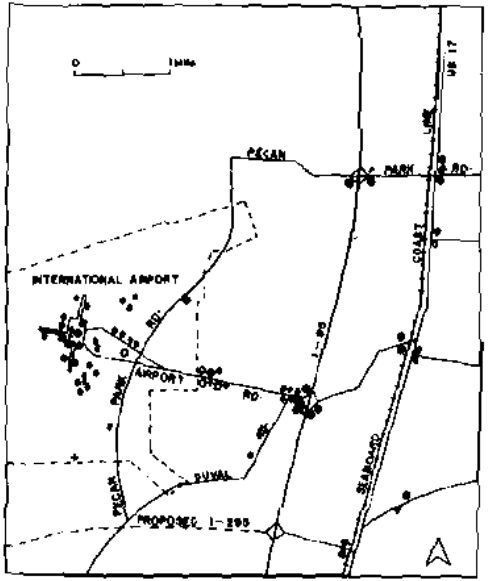


Figure 4

SPATIAL DISTRIBUTION OF THE OBSERVED CHANGES

LEGEND

1965–1966	1971–1972
1967–1968	1973–1974
1969–1970	1975–1976

After the data had been converted, simulation of the data was accomplished by using the Monte Carlo model. The simulations were divided into four groups: (1) Simulation using the characteristics of the land with gravity function; (2) Simulation with characteristics with exponential function; (3) Simulation without characteristics with gravity function; and (4) Simulation without characteristics with exponential function.[9] The differences between these simulations and the observed changes were then analyzed.

The two components to spatial diffusion (distribution over time and distribution over space) will be discussed separately. Changes over time in all simulations (both gravity and exponential functions) resemble the observed changes, although the resemblance of the simulation of the exponential function with the observed changes seems more conforming than the simulation with gravity function (Fig. 1). The exponential function resembles the observed changes, but the simulation with characteristics portrayed more clearly the changes that actually occurred (Fig. 2). Therefore we conclude that the characteristics of land parcels will modify the time when the parcel will change.

Next, the spatial distribution of the parcels that changed. Comparing the observed changes (Fig. 4) with the simulated changes in exponential function with characteristics (Fig. 3) reveals a number of striking similarities. At first most of the changes occurred around the terminal building of the airport, later the changes spread outward. There are some noticeable exceptions, however, as five of the parcels do not conform with the trend in Figure 3. The main reason is that the land occupied by these establishments had been in commercial use since 1968, but there were changes in ownership in recent years. Since the date that land last changed ownership is used as a variable in the simulation, it is expected to have some effect, if it is agreed that characteristics modify the changes.

Generally, the parcels in the airport and those close to it changed before those more distant. Commercial activities along the airport road do not indicate any significant change until 1969-70. All parcels along State Road 17 reveal no major changes before 1973-74. Those establishments along the airport road are also older than those farther away from the airport.

In percentage terms, the observed process resembles the exponential simulated process in that 30.9 percent of the parcels changed to commercial use in 1967-68 and in the same interval 23.9 percent of the parcels changed in the observed process. The spatial distribution of these percentages is also similar. In both Figures 3 and 4, all of those changes occurred around the airport. Also, most of the simulation changes which occurred in 1971-72 concentrate along State Road 17, while this also occurred in the observed process in 1973-74.

Conclusion

From the analysis of the temporal and spatial distribution of the observed and simulated processes of change, some generalizations are made.

1. All the simulation results tend to follow the logistic curve. The observed changes follow the logistic curve except in 1968, when there was an unusual jump in the number of commercial land that changed. The reason for the jump is that 1968 was the opening year of the airport and all the parcels that changed then accommodated the uses that ought to be present before the airport could function.

2. Characteristics of each parcel of land affected the change structure. When characteristics are used in the simulation, the parcels that changed exceeded those that changed in the simulation without characteristics, and the process lasted longer.

3. The exponential function of the simulation seems to be more appropriate for simulating the changes than the gravity function.

* * *

1. For example Harris suggested diffusion theory for land use changes in 1966 in his article, "The Use of Theory in the Simulation of Urban Phenomena," *Highway Research Record*, No. 126 (1966): 1-16; also W. L. Garrison suggested the same Methodology in "Different Decision in Land Use Model Construction," *Highway Research Record*, No. 126 (1966): 17-22.

2. Afolabi A. Adedibu, "Spatial Diffusion Analysis of Commercial Land Use Changes Associated with the Jacksonville, Florida, International Airport, 1965-1976" (Ph.D. diss., Dept. of Geography, University of Florida, 1977).

3. Ibid., p. 41.

4. Ibid., p. 62. Additional references are found in Jane B. Robbins, *Access to Airports: Selected References* ("Council of Planning Librarians Exchange Bibliography," No. 61) Monticello, Ill.: Vance Bibliographies, 1968.

5. D. M. Smith, *Industrial Location: An Economic Geographic Analysis* (New York: John Wiley and Sons, Inc., 1971), p. 270.

6. T. Hagerstrand, "On Monte Carlo Simulation of Diffusion," in *Quantitative Geography, Part D: Economic and Cultural Topics*, ed. W. L. Garrison and D. Marble (Evanston, Illinois: Northwestern University Press, 1967), pp. 1-32.

7. The program used to simulate the process was developed at the University of Washington by Professor R. L. Morrill.

8. For further readings on Mean Information Field see the following studies: D. F. Marble and J. D. Nystuen, "An Approach to the Direct Measurement of Community Mean Information Fields," *The Regional Science Association Papers* 2 (1963): 99-109; D. Amedeo and R. G. Golledge, *An Introduction to Scientific Reasoning in Geography* (New York: John Wiley and Sons, Inc., 1975), pp. 265-71; T. Hagerstrand, *Innovation Diffusion as a Spatial Process* (Chicago: The University of Chicago Press, 1967); R. Morrill and F. R. Pitts, "Marriage, Migration and Mean Information Field: A Study in Uniqueness and Generality," *Annals of the Association of American Geographers* 57 (1967): 401-22; L. Brown, *Diffusion Dynamics: A Review and Revision of the Quantitative Theory of Spatial Diffusion of Innovation* (Lund, Sweden: Department of Geography, Royal University, 1968); P. M. Blaikie, "The Spatial Structure of Information Networks and Innovative Behavior in the Zir Valley, Southern Morocco," *Geografiska Annaler* Ser 55B, pp. 83-105; K. E. Haynes and W. T. Enders, "Distance, Direction, and Entropy in the Evolution of a Settlement Pattern," *Economic Geography* 51 (1975): 357-65.

9. The gravity concept follows an inversely proportional distance-decay principle. The exponential concept, on the other hand, postulates that the increase in activities at any time period is proportional to the size already attained.

GEOGRAPHY THESES AND DISSERTATIONS ON FLORIDA, 1976-80

The following is a list of masters' theses and doctoral dissertations related to Florida, taken from *The Professional Geographer*, and from information supplied by geography departments in the state. The list includes works completed at Florida universities, as well as those on Florida done at other universities. Included also are titles which were omitted from the first listing (*Florida Geographer* 12-1: 20-21). There may be omissions; if readers know of any titles which should be included, please send them to the editor for inclusion in a future *Florida Geographer*. Grateful appreciation is extended to Shanon McCune, Patrick O'Sullivan, and Burke Vanderhill for their help in making the present list complete.

Adams, Sharon. "Model Recreation Plan Applied to Wakulla County." M.S. Florida State University, 1976.

Adedibu, Afolabi A. "Spatial Diffusion Analysis of Commercial Land-Use Changes Associated with the Jacksonville, Florida International Airport, 1965-1976." Ph.D., University of Florida, 1977.

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Beard, Wanda. "Rape in Tallahassee: A Cartographic Analysis of Some Demographic, Environmental, Socio-Economic, and Temporal Factors." M.A., Florida State University, 1978.

Bobo, Lawrence D. "Computerized Ownership Density Mapping: A Geographic Tool in Land Use Analysis" (Information gathered from the Florida Panhandle area.) M.A., Florida State University, 1972.

Brandt, Dehorah J. "Housing Needs in Perry, Florida." M.A., University of Florida, 1976.

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Crowe, Dennis R. "A Case Study In Recreation Geography: Spatial Interaction And Camper Perception." (Information gathered from the general area of Panama City.) Ph.D., University of Florida, 1972.

Dilmore, Darrell G. "Proposed Land Use Guidelines for a Delimited Area Contiguous to Lake Seminole." M.S., Florida State University, 1973.

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Ernst, Albert J. "Diffusion of Urban Land Use Types in Cocoa and Rockledge, Florida." M.S., Florida State University, 1971.

Gasman, Robin M. "The Viability of a Small-Scale Municipal Government within a Two-Tier Political Scheme: A Case Study of West Miami in Metro-Dade County." M.A., University of Miami, 1975.

Guilfoyle, Michael J. "An Investigation of Miami's Urban Residential Dynamics, 1950-1970." M.S., Florida State University, 1976.

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Ihns, Ramsey D. "Patient to Hospital Travel Patterns in Pensacola, Florida." M.A., University of Florida, 1976.

McJunkin, David M. "Aspects of Cypress Domes in Southeastern Florida: A Study in Micro-Phytogeography." M.A., Florida Atlantic University, 1977.

McJunkin, Joyce P. "Winter Fresh Vegetable Farming in Florida: Its Acreage Patterns and Marketing Flows," M.A., Florida Atlantic University, 1978.

McNeely, Jimmie W. "Alternative School District Patterns Established by an Objective Criteria Computer Algorithm." (Information gathered from the Tallahassee area.) M.A., Florida State University, 1977.

Meyer, Robert J. "A Human Information Processing Model of Urban Shopping Behavior." (Information gathered from the Tallahassee area.) M.A., Florida State University, 1976.

Miller, Stephan W. "An Analysis of Municipal Water Withdrawal Demand in Florida." M.S., Florida State University, 1976.

Ollry, Jan. "Changes in the Geographic Distribntion of Selected Retail and Service Establishments in the Tallahassee Urban Area, 1949-1969." M.S., Florida State University, 1970.

Remer, Susan T. "Jarvis's Law and the Mentally Retarded Children of North Central Florida." M.A., University of Florida, 1976.

Richards, Storm L. "Geographical Techniques for Differentiating Prehistoric Sites in Florida." M.A., University of Florida, 1978.

Rosenthal, Robert A. "A Least Cost Analysis of Solid Waste Disposal Site Selection in the Florida Keys." M.A., University of Miami, 1976.

Schmelzkopf, Karen F. "The Formation of Environmental Schemata." (Information gathered in Boca Raton, Florida.) M.A., Florida Atlantic University, 1978.

Segretto, Peter S. "The Relationship Between Urbanization and Streamflow in the Hillsborough River Basin, Florida From 1940 to 1970." Ph.D., University of Florida, 1975.

Smith, Edward R. "Land Value and Distance Decay: A Case Study of Gainesville, Florida." M.A., University of Florida, 1977.

Stone, Peter A. "Floating Islands---Biogeomorphic Features of Hillsboro Marsh, Northeastern Everglades, Florida." M.A., Florida Atlantic University, 1978.

Tepfer, Alan S. "Intra-Urban Spatial Variation in the Incidence of *Cannabis* Crimes." (Information gathered from the Gainesville area.) M.A., University of Florida, 1976.

Unger, Frank A. "Some Aspects of Land Acquisition and Settlement in Territorial Florida: The St. Joseph Community." M.S., Florida State University, 1974.

Wells, Richard W. "Environmental Assessment of a Regional Sewage Treatment System." (Information gathered from the Orlando area.) M.S., Florida State University, 1977.

Wilf, Charles M. "Predicting Potential Bus Patronage: An Integration Theoretic Approach." (Information gathered from the Tallahassee area.) M.A., Florida State University, 1974.

Woodbury, Kimball D. "The Spatial Diffusion of the Cuban Community in Dade County, Florida." Ph.D., University Of Florida, 1978.

Wright, Deborah Ann. "Impacts of Rapid Transit on Station Area Commercial Development: Case Studies of the Philadelphia-Lindenwold High Speed Line and the Proposed Miami Transit System." M.A., University of Miami, 1977.

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