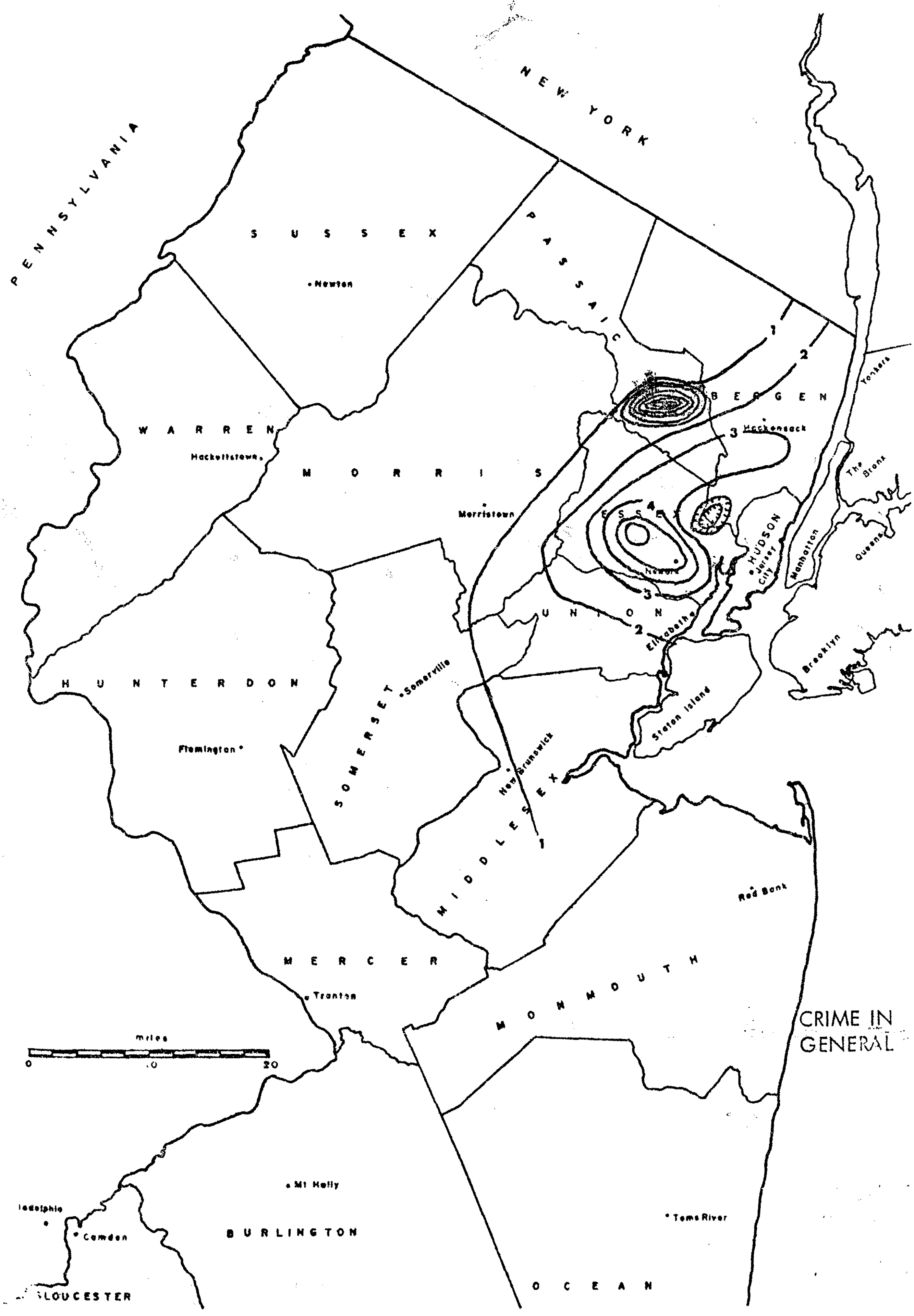
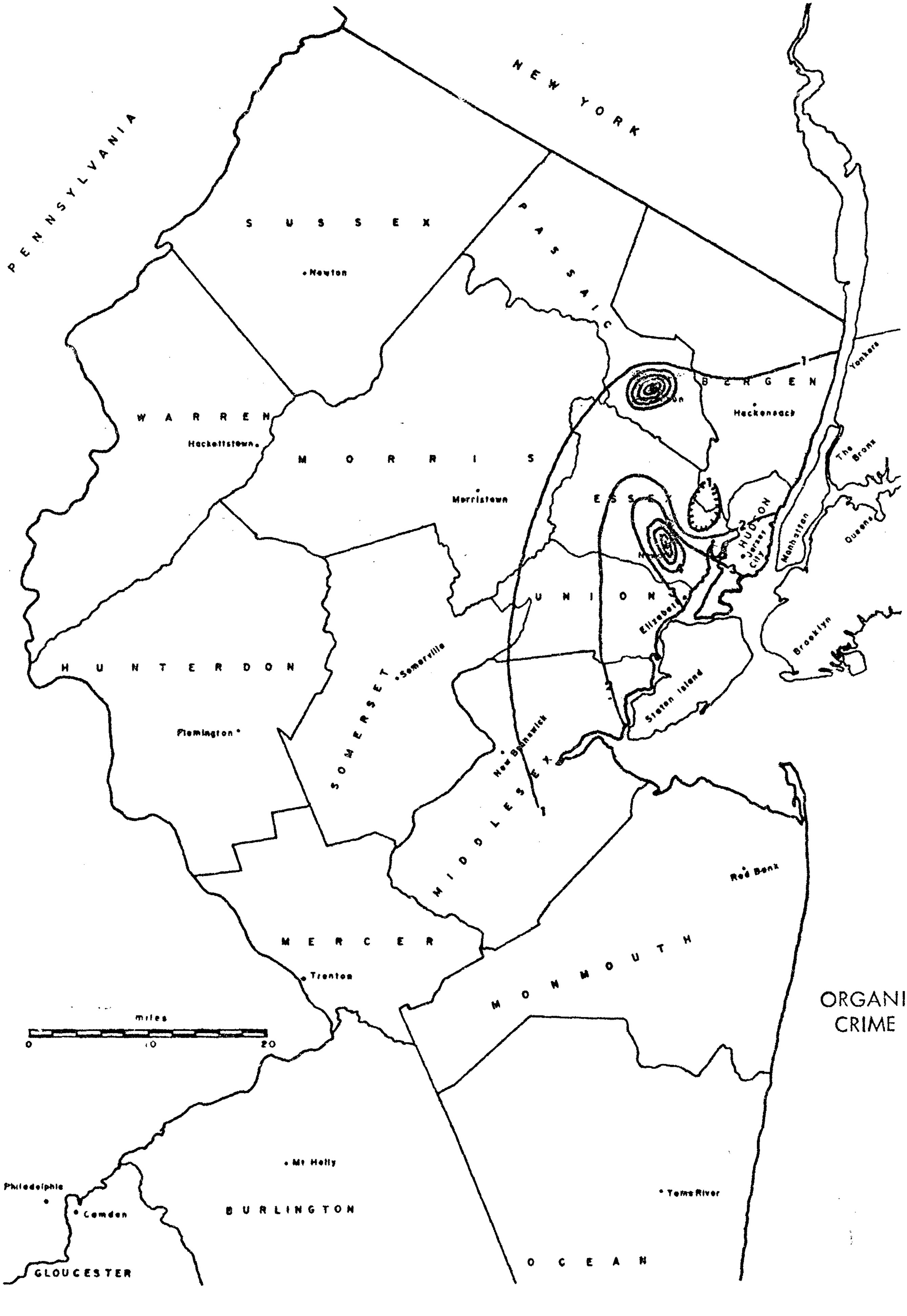


CRIME IN GENERAL



ORGANIZED
CRIME

While average in its penetration index, this problem was demoted to tenth in the priority rankings. The pattern again shows that Hudson County residents, both East and West, perceive themselves as cleaner than their neighbors, even though the major meadowland dumps lie in their territory. The slope from urban cores to outer suburbs is very steep in the case of solid waste disposal, with the 1 isoline lying well within the perimeter of our residential clusters. It's interesting that the Elizabeth Journal readers were exceptionally high in perception of the problem as critical, and Elizabeth has maintained the reputation of being the cleanest, most esthetically satisfying (least horrifying?) of New Jersey's major cities.

An unusually high 18 percent were disposed to think in terms of a regional solution to this problem.

Figure 11. Housing Scarcity (P.I. 1.6, 76% critical)

With a higher than average penetration index, this problem produces a strikingly different pattern of isolines. At last the residents of East Hudson land on an issue that is worth building into a peak; and Mount Newark, surprisingly, disappears, though a low plateau remains in the neighboring inner suburbs. The usual depression from the peninsula extends north to include both Bergen County clusters.

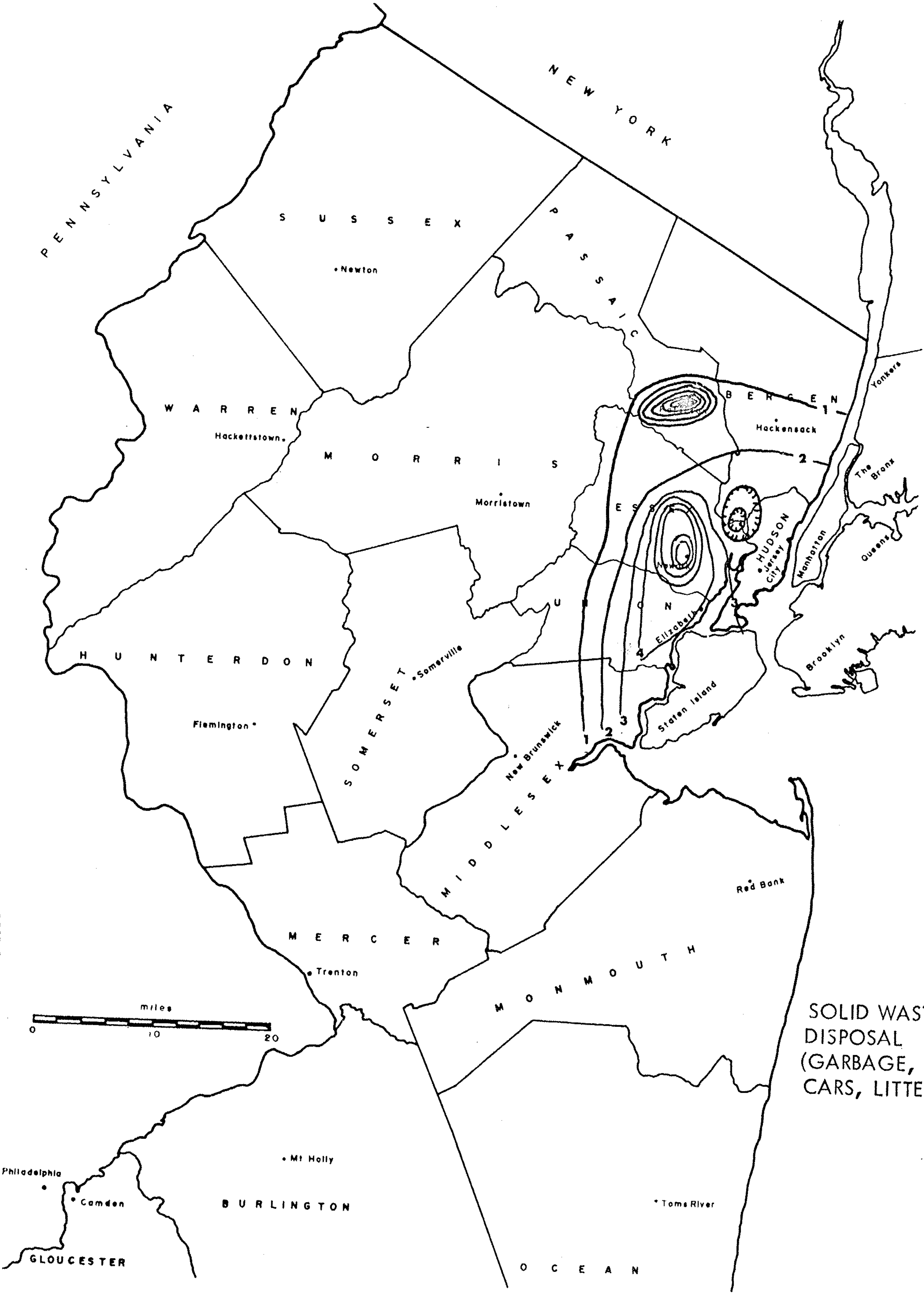
The penetration index in this case declined with rising income, but it climbed significantly in the highest income category. Penetration was very high among the partially employed, high among blue collar, and perception of the problem as critical was again somewhat low among government employees.

As in the case of the drug problem, the home rule alternative attracted a much higher than average number of responses (23%) but the modal solution was again higher level government intervention (33%).

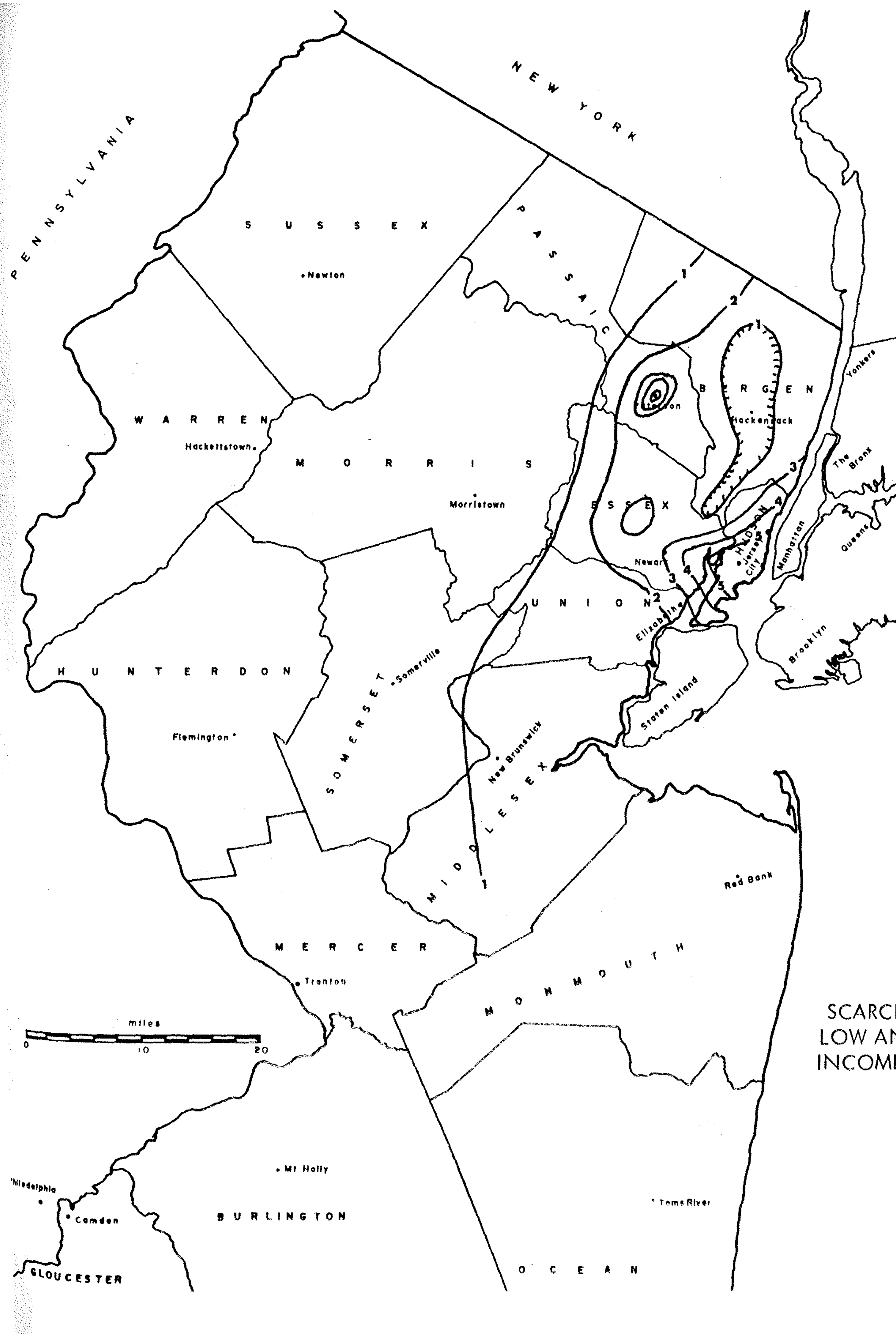
Figure 12. Automobile Traffic (P.I. 2.1, 71% critical)

While this problem was demoted strikingly to number 12 in the actual rankings, it was much higher than average in the penetration index. This was the only transportation problem to make the list of those selected as most critical.

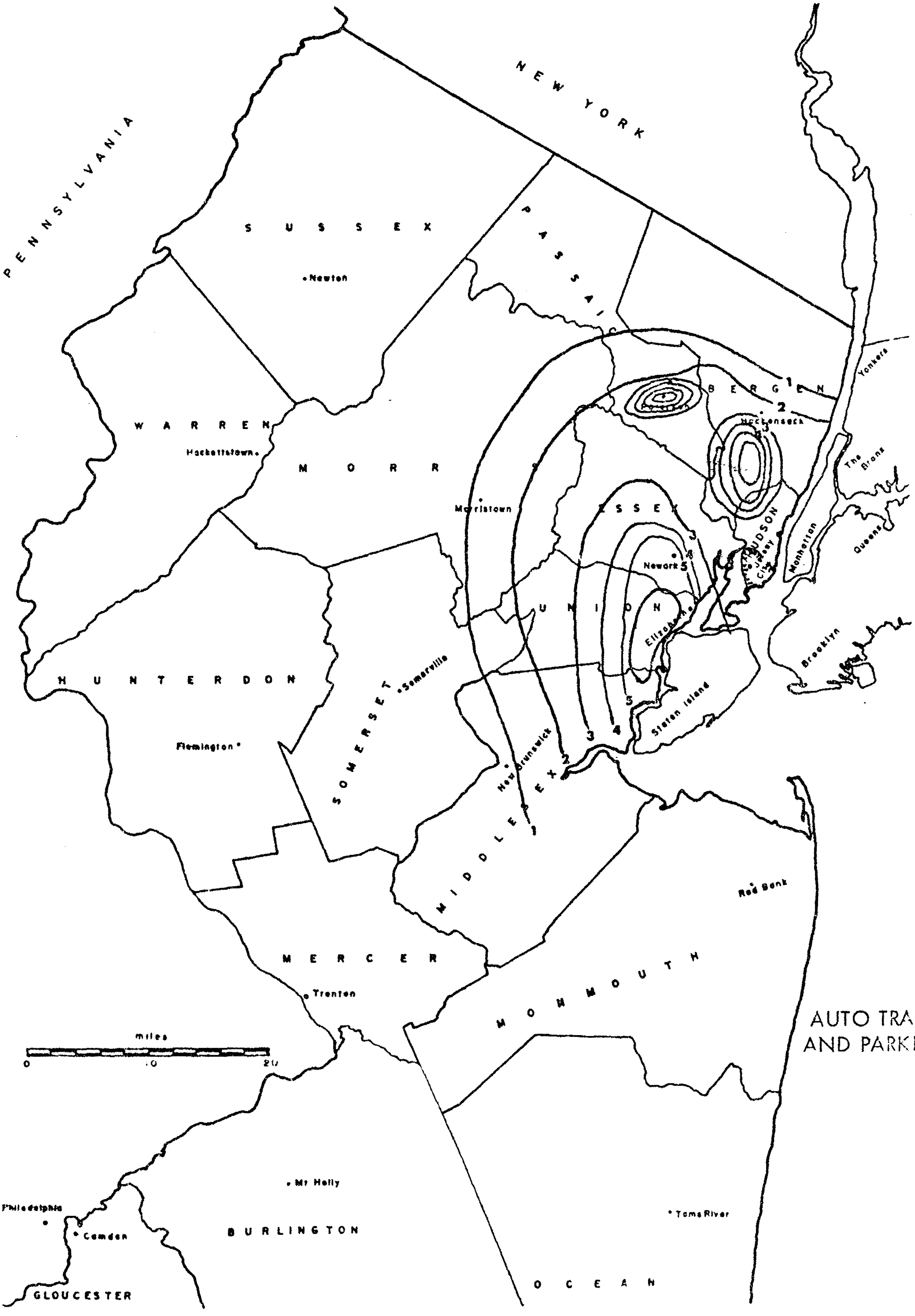
The pattern of isolines is unique, with peaks in the inner Union County communities and in South Bergen joining familiar Mount Paterson. A striking depression is found in Cluster 1, East Hudson, perhaps because few people drive there unless required to do so. Stated more positively, the interpretation might relate to the rail transportation terminals in Hobo-



SOLID WASTE DISPOSAL (GARBAGE, ABANDO[NED] CARS, LITTER)



SCARCITY OF LOW AND MIDDLE INCOME HOUSING



AUTO TRAFF
AND PARKING

ken and Jersey City.

Among income groups, the peak penetration was into the second level from the bottom, with a steady downward slope from that level into the highest income group. In recommending a solution, 42 per cent selected the alternative of a strengthened regional government, by far the highest percentage of any of the problems.(4)

Figure 13. Quality of Primary and Secondary Schools (P.I. 1.1, 71% critical)

While this one was low in penetration, it was promoted strikingly to number 5 in the actual rankings, suggesting a serious concern among suburbanites with the critical conditions in urban areas. The pattern is familiar, but with an especially steep slope from the urban cores to the suburbs; even the usual high values in Cluster 4 are reduced to outer suburban levels. As would be expected, the penetration index varies inversely with income, a result particularly predictable in view of New Jersey's archaic tax structure. The academic respondents were especially concerned over this situation, while government employees again recorded lower than average perception of the problem as critical.

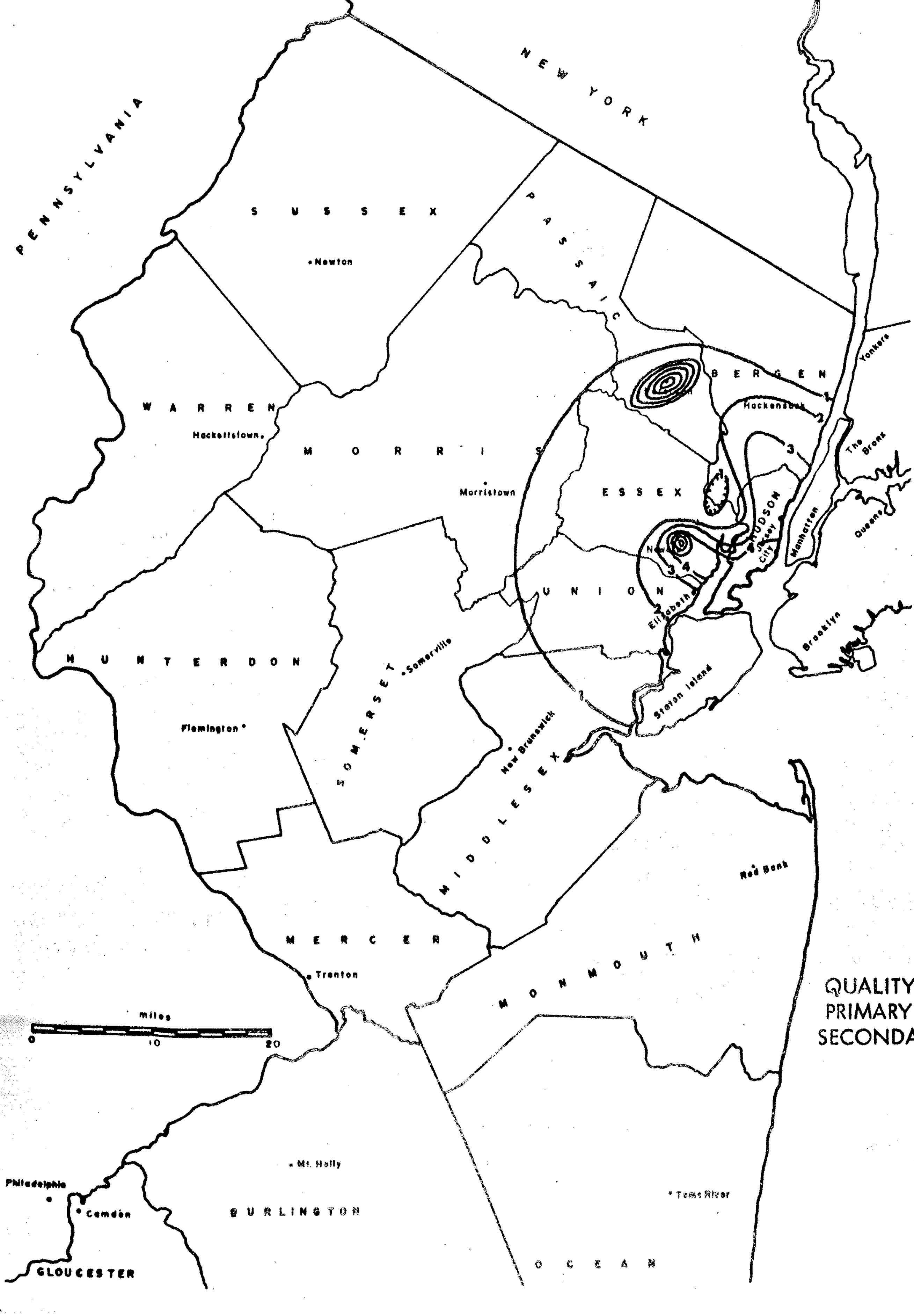
The modal solution cited in this case was community cooperation (43%), an alternative rarely applied to the other problems.

Figure 14. Commuter Railroads

Although this problem was only number 16 on the list of most critical, it is included to show the interesting reverse slope of the isolines, a pattern unique to this set of problems but easily explained. It also demonstrates that Mount Paterson can disappear - the respondents in that troubled city were indeed discriminating among the choices offered to them. The highest value in this case was recorded in Cluster 5, most of whose respondents must deal with the vicissitudes of the Jersey Central Railroad.

Conclusions

Any conclusions drawn from this study must be modulated by appreciation of the simplistic techniques involved in the analysis and the highly unscientific sampling procedure. Nevertheless, the principal conclusion is that a class of undergraduate students can be employed in the gestation and implementation of a worthwhile project, which has yielded interesting results in spite of the constraints imposed.



QUALITY OF
PRIMARY AND
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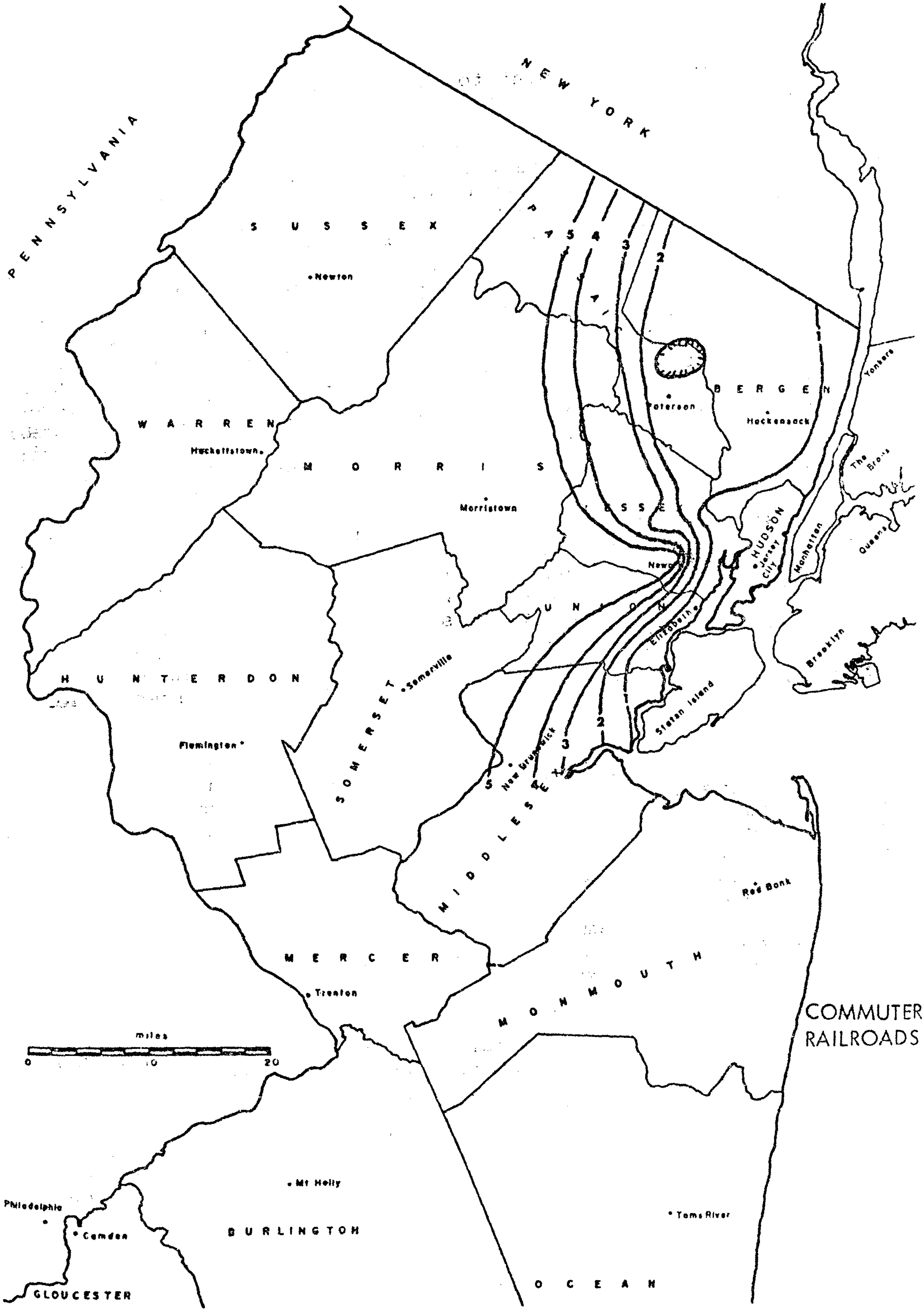

COMMUTER RAILROADS

Analysis does point to the following as significant points, all of which should be verified with further research.

1. The residents of northern New Jersey are highly dissatisfied with the effectiveness of their governments, at whatever level, to cope with problems pervasive in the New York Metropolitan Region, be they problems primarily national in character, such as inflation, or primarily local in significance, such as solid waste disposal. At the same time, there is little predilection to solving these problems by means of restructuring the federal system to recognize the de facto metropolitan region. Among the ten chief problems, only in the cases of automobile traffic, solid waste disposal and air pollution did respondents show a significant trend toward submitting to a regional authority, and only in the first case did the acceptance approach the level of 50 per cent. On the other hand, with certain problems, notably drugs and housing scarcity, respondents trended toward the desire to strengthen home rule, this in spite of the fact that local control of the zoning power has contributed markedly to the housing shortage.(5) It is apparent, however, that the respondents in this sample were very discriminating in the manner with which they perceived the various problems and selected possible routes to solution, each one adjusted to meet the specific situation as interpreted by the individual. While the responses are not calculated to cheer the advocates of regional government, they do appear to indicate that most problems require further attention from national and state levels and that residents of this area are, in principle at least, willing to accept intervention from higher authorities on many issues.

2. The "penetration index" appears to be a useful tool for measuring spatial variations in problem perception. It may even have some predictive value. In view of the low index for primary and secondary education in Bergen County, for example, it is not surprising that one town after another has defeated school construction bond issues. The index for the rising cost of living was about ten in the same areas, and a ten-to-one ratio of indexes may be too much to overcome even with a well-organized political campaign. One might conceive of a sample survey designed to test the relative penetration indexes before engaging inthe expensive proposition of designing a school construction plan and submitting it to the voters.

3. Residents in similar kinds of communities do respond in similar ways to many of the problems, though there may be local variations due to actual differences in conditions or to differences in perception among the inhabitants. The unique peaks on the traffic map in Clusters 10 and 6, for example, must certainly be related to the congestion on Routes 1 & 9 and 22 in the first case and Route 17 and 46 in the second, whereas

the absence of a Mount Hudson to match Mounts Newark and Paterson on most maps must primarily be explained by differences in perception. The unusual responses in the Peninsula may have interesting roots in the social conditions in that area. The prospects for further investigation are intriguing, to say the least.

4. With a properly abridged and focused questionnaire, scientifically distributed to a large sample in selected communities, designed for evaluation by factor analysis or some similar technique, one might hope to draw a series of really significant maps and collect usable data on perception which could be correlated against data on actual conditions. Organization of such a task is not beyond the realm of possibility with adequate funding, and the author intends to make the effort, with the help of one or more of his colleagues, in the summer of 1971.

FOOTNOTES

1 The high percentages indicated were due to the choices of combinations in the questionnaire; e.g., 67 per cent of the respondents depended on newspapers alone or in combination with radio and/or TV.

2 Sample state equalized 1968 property tax rates for communities in this study are as follows: Newark, 7.08; East Orange, 6.16; Hoboken, 8.37; Jersey City, 5.94; Paterson, 4.69; Harrison, 2.97; Upper Saddle River, 3.23. Source: State of New Jersey, Dept. of Community Affairs, _31st Annual Report of the Division of Local Finance_.

3 Mr. Raphael Caprio of Rutgers plans to do a study of Kearny as a suburb in transition.

4 This percentage is not very significant, however, because a sample of only twenty-six respondents ranked automobile traffic among the five most critical problems and therefore evaluated it on the section on solutions.

5 This point was dramatized for Bergen County residents by a strongly-worded, well-researched newspaper supplement published by the _Bergen Record_ on August 3, 1970. The title was "DANGER - ZONING."

THE MORPHOLOGY AND EVOLUTION OF THE COMPANY TOWN

by

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The company town, once fairly common among the ranks of nucleated settlements, has all but vanished from the American landscape. Although most towns founded by companies have passed into the ownership of their occupants, there still remain sufficient vestiges of the past to give these places a distinctive form. Furthermore, there still exist a few towns owned by a dominant employer and the form of these has changed little with the passage of time. For purposes of this paper, a company town is defined as an agglomerated settlement that is now or recently has been owned by the principal employer.

Although each urban community is uniquely different in detail, there are enough similarities among them to permit classification and meaningful generalization. In one group might be placed the company town, whose inception and growth has been governed by a single organization, or often one man, and whose design and function are sufficiently distinctive from the spontaneous and heterogeneous town to warrant geographic study. While a large volume of geographic literature exists on urban centers and villages, the company town has been neglected or mentioned in name only. Owing to this deficiency, most of the material presented here rests upon field work conducted in 25 communities in 13 states. The objective of this paper is to describe the general characteristics and to analyze the morphology and recent evolution of the company town.

General Characteristics

Most references to company towns carry with them a negative connotation. The public image is one of company exploitation of quasi captive labor forced to live in substandard housing and to purchase necessities from the company store at inflated prices. While there are well-documented instances of company abuse in the past, little evidence of resident-company disharmony was found in any of the existing or recently sold company towns studied in this project. The following is an attempt to characterize the company town as to 1) size, 2) location and 3) townscape.

TABLE I

COMPANY TOWNS INCLUDED IN FIELD STUDY

STATE		COMPANY TOWN	MAJOR FUNCTION
ARIZONA	*	AJO	COPPER
		LITCHFIELD PARK	COTTON FARMING
CALIFORNIA	*	SCOTIA	LUMBER
CONNECTICUT		NORTH GROSVENOR DALE	TEXTILE MILLS
		WAUREGAN	TEXTILE MILLS
		ATTAWAUGAN	TEXTILE MILLS
GEORGIA	*	REMERTON	TEXTILE MILLS
ILLINOIS		KINCAID	COAL
MASSACHUSETTS		HOPEDALE	TEXTILE MACHINERY
MICHIGAN		WHITE PINE	COPPER
		NAHMA	PLAYGROUND EQUIPMENT
NEW JERSEY	*	HELMETTA	SNUFF
NEW YORK		LYON MOUNTAIN	IRON ORE
		PIERCEFIELD	LUMBER
		CONIFER	LUMBER
		NEWTON FALLS	PAPER
NORTH CAROLINA		KANNAPOLIS	TOWELS
OKLAHOMA		SOUTHARD	GYPSUM
OREGON		HINES	LUMBER
WASHINGTON	*	PORT GAMBLE	LUMBER
		PORT LUDLOW	LUMBER
	*	SAPPHO	LUMBER
		MCCLEARY	LUMBER
		DUPONT	CHEMICALS
WYOMING		SINCLAIR	PETROLEUM

* COMPANY OWNED IN 1969.

Size -- Company towns are invariably small places, with populations seldom over 2,000 and commonly under 1,000. Their size is governed directly by the company's labor demand. To live in such a town one has to be an employee of the company, or necessary to its function like the postmaster or school teacher and often the latter is hired directly by the company. Commuting to work at a company town, while technically possible, is rare.

The company town rarely serves as a central place in the usual sense and its relationship with the surrounding area is tenuous at best. Its very specialized function of serving the company's needs virtually precludes it from serving others, hence growth is limited. A few former company towns, like Kincaid, Illinois, have experienced some highway-oriented commercial growth not directly related to the town's original function, but this is an exception for most of them are off well-traveled highways.

Location -- Most company towns are oriented to a resource or power source. Towns based on mining show the least variation in choice of site, normally locating within a few hundred yards of the mine opening. Forest and power oriented towns show a somewhat greater flexibility in the selection of site, but are always within easy walking distance of the plant headquarters. Seldom is a company town on a major highway, a location on a county or township road not infrequently at the end of the road being more common. Consequently few people have ever seen a company town.

Considering location on a national scale, it can be generalized that company towns have developed in every major region where manufacturing or exploitive industry exists. On the basis of limited documentary evidence it appears that company towns have been most numerous in the coal-rich Appalachians and the forested northwest but sufficient data are not available with which to make an adequate distribution map.

Townscape -- The company town's truly unique characteristic is its nearly homogeneous townscape. The person who travels through such a community is immediately struck by the differences between it and other communities nearby. This difference is manifest primarily in the presence of houses of similar or identical architecture. Many, if not all dwellings and public buildings are painted the same color and relatively few commercial establishments are present, considering the size of the community.

Morphology

The primary purpose of the company-developed town is to provide housing, services and other amenities of community living in order to attract and to retain a stable labor force. Commonly established in rather isolated locations, the company ownership of a town seemed to the company to be a necessary capital investment and overhead expense for its very functioning. The following is an analysis of the residential, commercial, institutional and industrial forms in the company town.

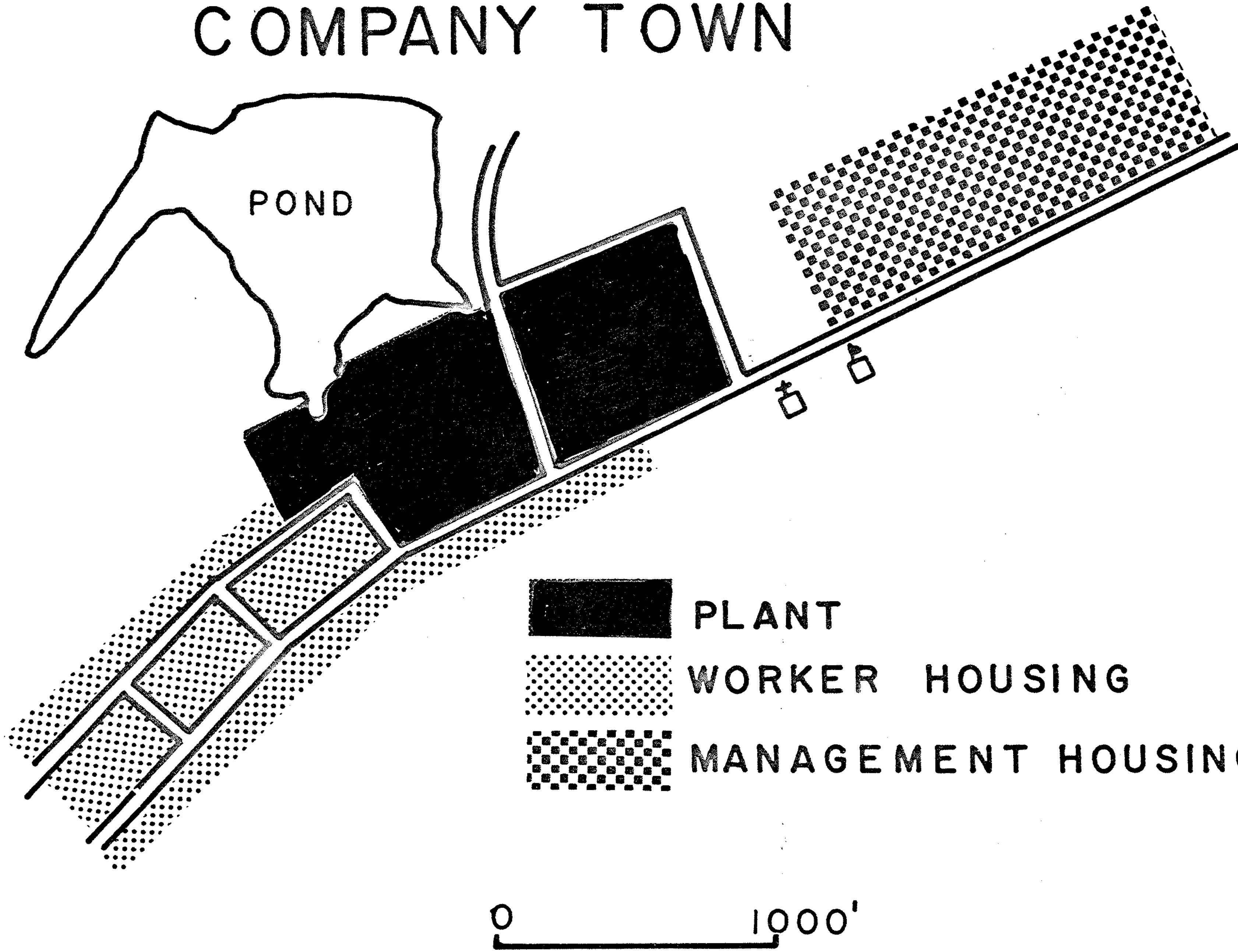
The residential area is most conspicuous for its distinctive architectural styles and color schemes. Not all the houses are identical, for the quality varies with the "rank" of the employee-occupant and the style varies with the time of construction.

In most company towns there are three levels of housing based on quality. The best quality are usually two story, substantial homes of slightly varying architecture set on large and often well-landscaped lots. These are few in number and occupied by the executive personnel of the plant. The middle quality houses-often greatest in number- are located in different blocks constructed at different dates. There is some variation between blocks, but little within them. The lower quality housing frequently consists of either simple, often shed-like single family dwellings or two story row houses. These are occupied by lesser skilled workers, minority groups or recent immigrants. Although the architecture varies from town to town, distinct regionality of style seems to be lacking, for similar styles have been observed on both coasts and Spanish-style architecture appears exoticly in Sinclair, Wyoming. Since most of thehomes were constructed before the workers possessed automobiles, the garages were built later. In Hopedale, Massachusetts and Scotia, California garages large enough to house several autos are scattered throughout the residential area.

The commercial portion of the company town is unusually small for the size of the community. A general store, which carries, food, hardware, clothing and drugs and a gasoline station, frequently combined as one enterprise, are invariably present and often the only retail functions. Even in the smallest company towns there is a post office in either the general store or in a separate building. In the larger company towns there appear in order of frequency a barber shop, beauty parlor, and hotel or rooming house with cafe. The hotel, when functioning served as the home of the single workers and also contained a recreation room and frequently a bar open to the town residents.

The small number of commercial units is partly explained by the fact that the company controlled the businesses either through direct ownership and operation,or through concessionaires or lessees, but in either case since the company owned the land

GENERALIZED PLAN OF A COMPANY TOWN



and buildings it had control over the number and kinds of commercial units that could be established. When the company operates the general store it is usually in a building housing other company functions such as those of the general offices. An other explanation for the small number of commercial units lies in the fact that the company town has almost no service area outside the town itself. Isolated from other communities and located in areas of sparse rural population, the company town has seldom become a trading center except for the residents who often had no other shopping alternative.

In many small towns the church and school represent the only institutional forms and the company town is no exception. However, what is distinctive about the company town in this regard is that the buildings, which are often painted like all the other buildings in town, have been built by the company. Furthermore, the company often provides the upkeep and much of the other necessary financial support as well.

The industrial form of the company town is so varied that it almost defies generalization. The largest and most complicated building assemblage is that associated with the company enterprise which varies with the nature of the operation, hence from town to town. Table I, lists the company towns studied in the field and the kinds of economic activities that have spawned them. The variety is striking, ranging from agriculture to snuff manufacture but mining, lumber and textiles dominate.

The general layout of the company town is similar to that of like-sized communities in spite of the fact that overall planning was involved from the inception. However, the distinctive characteristic of the company town is the clear separation of functions and especially housing quality. Figure 1 is a model based on several towns to illustrate how the housing for executive personnel is separated from the worker's housing by the plant buildings. The density of housing is much greater in the worker area where the lots are smaller and some of the dwellings are multi-family.

Evolution

Like most living organisms, company towns pass through a series of discernible stages of development in their life cycle. Not all towns experience the same evolution, but there is sufficient similarity in their histories to generalize about three stages.

In the initial stage, the company enterprise is established simultaneously with the residential and commercial portion of the community. Frequently the latter two take on a very temporary form to be expanded and improved as the company prospers, but many towns never progressed much beyond the "camp" stages before the company floundered. A few companies did not originally intend to house their workers, but felt compelled to do so in order to avoid the ramshackle type of town that was developing spontaneously.

The second stage is characterized by the expansion and improvement of facilities including painting and landscaping homes, paving streets, and the development of recreational facilities. If the company, as it prospers, requires additional labor, then additional housing units will be constructed, but often in a style different from existing units. As permanency of settlement seems assured efforts are made to increase the livability and attractiveness of the community. Those few towns that are still company owned are in this stage. A number of towns like Hopedale, Massachusetts, Litchfield Park and Ajo, Arizona and Scotia, California show good planning from the start, but most others show little evidence of a carefully conceived plan for future development.

Once a fairly common form of settlement, the company town has now all but disappeared from the American landscape. What has caused the demise of company towns? There are many answers. In some instances the resources on which the company depended became exhausted or marginally productive - accounting for the death of a large number of mining and a few forest industry towns. The consolidation of two or more companies, particularly in the lumber industry, often eliminated the town held by one company. The large investment in buildings, their annual upkeep and the large portion of an executive's time devoted to town administration, when matched against the low return from rents has made company towns uneconomic. Most companies have sold out at a substantial loss just to be free of landlord's headaches. Finally, a certain stigma has developed over the years about company towns and it has become unpopular in the days of organized labor for a company to be landlord, employer and merchant, so many have relinquished their residential and commercial holdings to improve labor relations.

Most companies sold their towns in the period from 1930-1960. Houses were offered to the occupants before they were advertized to outsiders at very reasonable sale prices. For instance in Sinclair, Wyoming, attractive brick or stucco homes sold for less than $5,000 in the mid-1960's.

So many company towns were up for sale during the 1940's and 1950's that one real estate and land management firm, John Galbraeth and Company of Columbus, Ohio specialized in the purchase and resale of company towns. This firm has handled the sale of more than a dozen towns west of the Mississippi since the end of World War II.(1)

In the more remote forest and mineral based former company towns where the company still operates, most of the residents remain company employees owing to the factor of isolation. But in the northeast, where nearly every community has some manufacturing, the population of the former company town soon becomes occupationally more heterogenous. The several former company-owned cotton mill towns in the Quinebaug River Valley of Eastern Connecticut have been sold parcel by parcel to individuals many of whom never worked for the company. The proximity to a number of job opportunities attracted the outside purchaser to the fairly cheap housing offered by the former company town. Hence, a few towns have become dormitories for people who commute elsewhere to work. However, the company-built town also offers numerous jobs, for the industrial buildings are often subdivided into many small separate factories.

Some of the forest-based company towns may potentially become vacation centers because of their location in scenic areas with large adjacent acreages for outdoor sports. The company that owned Port Talbot, Washington on the west side of Puget Sound has sold the houses largely as second homes and is now selling lots and building vacation homes. Thus, a former company town is serving as a nucleus for a resort community within two hours of Seattle. Few are so fortunate.

It is difficult to disguise a former company town so as to make it look less like one that was stamped from a mold, yet when a town has been sold the new owners try to change its appearance. The most obvious way to individualize the housing is by repainting in distinctive colors or by adding a porch or a garage. These and other changes are often made within the first year or two after the individual has purchased a house from the company, but psychologically pleasing as these efforts may be to the new owners, the community still looks like a company town and probably will for a long time to come.

Thus the company town born of economic necessity has now largely fulfilled its intended purpose. Several have outlived the companies on whose existence they originally depended and have now become incorporated places in their own right. An untold number have simply vanished. Only a few remain in company ownership out of a total that once ran into the hundreds, and those that remain possess a distinctive townscape that adds variety to the American settlement complex.

FOOTNOTES

1 Allen, James B., *The Company Town in the American West.* University of Oklahoma Press, Norman, 1966.

A DYNAMIC ANALYSIS OF WATER POLLUTION IN THE NEW YORK-NEW JERSEY METROPOLITAN ESTUARY*

by

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Increases in adverse environmental quality publicity have resulted in a parallel increase in environmental concern by governments on all levels. This concern has often manifested itself in an increase in existing sampling programs and surveys, with the result that considerable areal and parameter overlap has taken place. Serious and important questions may be raised as to the selection of variables included in surveys conducted at all governmental levels. Because of a considerable lag time between the introduction of the pollutant and awareness of its presence, the effects of particular pollutional parameters are often unknown. The DDT, and more recently, the mercury problem evident in large parts of the world are cases in point. The obverse situation also prevails: parameters are included more due to custom and available technology than because their effects on the health and well being on the population have been fully substantiated and confirmed.

Procedure

Principal component factor analysis has been used to a) test the independence of variables included in a major governmental water monitoring effort conducted in the western part of New York Harbor, and b) classify the same waters based on the areal and temporal behavior of parameters included in the survey (Table 1).

Geographers have traditionally used the R mode version of this model, which attempts to reduce a selected number of variables obtained from several different locations on one occasion to a smaller number of more manageable factors.(1) Graphically, this concept is shown in Fig. 1, where the x axis identifies the variables under consideration, the y axis the sampling points, and the z axis occurrences. Using this mode, it is assumed that all measurements relate to one specific occurrence (day, month, year, etc.). The P mode technique analyzes variables over time (occurrences) for a specific location and collapses those variables into factors which behave temporally similar. The S mode variation of the model, the second to be used in this paper, analyzes the temporal behavior of one variable over several locations for

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* This research was supported by a grant # 14-31-0001-3147 from the Office of Water Resources Research, United States Department of the Interior, Washington, D.C.

many occurrences.

Table 1

Station	Location
1	U.S. Gypsum Plant, New Brighton S.I., Kill van Kull, Hereafter identified as Kill van Kull
2	Outer Bridge Crossing, Arthur Kill, hereafter identified as Arthur Kill
3	Quarantine Station, Rosebank, S.I., The Narrow, hereafter identified as the Narrows
4	Victory Bridge, Perth Amboy, Raritan River, hereafter identified as the Raritan

Data

Data have been obtained from the Department of the Interior's Federal Water Quality Administration for four stations within the New York-New Jersey Metropolitan Estuary (Fig. 2).

The stations are automated electronic devices which sample the water approximately once every 15 minutes for eleven parameters (Table 2), yielding more than 4000 observations every 24 hours. Data have been obtained for the year 1969 amounting to some 1-1/2 million pieces of information.

P-Mode Analysis

Five hundred and sixty eight stratified random samples were taken for each station.[2] Zero and no recorded observations were excluded from the analysis as well as those variables on which less than 50 observations had been taken. In addition, ph was deleted from the Raritan River station due to incorrect

FACTOR MODES

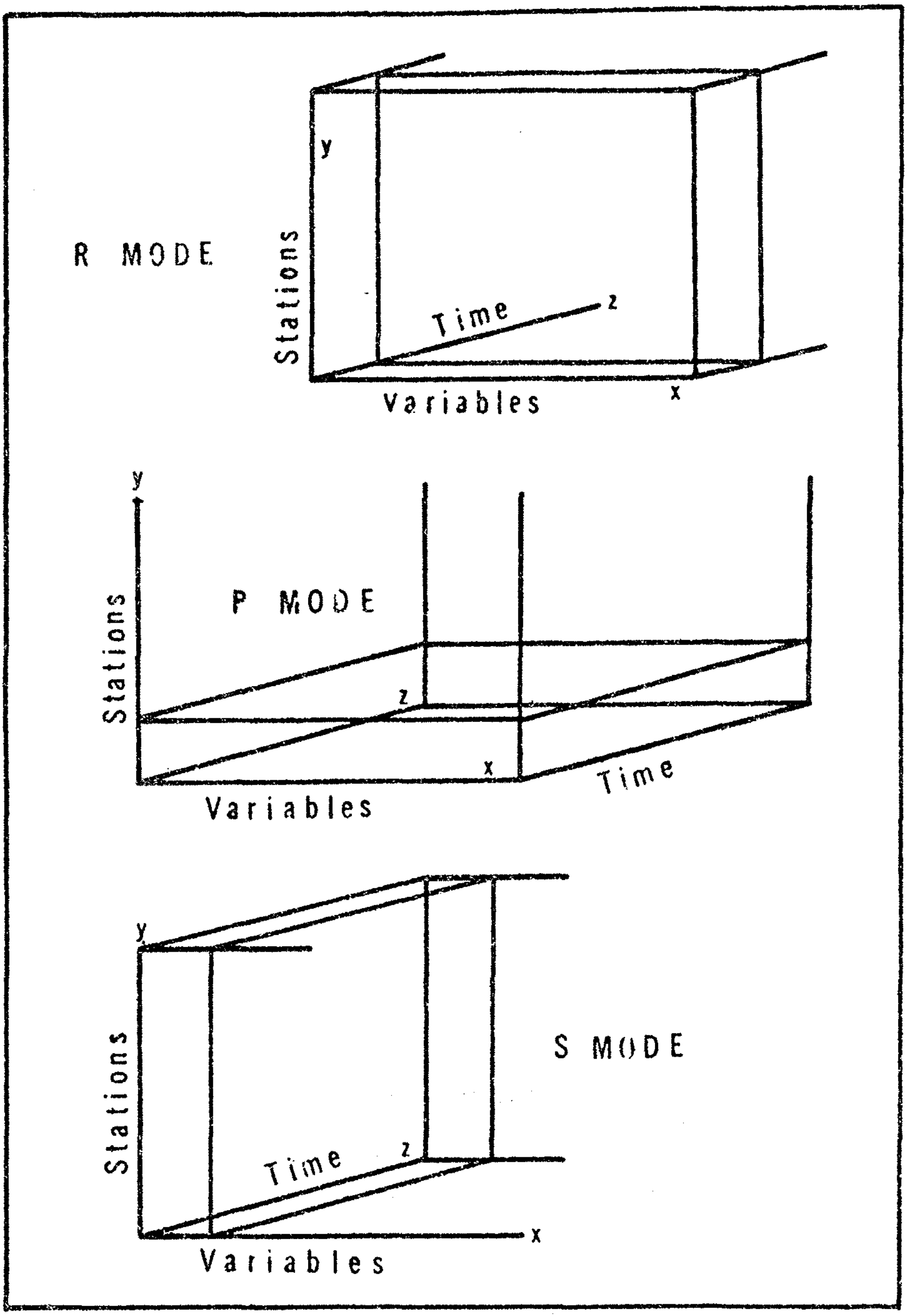

Fig 1

nw

LOCATIONS OF F.W.Q.A. STATIONS

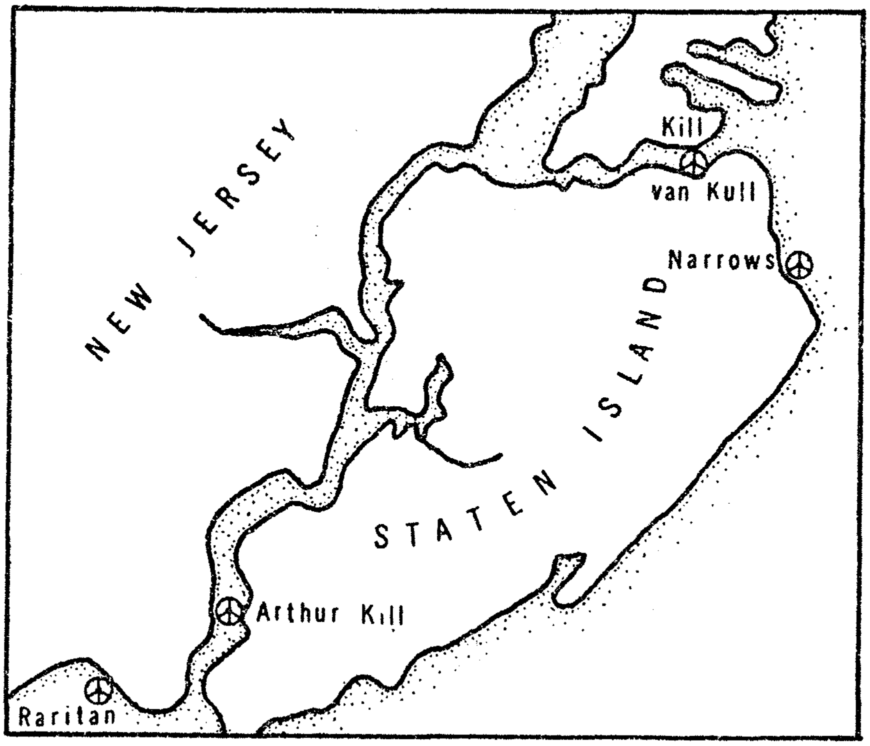

Fig. 2.

recording of observations.[3]

Table 2

Variable	Characteristics
X_1	Time of measurement (year, day, hour and minute)
X_2	Wind direction
X_3	Wind velocity
X_4	Solar Radiation Index (S.R.I.)
X_5	Turbidity (deleted in all samples due to faulty equipment
X_6	Low conductivity
X_7	High conductivity
X_8	Oxygen reduction potential (O.R.P.)
X_9	pH
X_{10}	Dissolved oxygen (DO)
X_{11}	Temperature

Each factor whose eigenvalue[4] was positive and exceeded unity was included in the analysis and rotated orthogonally using the Verimax version to identify clusters of variables.[5]

Four P-mode factor analyses were run, one for each station, yielding between 26% and 51% of the total variance. The rotated factor loadings appear in Table 3. No consistent pattern appears in the unrotated version, although two stations (Kill van Kull and the Narrows) show a strong inverse relationship between DO and temperature, which substantiates the Streeter-Phelps model.[6] This model was developed in the early part of this century and uncovered the various factors impinging upon the DO levels of streams and lakes. This relationship lends support to findings obtained from fresh water data which have been analyzed in an unpublished working paper by Carey.[7] An even less consistent relationship exists between low conductivity and O.R.P. Only three other parameters (Wind direction, S.R.I., and pH) have loadings exceeding .7, accounting for approximately 50% of their variation on a particular factor. However, no

Table 3

ROTATED FACTOR LOADINGS[1] ON FOUR P-MODE FACTOR ANALYSIS

	Kill van Kull		Arthur Kill		The Narrows		The Raritan	
	1. Factor	2. Factor	1. Factor	2. Factor	1. Factor	2. Factor	1. Factor	2. Factor
Time	-0.01	-0.10	0.12	0.02	0.04	0.11	-0.01	0.05
Wind D.	0.61	0.51			0.16	0.03	0.13	0.06
Wind V.	0.16	0.43	0.30	0.05	-0.41	-0.06	0.60	-0.31
S.R.I.	0.62	0.59			0.10	-0.10	0.41	0.31
L. Cond.	0.57	0.52	-0.34	-0.24	0.34	0.99	0.75	0.03
H. Cond.	0.49	0.17	-0.07	0.60	0.12	-0.23	-0.30	-0.06
O.R.P.	0.59	0.54	-0.67	-0.42	0.03	0.52	-0.06	0.49
pH	0.58	0.10	0.13	0.83	0.23	-0.45		
DO	-0.01	0.91	-0.77	0.40	-0.82	0.06	0.13	-0.50
Temp.	0.92	-0.17	0.53	-0.21	0.87	-0.20	0.02	0.71
Cum. Prop. of Tot. Variance	51%		38%		33%		27%	

[1] Each factor loading (the intersect between the variable and the factor) represent the amount of co-variation which the variable has with the specific factor. It may be interpreted as a correlation coefficient.

spatial consistency exists among the three variables.

When analyzing the rotated version, only the Narrows maintains the inverse relationship between DO and temperature. For the three remaining stations, the temperature/DO relationship may still be identified but their loadings are reduced, as in the case of the Raritan. In the two Kill stations the DO and temperature are still significant, but load on different factors. The weak relationship between low conductivity and O.R.P. observed in the unrotated version of the analysis has weakened further, although the direction of the relationship still exists. There is no bio-chemical reason for this relationship and it has been discarded in the interpretation of the factors. Similarly, all meteorological loadings have been reduced in the rotated version and have been discarded in the explanation of the factors.

S-Mode Analysis

The second part of the analysis utilizes the S-mode version for an analysis of those pollution parameters which indicated significant loadings on the rotated version of the P-mode analysis. The loadings of the three parameters appear in Table 4.

Table 4

Station	Do	Temp.	L.C.
Raritan River	.65	.60	.16
Kill van Kull	.83	.84	.16
Arthur Kill	.63	.80	.25
The Narrows	.82	.92	.34
Cum. Variance	55%	63%	18%

No factor was recognizable in the case of low conductivity and only one factor appeared on the remaining two parameters. Therefore, no rotation was possible and the conclusion has been based on the unrotated version. The cumulative proportion of the total variance ranged from 18% in the case of low conductivity to 63% in the case of temperature. The pattern which appeared in the P-mode analysis is substantiated in the Narrows and, surprisingly, also for the Arthur Kill station. No discernible pattern is recognized in the case of low conductivity.

Of the eleven variables included in the analysis three measure meteorological characteristics and consistently show independence with respect to the quality of the water under investigation. Likewise, time has low loadings on either factor, indicating a similarly strong independence both in the unrotated and rotated versions of the analysis. Of the remaining seven variables (O.R.P., L.C., H.C., pH, DO and Temp.), only two (DO and temperature) indicate a fairly consistent inverse relationship which is evident spatially as well as temporally. It may be concluded that the variables adapted by the survey measure different aspects ofthe physical characteristics of the water. No attempt has been made to determine whether these variables are the most efficient and meaningful parameters from a bio-chemical standpoint. As has already been pointed out, expediency may be a problem in this regard.

Classification of Stations

The second objective of the paper is an attempt to describe and thereby to facilitate a greater understanding of the quality of the waters from the spatial point of view. Using general systems terminology, the following typology may be suggested. All four stations are located in waters which have been variably affected by the introduction of pollutants. The behavior of the parameters on the four stations suggests that at least two and possibly four stages of water systems degradation are represented.

Of the four bodies of water under consideration, the Narrows is located farthest away from the major sources of pollutants and benefits to a greater extent by the dilution effect of the Atlantic Ocean. This station is relatively more representative of a natural estuarial system where the inputs in the form of foreign matter (pollutants) may be equated in general systems terminology to part of a negative feedback loop.[8] The system is selfregulating, governed by homeostatic adjustments to its environment. That is energy inputs are in balance with energy outputs, oscillating around the optimum level of that system. Such a system is considered to be open, stable and in steady state.[9]

The two Kill stations have received much greater energy inputs in the form of organic and inorganic effluents from the industries and municipalities located on the Passaic and Hackensack Rivers, Newark Bay, Arthur Kill and Kill van Kull. Consequently, the homeostatic adjustments made by the steady state system are no longer capable of coping with the larger and sometimes erratic inputs of pollutants. The steady state system operating under ever increasing oscillations caused by increased energy inputs may reach a critical zone, at which point the negative feedback ceases and an amplifying feedback takes over, resulting in the complete alteration of the system. The effects may be compounded by possible synergism resulting in reactions, the sum of which may be greater, by several magnitudes, than each of the contributing parts (pollutants).

The behavior exhibited by the four stations suggests that several stages are represented along the evolution or degradation of natural systems. The Narrows is a system capable of adjusting to the effluent loadings introduced into it. Should these increase, it is entirely possible that the principle of negative feedback or homeostatic adjustment may reach the critical zone. At this point the negative feedback may be destroyed and/or substituted by the amplifying feedback. There are indications that the Raritan and the two Kill stations are approaching or have already reached this stage. This conclusion is based on the complete or partial breakdown of the DO/temperature relationship in these systems. The direct cause for such a breakdown could be due to pollutants not yet monitored by the system.

Conclusion

A degree of success was obtained in reaching the objectives of the paper. Further, it appears that the P and S-mode factor analysis offer possibilities for geographers interested in coming to grips with the behavior of dynamic relationships.

A number of additional possibilities exist for continued research in this area. Many of the reactions occurring in the streams and lakes have lag times extending from hours to years. For example, an increase in the S.R.I. might result in an increase in both water temperature and algae growth. An increase in algae might result in higher DO levels, assuming the availability of sufficient light and nutrients. This relationship has been indicated in a preliminary investigation of the Raritan Bay. Since the chain reaction caused by the increased solar input is not instantaneous, but could occur several hours after the initial input, a direct correlation between solar input and algae would be masked by any statistic which does not take a possible lag in time into consideration. Spectral analysis is a statistic which offer opportunities for analyzing cyclic behavior of two or more sets of data and in which a lag is believed to exist. Additional research is planned along these lines.

BIBLIOGRAPHY

Carey, George W. "Principal Component Factor Analysis and Its Application in Geography" Department of Urban Planning and Policy Development and the Department of Geography, Rutgers University, New Brunswick, 1969

Fruchter, B. Introduction to Factor Analysis, D. Van Nostrand Comp., New York, 1954

Harman, H. Modern Factor Analysis, The Univ. of Chicago Press, Chicago, 1960

Horst, Paul Factor Analysis of Data Matrices, Holt Rinehart and Winston, Inc., New York, 1965

Phelps, Earl B. Stream Sanitation, John Wiley, New York 1944

Rummel, Rudolph "Understanding Factor Analysis" Jour. of Conflict Resolution, (1967), Vol. 11, No. 4, pp 440-480

FOOTNOTES

1 All factor analytical models regardless of mode, reduce a correlation matrix m x m into a m x p matrix where m is a variable and p a factor and p = m. For additional comment see Leslie J. King Statistical Analysis in Geography, Prentice Hall Inc., Englewood Cliffs, N.J. 1969, pp 166-193.

2 All observations were taken in blocks of four, one for each station within 5 minutes of one another. Five hundred and sixty eight blocks were randomly selected yielding a total of 2272 observations.

3 The mean of the pH for the Raritan station with no recordings deleted was calculated at .6 - An inspection of the raw data indicated a significant number of recordings below .5.

4 Eigenvalues measure the amount of variation accounted for by a particular factor. It is obtained by summing the squared loadings for each factor. Eigenvalues below unity are not usually included in the analysis because such factors explain less of the observed variance than the original variables. For further information, see Donald Veldman, Fortran Program-

ming For the Behavioral Sciences., Holt, Rhinehart and Winston, New York, 1967, pp. 211-212.

5 An unrotated factor analysis defines general patterns of relationships in the data. The rotated version enables the operator to rotate the reference system about its origin in an infinite number of ways. The version used in this analysis identifies clusters of variables about the coordinates in such a way that the squared distance between each vector and its coordinate is minimized still maintaining the orthogonality of the coordinate system.

6 Phelps, Earl B. Stream Sanitation, John Wiley, New York, 1944.

7 George W. Carey, "Discussion of Factor Analysis of Elizabethtown Company Data Run # 2" Mimeo, Rutgers University, New Brunswick, Sept. 1970.

8 The basic notion of the feedback is based on the principle of the governor in mechanical engineering. For example when an input of energy approaches the capacity of the system, information flows forward to a regulator which reduces the input below the critical zone of that system. The oscillations resulting from adaptations made by the system to the varying input are known as homeostatic adjustments.

9 An open system, as oposed to a closed system, is any system in which an exchange of energy occurs between it and its environment. If the system is using the input for maintenance of that system, it is considered to be in steady state. Systems in steady state also are considered stable. For additional information see Ludwig von Bertalanffy "The Theory of Open Systems in Physics and Biology" Science (Jan. 1950) for an application of open systems in estuarial ecology see H.T. Odum "Ecological Potential and Analogue Circuits for the Ecosystem" American Scientist, Vol. 48, pp. 1-8.

SPATIAL DISTRIBUTION OF EFFLUENT LOAD IN WATER QUALITY MANAGEMENT

by

Ethan T. Smith*

One of the key problems in water quality management is the development of methodology which can be used to determine what specific action is required by individual sources of pollution within the context of a comprehensive plan. Such a plan has been developed over a period of years by the Delaware Estuary Study of the Federal Water Quality Administration.[1] It is currently being implemented by the Delaware River Basin Commission for the portion of the Delaware River between Trenton, N.J. and Wilmington, Del. The plan includes several alternative ways in which the water quality standards for the estuary can be attained. Any given alternative results in a precisely defined limitation of waste effluent for each municipality and industry along the estuary.

This plan has been designed by use of a systems approach. Since there are many interpretations of this term, perhaps it would be advisable to define what it means in this context.

Systems analysis and operations research can be used to structure intensive water quality management studies. Such intensive studies focus effort on individual river basins, or on highly urbanized areas within basins where water pollution is unusually serious. In such an area, the major objective of water quality management is to secure levels of water quality in the streams suitable for the multiple use requirements of the regional population. The uses for various streams, and their associated numerical criteria, are provided by water quality standards, and result in a stream assimilative capacity such as shown in Figure 1. A comprehensive river basin study is designed for a particular span of time, and is always future-oriented. This means that a plan can be designed, for example, for ten or twenty years ahead. Within this period, there will be various alternatives available for meeting the demands of the regional population. The alternatives are strongly influenced by both the level of technology and the economic resources that can be expected for this period. The growth of the regional population and its associated demands for conflicting water uses such as recreation on one hand and waste disposal on the other will force a choice to be made between the available alternatives.

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Presented at the 11th Annual Meeting of the New York-New Jersey Division, Association of American Geographers, State Univ. College, Cortland, N.Y., Oct. 16 & 17, 1970.

Figure 2 shows the major steps in a comprehensive river basin study. These steps were followed to design the Delaware Estuary plan, and are presently being applied by FWQA to the Raritan River Basin in New Jersey.[2] To prepare a program capable of implementation, it is necessary to combine data on the physical river system with socioeconomic data from the basin area. Systems analysis of all information permits meaningful alternatives to be defined, and operations research methods are then applied to discriminate among various alternatives and finally to aid in an optimal choice.

Water Quality Simulation Models

A systems analysis of the river itself is the indispensable first step in water quality management. This consists of representing with mathematical equations the cause and effect relationship that exists between waste effluent and the resultant in-stream water quality. The outcome is a water quality simulation model that permits alternative combinations of waste treatment to be examined. Such models can be used to predict the effects of effluents containing various contaminants, although most work to date has been concerned with the effect of organic waste loads. Water quality models have various characteristics depending on the method of formulation. Models generally are composed of a number of separate geographical reaches within the river system. Each reach is represented by separate mathematical equations. They can be designed for simple river systems, or for estuaries with superimposed tidal fluctuations.

Any change in such a model can be used to predict a change in the real river. For example, we can test ahead of time the effect of increasing the flow of water in the river, or we can predict exactly how much the river water quality will increase if the waste effluents are decreased. It is this connection between the effluents and river water quality which is most important.[3][4]

Figure 3 shows the 30 section model used by FWQA in the Delaware Estuary Study.

Options for Water Quality Management

Once a water quality model has been formulated for a river system, it is possible to construct alternative water quality management strategies, and to examine them for optimality. Within the context of the water quality model any number of such alternatives can be constructed, but they all have several characteristics in common.

First, the objectives for any given scheme are supplied by water quality standards, which assign numerical levels of desired water quality to reaches of a stream depending on the desired use to be made of each portion. For example, the water quality standards may state that a particular stream should have water quality suitable for water contact recreation. That numerical level of water quality then becomes our objective, and our optimization models are used to find alternative ways to meet that goal.

The most important problem in the construction of alternatives is probably the selection of optimization criteria. These are not the same as the criteria associated with water quality standards. Rather, optimization criteria are those factors which we decide are important enough so that we will seek best solutions in terms of them. That is, if some group of waste sources is discharging into the stream, we must decide what subsidiary objectives are important enough to warrant consideration, in addition to the prime objective of attaining a given water quality level in the stream. Various possibilities for these optimization criteria can be proposed.

One, for example, would be to look for the solution that would be least expensive to implement. Another possibility would be to require waste dischargers in the same part of a river to provide the same amount of waste treatment. Still a third possibility would be to require large waste dischargers to provide a greater degree of waste treatment than small dischargers. Any criteria used will result in some spatial distribution of modified effluents.

This problem was met in the Delaware Estuary Study by constructing a series of optimization models based on cost.(5) (6) Each waste source has an associated cost function which states how much it would cost to remove additional waste load from that particular effluent. The economic optimization models allow one to specify three different solutions to achieve any desired stream quality goal. The first solution requires a uniform effluent modification from each source, the second solution is defined by the mathematically minimum cost for all sources acting together, and the third solution permits one to group sources into aggregates which are independent of each other, but within which each source must be modified uniformly. Any alternative solution requires a particular spatial set of effluent modifications which are unique to that solution. Each of these models will attain the same water quality goal, although they differ greatly in efficiency. For example, the uniform treatment solution has the appearance of equitability, but is much more expensive than the minimum cost solution because the latter only requires waste treatment by those sources necessary to achieve the goal at least cost.

Waste Load Allocation Models

After a water quality goal and an optimization model are selected, it is possible to consider the derivation of waste load allocations for each source. The solution of an optimization model states what action is required of a particular set of N sources at a particular year, say e.g.,time one. However, these are not the only waste sources that must be considered. There are also minor waste sources that are too small to be significant at time one, but which may grow over time. Then there are new waste sources that may enter the system in the form of municipalities and industries that do not yet exist at time one. On top of this, it is probably legally inequitable to apply the idea of a fixed discharge load only to the original N sources. All sources that are in the system between time one and time two must be considered if the plan is to remain effective over some span of time.

For all these reasons it seems necessary to use some kind of a distribution approach, whereby conclusions that are drawn for some representative set of sources are subsequently applied to a much larger set. This approach can be facilitated by introducing the concept of a management zone, a reach of the estuary typically between 15 and 30 miles in length. (Figure 4) Within any given zone, all waste dischargers must treat their effluents to the same percent removal. Four such zones were defined along the Delaware Estuary between Trenton, New Jersey to south of Wilmington, Delaware. The required percent removal of waste before treatment can vary from one zone to the next. The first step in deriving load allocations is to determine the maximum permissible waste load that can be discharged to each zone. This information is given by the three optimization models. It is the sum of the N modified effluents plus the unmodified minor effluents. These zone allocations determine the "size of the pie," i.e., the maximum amount of waste that can ever be discharged to each zone by both present and future waste sources, if the water quality standards are to be maintained. Figure 5 gives the zone allocations for the four zones of the Delaware Estuary as determined by each of the three optimization models. It is evident that the models differ considerably in the spatial distribution of waste load, even when they all attain the same goal. The assumption is implicit in this figure that the zone allocation for each zone is uniformly distributed among the model sections comprising each zone. This should not affect the resulting water quality profile because spreading the load over a number of sections reduces the impact of the effluent in any single section.

The zone allocations must now be apportioned so as to consider (1) presently existing sources, (2) new municipalities and industries that may discharge to the estuary in the future.

It is necessary to define a specific period between $t_1 = 1964$ and $t_2 = 1975$ for which a set of allocations can be derived. Similarly, one could compute allocations for the period 1975-1985, 1985-1995, etc. The fixed zone allocations will cause individual waste source allocations to decrease for successive periods providing new load is generated within the system. As long as growth continues, the required percent removal of raw load will increase and approach 1.0 asymptotically. Growth projections for the Delaware Estuary are given in Figure 6. These projections cover waste from both present and future sources before treatment.

The analysis must focus on the time two state of the system to derive load allocations for each waste source. At t_2, it is necessary to know (1) the t_2 projected load before treatment for each of the original waste sources in the system, (2) the projected load before treatment for all anticipated new sources to enter each zone by 1975.

The solution indicates that all sources must adopt a percent removal sufficiently high to meet the expected growth through t_2, i.e., 1975. This required percent removal is applied to all existing sources at their 1975 load levels to derive individual load allocations for each source. Each load allocation is constant from 1964-1975.

Any new sources which come into existence between 1964 and 1975 are treated equitably. This means that whatever 1975 projected waste load remains after providing for present sources is regarded as a reserve for new sources. Any such source will receive a share of the reserve upon its entry into the system. How much depends on its untreated load growth projection for 1975, which must be made for each new source as it occurs. Then the allocation for such a source is derived by applying the 1975 required percent removal to the source projected waste load before treatment.

It is of course possible that the actual growth over time will be different than that projected. This will lead to difficulty if too many unanticipated sources seek to enter the system. Such a situation would require redistribution of the zone allocation before the expected terminal date of 1975. It would mean that the required percent removal would increase, and the load allocation for each source would decrease. Since waste treatment facilities require substantial time and money for design and construction, it is not desirable to reallocate waste load among the waste sources too frequently. This points up the necessity of accurate waste load projections for the region.

An example of this spatial distribution of waste load is given in Figure 7. This shows the result of distributing the zone allocations now being implemented by the Delware River Basin Commission to each of the waste sources along the Delaware Estuary. The horizontal lines indicate the amount of reserve load available for allocation to new waste sources that might enter the system by 1975. This assumes that the reserve for a given zone is uniformly distributed among the model sections composing that zone. By 1975 the reserve will be exhausted and reallocation must be carried out for the period 1975-1985.

Let us review briefly what has been demonstrated by this example:

1. The use of a water quality simulation model makes it possible to predict how water in a stream will change if waste effluents are modified.

2. Optimization models make it possible to consider alternative strategies for enhancing present water quality to achieve desired use criteria.

3. Once a strategy is chosen, waste load allocation models distribute the allowable waste discharges among present and future waste sources so that enhanced levels of water quality can be maintained over time in spite of continuing population and economic growth.

This approach is one way in which modern systems techniques can be used to navigate a rational course of action between the Scylla of irresponsible use of the environment and the Charybdis of repressive restriction in a free society. It is certainly not an easy course to follow but neither is it an impossible one. It at least shows signs of being a better course than we have followd up to now.

BIBLIOGRAPHY

1. Delaware Estuary Comprehensive Study, "Preliminary Report and Findings", U.S. Dept. of the Interior, Federal Water Pollution Control Administration, Philadelphia, Pa., 1966.

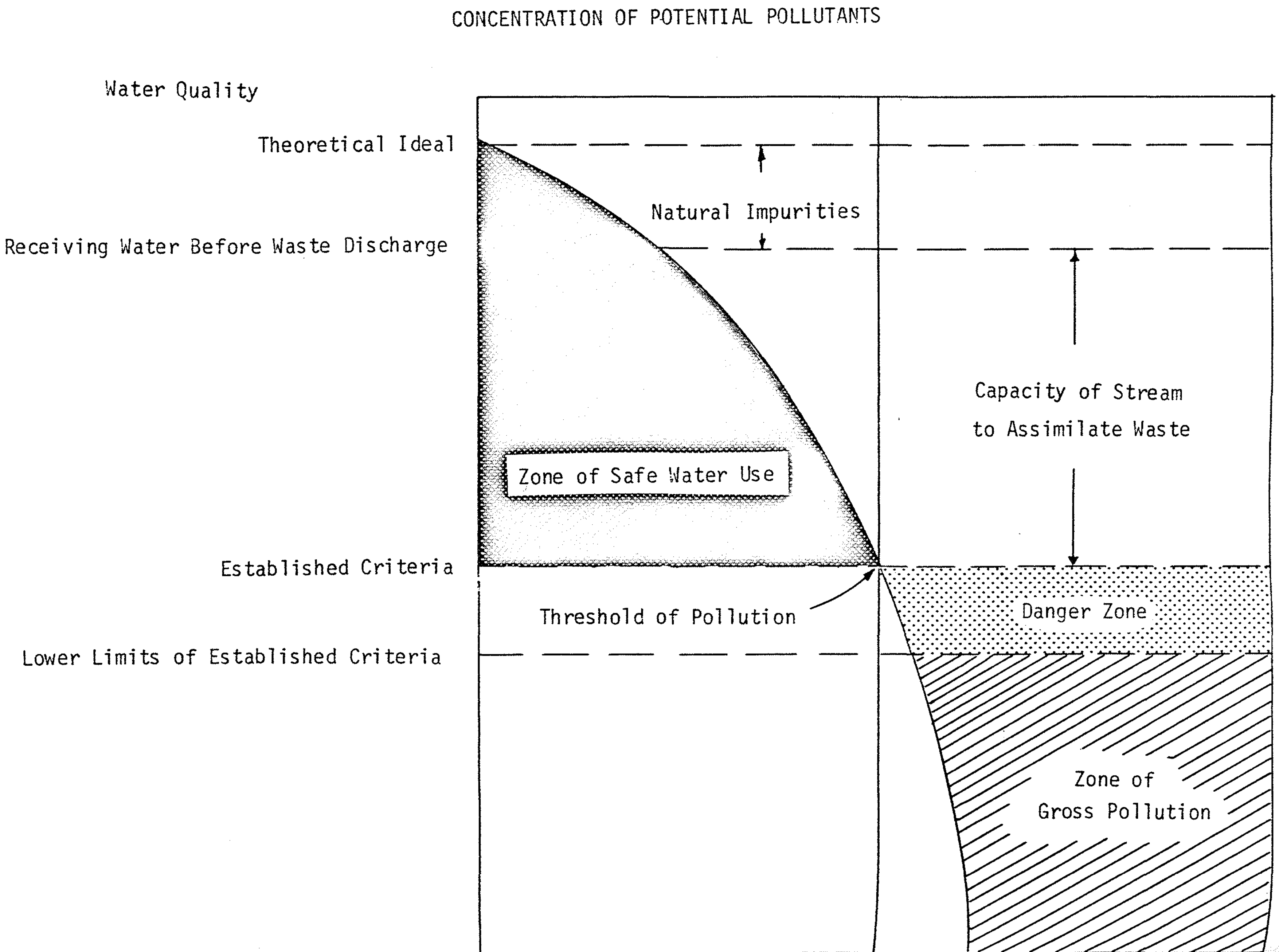
2. Morris, A.R., Statement for the New Jersey Clean Water Council Hearing on the Raritan River Basin, Federal Water Pollution Control Administration, October 21, 1969.

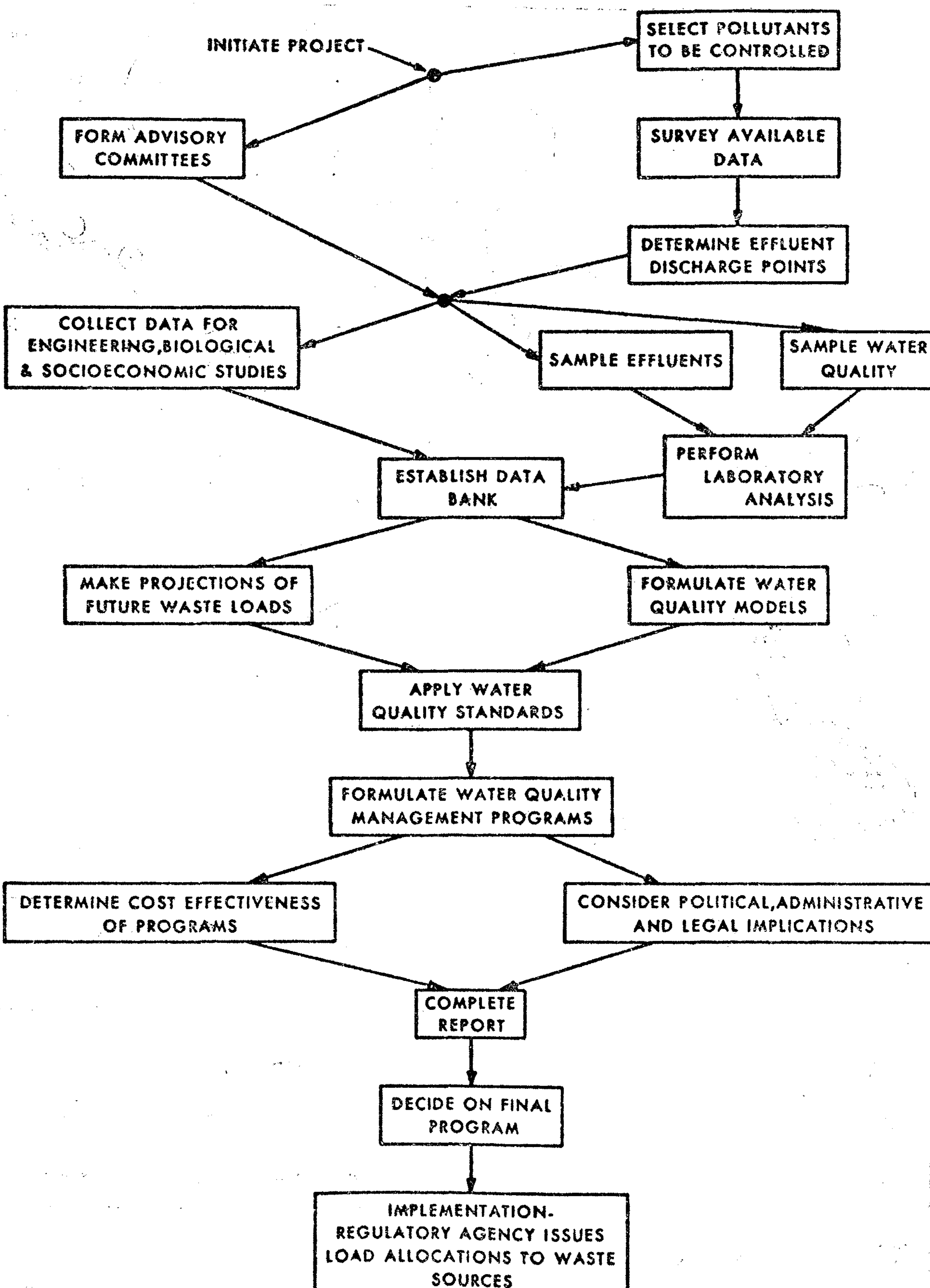
3. Thomann, R.V., "Mathematical Model for Dissolved Oxygen", Journal of the Sanitary Engineering Division, Proceedings ASCE, Vol. 89, No. SA5 (1963).

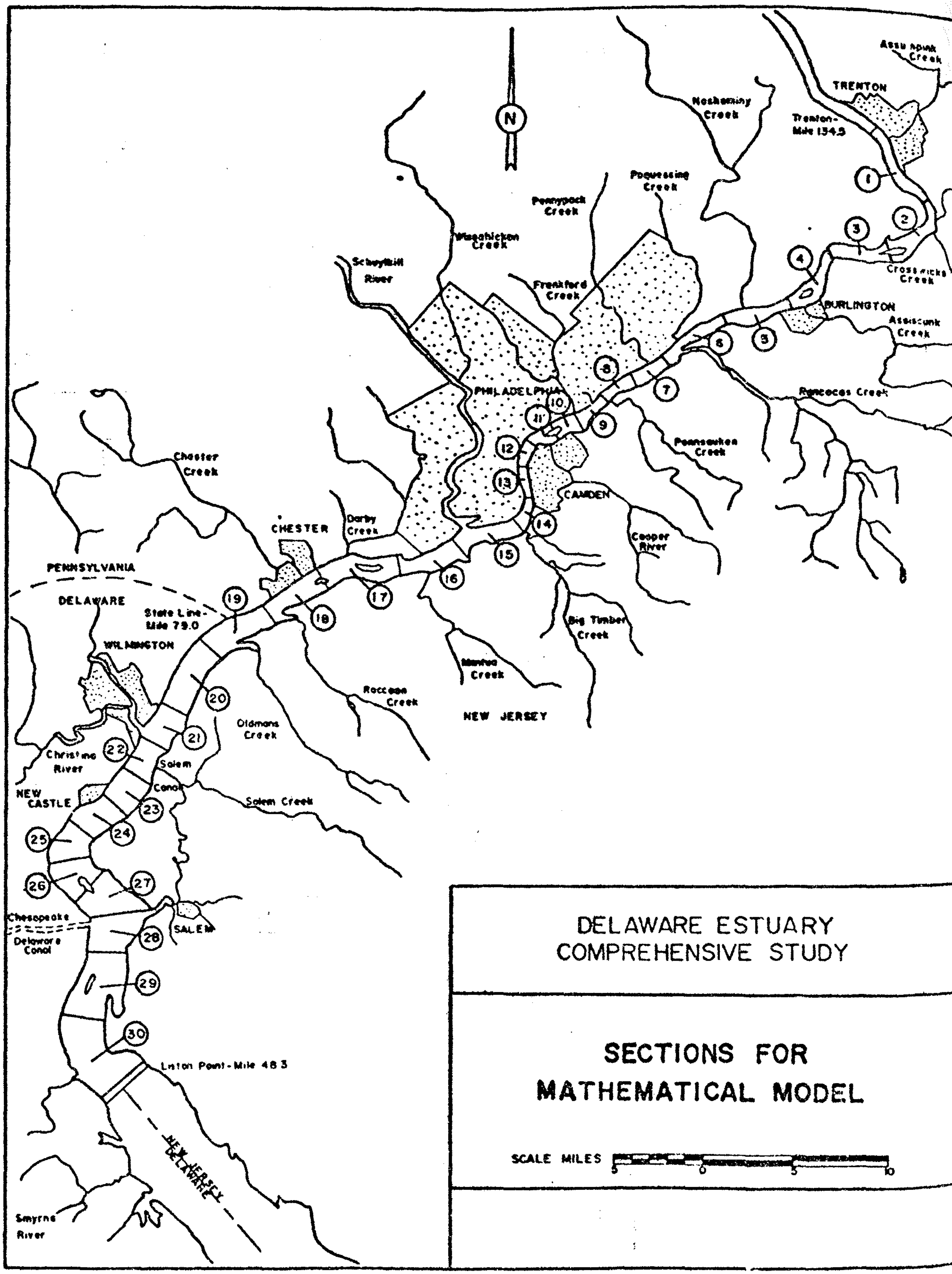
4. O'Connor, D.J., "The Temporal and Spatial Distribution of Dissolved Oxygen in Streams", Water Resources Research, Vol. 3, No. 1, 1st Quarter 1967.

5. Smith, E.T. and Morris, A.R., "Systems Analysis for Optimal Water Quality Management", Jour. Water Pollution Control Federation, Sept. 1969.

6. Smith, E.T. and Mehr, E. "A Cost Allocation Model for Zoned Optimization of Waste Treatment Requirements", presented at the 2nd Mid-Atlantic Industrial Waste Conference, Drexel Institute of Technology, Philadelphia, Pa., Nov. 18-20, 1968.


CONCENTRATION OF POTENTIAL POLLUTANTS
Water Quality
Theoretical Ideal
Natural Impurities
Receiving Water Before Waste Discharge
Capacity of Stream
to Assimilate Waste
Zone of Safe Water Use
Established Criteria
Threshold of Pollution
Danger Zone
Lower Limits of Established Criteria
Zone of
Gross Pollution


INITIATE PROJECT
SELECT POLLUTANTS TO BE CONTROLLED
FORM ADVISORY COMMITTEES
SURVEY AVAILABLE DATA
DETERMINE EFFLUENT DISCHARGE POINTS
COLLECT DATA FOR ENGINEERING,BIOLOGICAL & SOCIOECONOMIC STUDIES
SAMPLE EFFLUENTS
SAMPLE WATER QUALITY
PERFORM LABORATORY ANALYSIS
ESTABLISH DATA BANK
MAKE PROJECTIONS OF FUTURE WASTE LOADS
FORMULATE WATER QUALITY MODELS
APPLY WATER QUALITY STANDARDS
FORMULATE WATER QUALITY MANAGEMENT PROGRAMS
DETERMINE COST EFFECTIVENESS OF PROGRAMS
CONSIDER POLITICAL,ADMINISTRATIVE AND LEGAL IMPLICATIONS
COMPLETE REPORT
DECIDE ON FINAL PROGRAM
IMPLEMENTATION-REGULATORY AGENCY ISSUES LOAD ALLOCATIONS TO WASTE SOURCES


DELAWARE ESTUARY
COMPREHENSIVE STUDY
SECTIONS FOR
MATHEMATICAL MODEL
SCALE MILES
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N
TRENTON
Trenton-
Mile 134.5
Neshaminy
Creek
Poquessing
Creek
Pennypack
Creek
Wissahickon
Creek
Schuylkill
River
Frankford
Creek
Crosswicks
Creek
BURLINGTON
Assiscunk
Creek
Rancocas Creek
PHILADELPHIA
Pennsauken
Creek
CAMDEN
Cooper
River
Big Timber
Creek
Mantua
Creek
NEW JERSEY
Chester
Creek
CHESTER
Darby
Creek
PENNSYLVANIA
DELAWARE
State Line-
Mile 79.0
WILMINGTON
Raccoon
Creek
Oldmans
Creek
Christina
River
Salem
Canal
Salem Creek
NEW
CASTLE
SALEM
Chesapeake
Delaware
Canal
Liston Point-Mile 48.3
NEW JERSEY
DELAWARE
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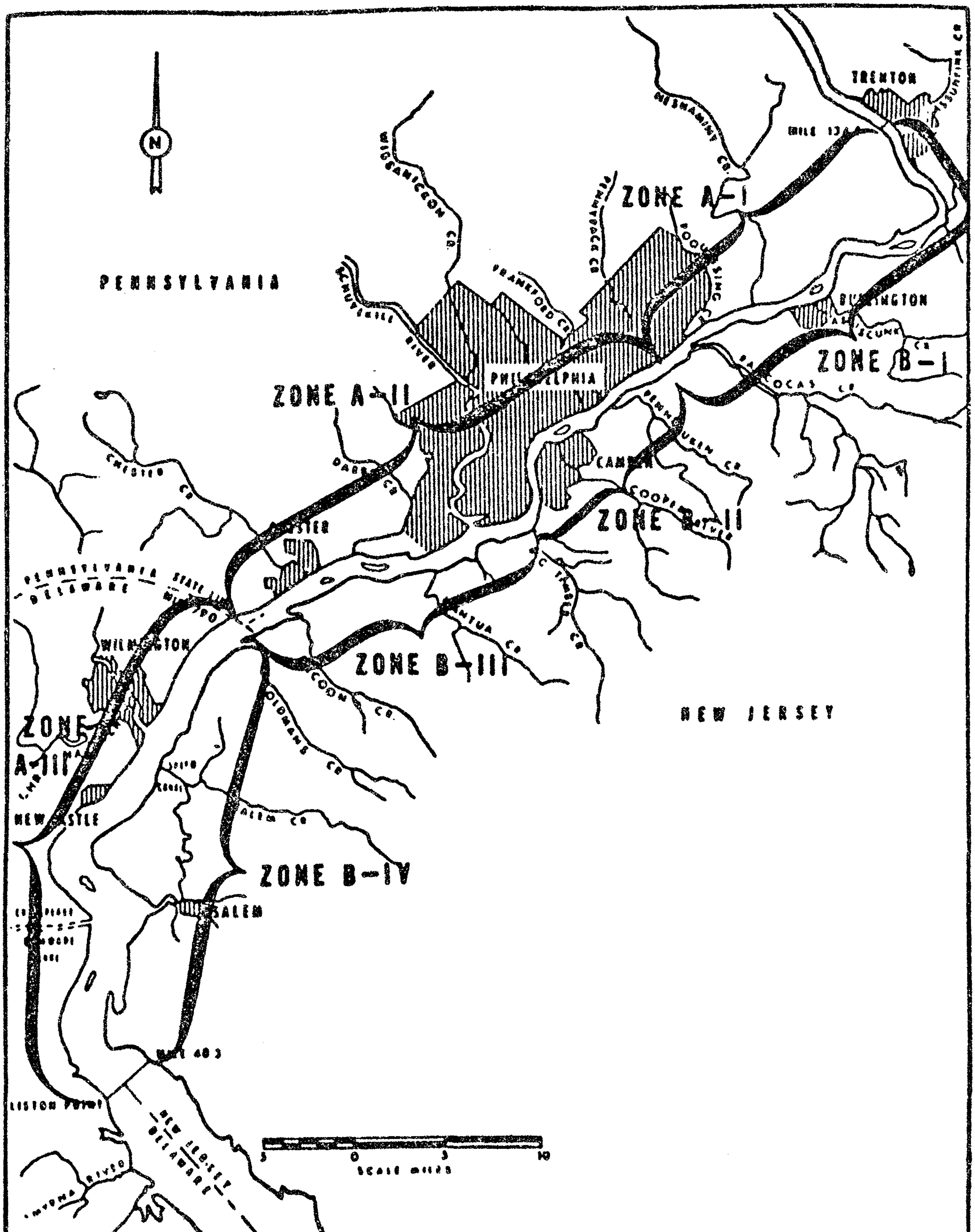
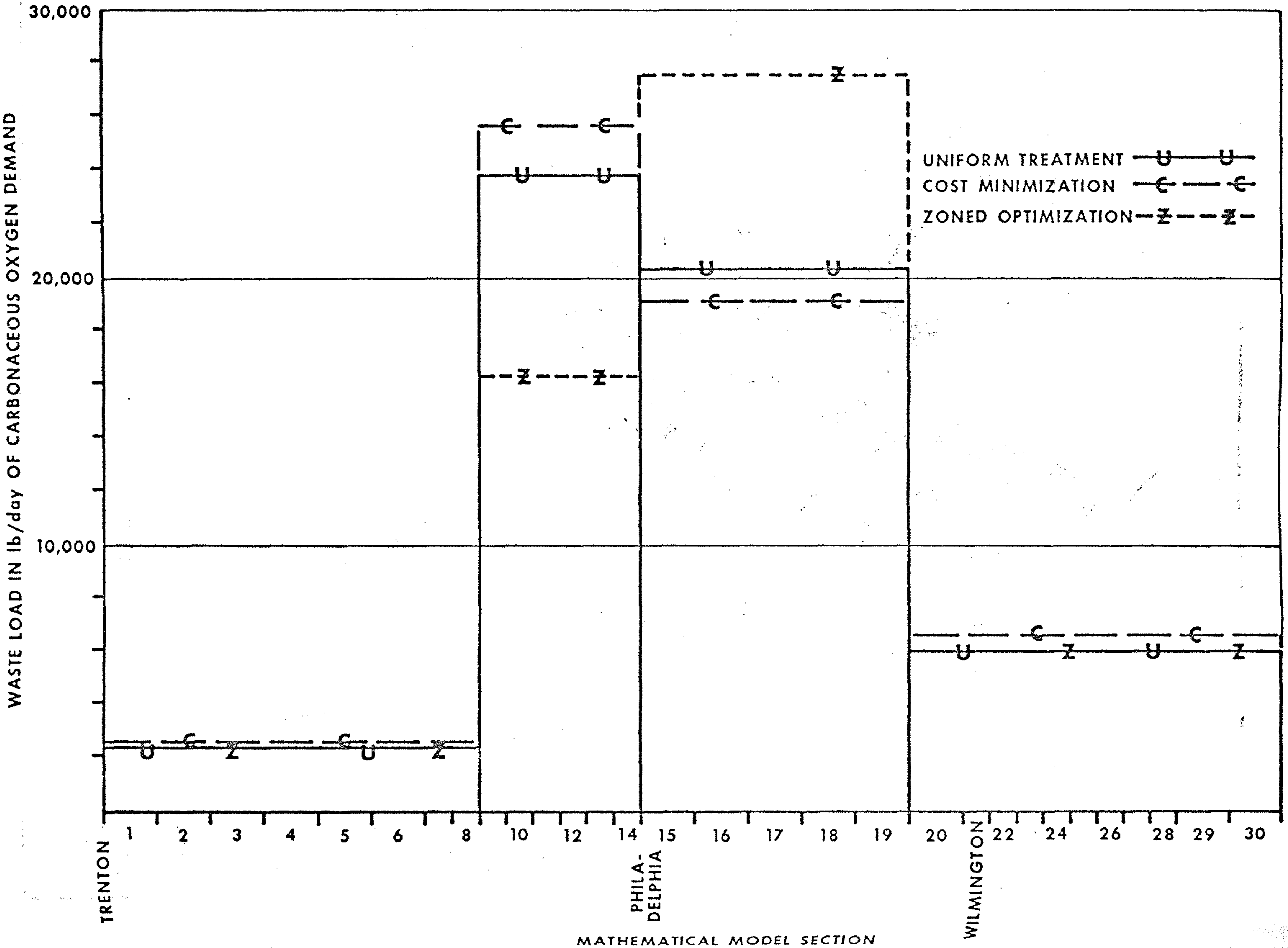
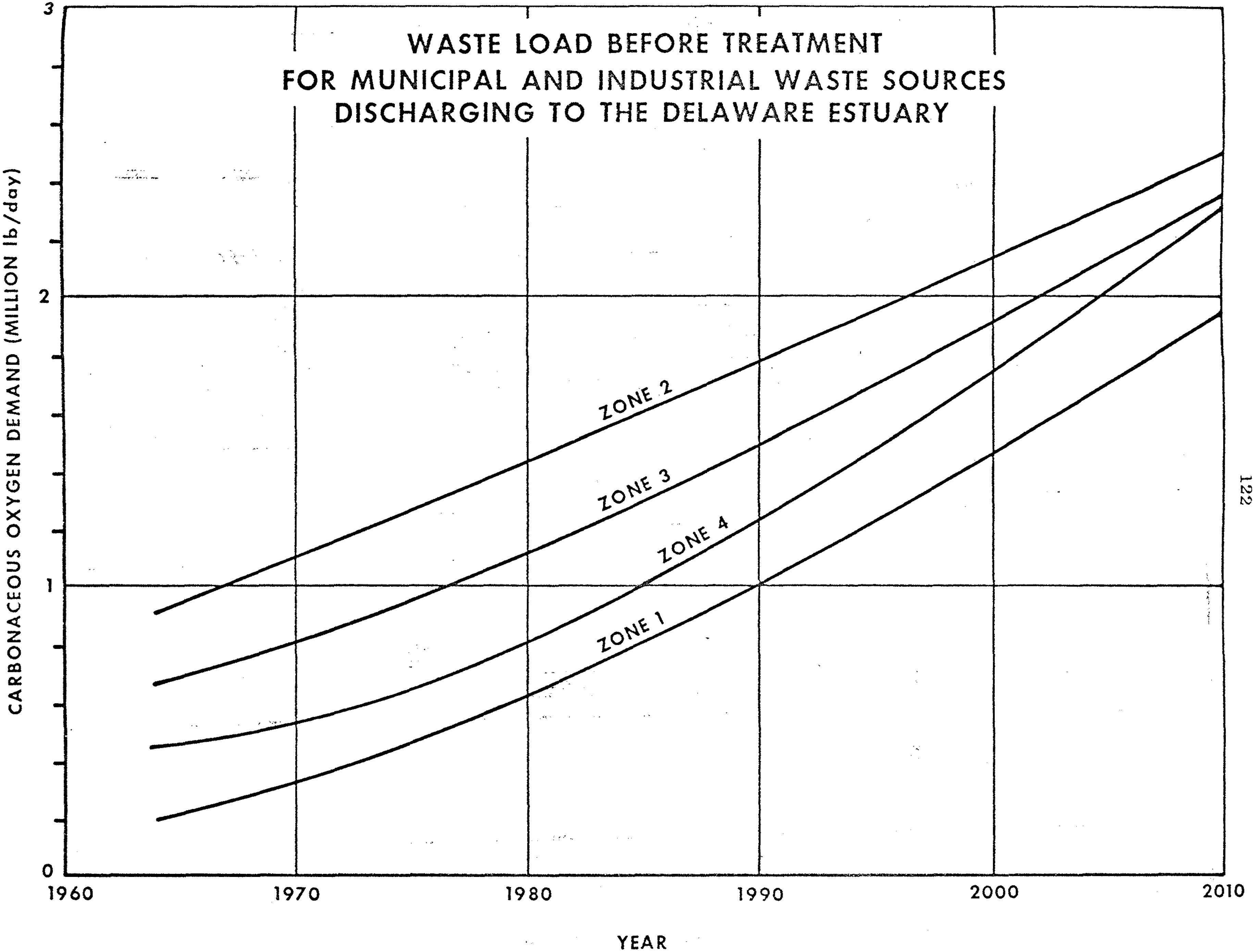


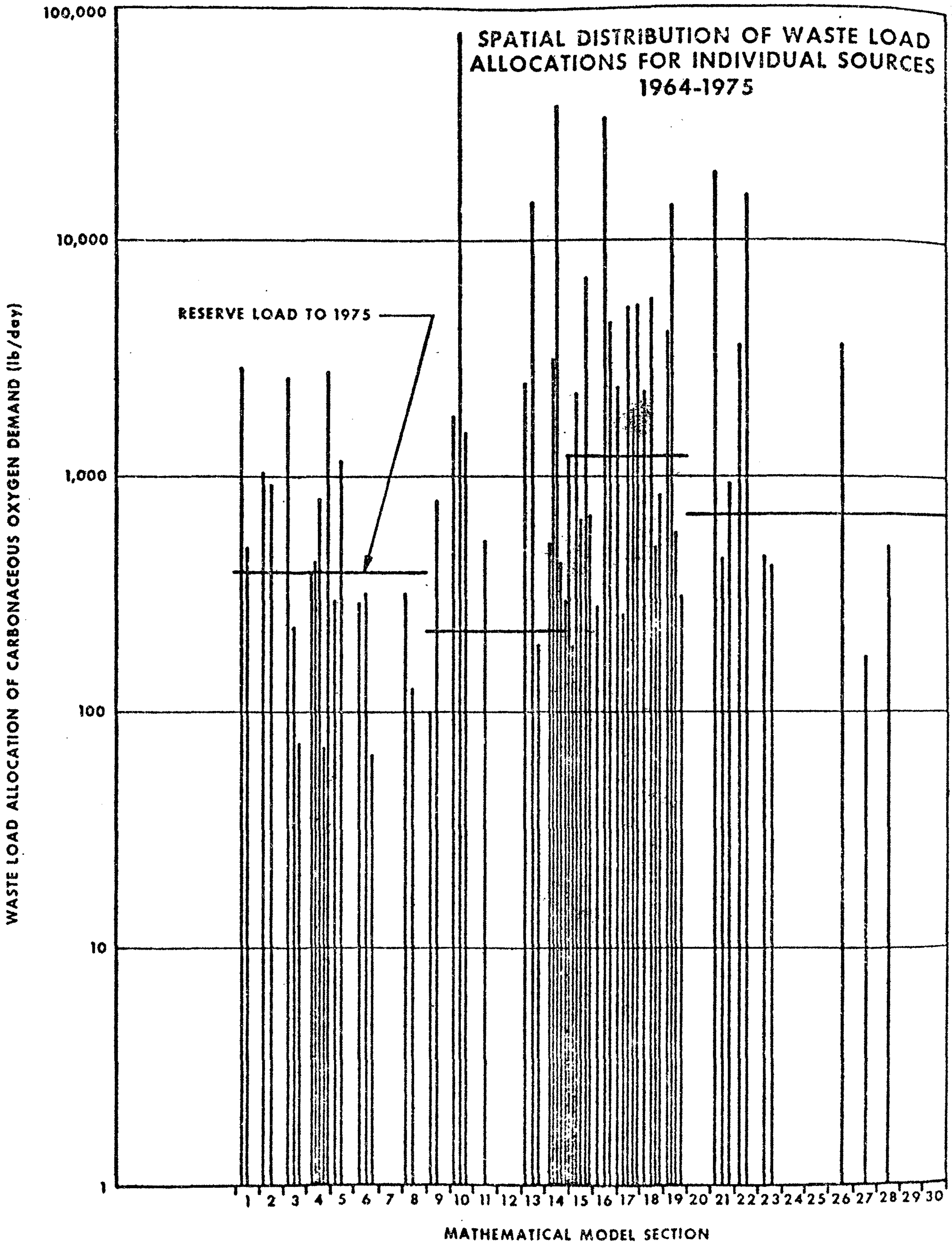
A-Zone and B-Zone configuration used for evaluation of alternative programs.

ZONE WASTE LOAD ALLOCATIONS





WASTE LOAD BEFORE TREATMENT
FOR MUNICIPAL AND INDUSTRIAL WASTE SOURCES
DISCHARGING TO THE DELAWARE ESTUARY
CARBONACEOUS OXYGEN DEMAND (MILLION lb/day)
3
2
1
0
ZONE 2
ZONE 3
ZONE 4
ZONE 1
1960
1970
1980
1990
2000
2010
YEAR



SPATIAL DISTRIBUTION OF WASTE LOAD ALLOCATIONS FOR INDIVIDUAL SOURCES 1964-1975
RESERVE LOAD TO 1975
WASTE LOAD ALLOCATION OF CARBONACEOUS OXYGEN DEMAND (lb/day)
100,000
10,000
1,000
100
10
1
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
MATHEMATICAL MODEL SECTION

RECYCLING OF WASTE -- A FACTOR IN ENVIRONMENTAL PROTECTION

by

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The City College
City University of New York

In the past few years much publicity has been generated regarding the deterioration of the environment, and the term "ecology" has become a household word. When action groups sprouted, a highly motivated younger generation predominated in them. They had found a cause for which to fight - a cause in which every thinking, responsible individual truly has something in common.

This reached culmination in such events as "Earth Day" and "Environmental Teach-Ins" during 1969 and early 1970. Publicity was most widespread. I, for one, as a resource-conservation geographer, was quite encouraged by all this concern. It was truly heartwarming. Yet today, approximately one year later, much of this enthusiasm appears to have died away, and many of the action groups have either disbanded or become inactive. Only a greatly reduced number are still on the scene. They represent the more dedicated ones. Along with them we find that the leadership has been assumed by some of the older conservation organizations (such as the Sierra Club, The Wildernew Society, etc.), and a number of action groups of more mature individuals. These serve as pressure groups which support or sponsor corrective measures, which they expect to come about in due course, rather than instantly, as the impatient younger groups insist. In the light of this waning interest, it would appear that all this display of concern was, to a large extent, a fad among our young people: an instrument with which to give vent to pent-up emotions.

Yet the problems about which they exhibited so much emotion and vehemence are still with us, and still cry for solutions. One broad set of these problems to which I wish to address myself today has received comparatively little attention, but is of paramount importance in the areas of resource conservation, environmental protection, and the protection of the ecological balance of Nature. This is the matter of what to do with our waste. So far as the more developed countries are concerned, this is virtually a universal problem. As our technology grows and our population expands, the problems related to this situation have mushroomed amazingly.

Up to fairly recently wastes of all sorts have been regarded as an abomination which had to be destroyed or hidden, the faster the better, and the more completely the better. Yet among the ancients, and even today among the less technologized cultures, waste never went to waste. There generally was some use for it.

The bible has an expression which says in effect, "from dust through art, to dust returneth". This is a perfect expression describing the recycling of waste. All organic matter is derived from the soil, and should be returned to the soil when it has served its purpose in life. As a matter of fact, most materials, inorganic as well as organic can be recycled, and have some utility in some manner. Hence I must insist that all waste be regarded as a resource. Garbage, for instance, is not something that must be destroyed or buried, but is a resource just as much as iron ore is. This is a material that has further utility. From it desirable economic products can be produced. These are products essential to the replenishment and revitalization of the soil. Chemical fertilizers alone cannot accomplish this, no matter what that industry's propaganda tells you. Waste has vast economic as well as social potentialities. It is not just plain dirt. To dump or bury refuse or waste, or to incinerate it, not only wastes valuable resources, but these are the very "solutions" which contribute so heavily to pollution of our air and water, and to the marring of the environment, and the destruction of the local ecological conditions of an environment. The only true solution lies in recycling of all wastes insofar as is physically possible.

I shall not try to discuss all possible aspects of the situation, but I should like to mention some of the more important ones. Disposal of garbage has become a very serious problem. While this dilemma is greatest in the urban areas and the more populous suburbs, it also exists to some extent in some rural areas as well. In this refuse there is commonly much which has salvage value. Included among these materials would be paper, rags or discarded clothing, glass, rubber, and a variety of metallic objects. In the past year more salvage action has become apparent as a direct result of the environmental action interest. Yet, economics limits this activity. Unless a profit can be derived from this salvage, private initiative is not interested. And no one should condemn them for it. They are entitled to a decent return on any investment or outlay of funds. In the interest of the long-range benefits which will accrue in due time, government subsidies must be made available until such a time as these activities may become self-supporting.

Waste, or refuse comes in a number of forms. Let's consider first the so-called "clean wastes" - in other words not including household or kitchen garbage and the like. Foremost in this category would be excavation debris and demolition debris. This is the only type of refuse which truly merits consideration for land-fill purposes, provided the right sites are chosen for such disposal. Coastal marsh lands or other wet lands which have unique biotic associations are not such places.

Once all salvageable materials are removed, garbage, as well as sewage sludge, are recycled through composting: a process wherein the organic matter is broken down to humus as an end product. In the composting process fermentation occurs, generating enough heat over a long period of time to destroy pathogens and weed seeds.

Compost has many valuable attributes. Firstly, it is an excellent soil dressing or amendment, which helps to maintain the viability of the soil. In addition to providing humus, it is also an excellent source of assimilable mineral nutrients and a most valuable source of trace elements. After all, the plants and the animal matter from which the compost was made did contain mineral matter, which remains in the compost in a form far more desirable than quickly soluble chemical fertilizers. Humus (compost) greatly improves the water-holding capacity of soils. This is a particular boon for sandy soils, which tend to become droughty rather rapidly during dry spells. Moreover, compost tends to improve the tilth of clayey soils by improving the structure, and thus making it easier for deep roots to penetrate, and for the soil to drain more freely.

What is more, compost makes the soil less susceptible to leaching out of nutrients by percolating waters. Thus it tends to improve the fertility and makes necessary lesser quantities of chemical fertilizers. Conservationwise this is important. Chemical fertilizers are derived from bedrock deposits, which are subject to depletion, as are all geological resources.

One more point: humus-rich soils are far less subject to erosion, especially on slopes. It has been amply demonstrated in this country, in England, and in the Netherlands that large applications of chemical fertilizers, without any added humus, results in loss of soil structure, which is so vital to its tilth, and is followed by increasing susceptibility to erosion. Soils which are cropped continually tend to lose their humus unless it is replenished regularly. Compost is an excellent source of such humus.

As previously indicated, refuse disposal problems are not restricted only to urban and suburban areas. For example, chicken farms, which frequently have little land acreage associated with their enterprises, often have difficulty disposing of their manure. Likewise, in a number of parts of the country there are dairy farmers with very limited areas of land. Their stock is kept penned up in barns at all times (the cows never see daylight). All feed and forage are purchased. Feeding and milking times follow rigid schedules. These situations exist especially in a number of areas in California near large suburban communities. Here, too, manure disposal becomes a problem since outdoor storage is objectionable to the community. The answer lies in composting, and the nearby homeowners are customers for the compost. Because cattle manure commonly contains much straw or sawdust bedding, it poses no problem in composting. However, because poultry manure has too high a nitrogen content, it may be necessary to mix it with sawdust, which also sometimes presents a disposal problem, in order to create an appropriate carbon-nitrogen ratio. Where sawdust is unavailable, shredded paper serves the same purpose.

In poultry processing plants, the feathers have often been a problem. The use of chicken feathers as a substitute for duck or goose feathers in cheap bedding and pillows was at one time a small source of revenue for feather processors. But with the advent of foam rubber and other types of plastic filling material, this market has waned considerably in recent years. However, processed and pelleted chicken feathers are now being fed back to poultry as a high-protein concentrate. Also, recent experimentation has indicated that chicken-feather protein will be eaten by cattle, too. Feathers are also being investigated as a source of plastics.

Speaking of plastics, these are, on the whole, nonbiodegradable. They constitute a problem in composting. The filmy types of plastic have been particularly troublesome. It has been difficult to separate out from garbage, and hence much of it has generally gone through the composting process without breaking down. Compost users have often complained of the process of being developed to separate out this material by mechanical means. Scrap plastic of this type, experiments have shown, can be melted down and molded into new items having consumer value. This is possible even with mixed types of plastics.

Heavy wooden items that cannot be decomposed in the course of rapid, short-time composting operations, can either be incinerated and the ashes added to the compost, or more appropriately, be ground down to wood chips, which would degrade rapidly in the composting process. In the wood-using industries an increasing amount of wood waste is now being utilized for a variety of purposes. For instance, sawdust is now being molded into fire-place logs with the use of a suitable binder. Much sawdust is being converted to charcoal briquettes for use in grills and braziers. Some large-scale conifer sawdust producers find a market for their product in the paper mills. Still others make use of at least some of their sawdust in furnaces to supply heat, steam, and power. Much scrap wood today is being sent to the paper mills or charcoal makers, depending on what kind of wood it happens to be. Wood bark, which once was burned, or more usually dumped into streams and lakes, creating havoc with the ecology and polluting the water, is now being used, to a large extent for making insulation board. When wood chips and sawdust are converted to charcoal, the wood undergoes destructive distillation, and in the process many valuable chemical products are derived as by-products. Included among these are wood alcohol, acetic acid, acetone, and wood tars.

Sewage effluent need not be wasted either. Appropriately treated, it can be used for irrigation purposes, and it is already being thusly used in many parts of the world. Chicago is now running a pilot project, whereby it is sending much of its treated effluent and sludge, in the form of a slurry, to farms up to something like 100 miles to the south, where it is being sprayed on lands of cooperating farmers whose soils are rather on the poor side. Many canneries are now doing the same thing. Results so far have been most gratifying. Not only is farm land being irrigated in this manner (and enriched as well), but woodlands, too, are having sewage and cannery slurries applied with resulting acceleration of tree growth, as well as improved health of the stands. Let us also keep in mind that sooner or later it is going to be imperative to re-use sewage water for domestic purposes. In fact, much research along these lines is already well advanced. Water derived from purified sewage effluent is already being used in swimming pools in several places along the Pacific coast.

The need for recycling or re-use of all possible resources is a must if we think beyond our present generation. The conservation way of life must consider the future generations, which must be left an adequate supply of resources, too. By recycling, we cut down on the use of primary sources of resources and make fuller use of what has already been extracted from the ground, the forests, or the fields. Hence recycling must become a way of life, not only for the sake of the resources themselves, but also for the health of the environment and its inhabitants. It would help to minimize the trend toward ecologic destruction, and even perhaps preserve of little bit of wild, pristine space for posterity to enjoy. Above all, let us not adopt the attitude that technology can solve all of our problems. Technology has its limitations, one being that it uses up resources in "solving" our problems. Let me point out that aside from sheer numbers, it is technology which is responsible for so many of our problems that we hope to rectify through recycling. If anything, technology must be put to work to help make recycling more efficient and more complete.

Please remember that what I am speaking about transcends immediate economic situations. If we think only in terms of what is simply good economy today, we may be running counter to the long-range good of Nature and adversely affect our future generations.

LANGUAGE BOUNDARIES IN CENTRAL INDIA: AN INVESTIGATION OF THEIR FORM

by

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Introduction

In many societies, a person's language is often the variable by which he defines his "ethnicity."(1) Indeed, this ethnic identification may supercede national, regional or other levels of identification. Thus, where languages are in contact, diverse ethnic groups may be in contact, and the spatial distribution of languages should be indicative of the nature of the interaction between the groups in question.

In this paper, preliminary results of an analysis of the spatial form of contact areas, conceived of as "language boundaries," between several language groups in central India, and the research techniques used in the investigation, are presented. The principal objective is to present (graphically) the nature of language contact in concise quantitative terms so that variations or consistencies in the intensity of contact between language groups, and in the duration of their contact over space may be clearly seen and compared. The second objective is to measure and illustrate graphically the degree to which people in the boundary zone may actually be in contact, by means of an analysis of spatial segregation. A third objective, which will be noted only briefly in the paper, is to determine how closely the language boundaries correspond to political boundaries which are supposedly based on language.

Although the research described here is primarily concerned with the patterns of language contact, these cannot be separated from underlying processes which work to create them. For this reason, tentative explanatory factors will be suggested where applicable, but these are not pursued.

The Choice of the Study Area

Three considerations encouraged the choice of south-central India as a focus for this study. First, it is an area of known language contact. The 'divide' between the indo-European and Dravidian speaking peoples has evolved without forced displacement of peoples, and exhibits significantly different languages. Second, the <u>Census of India</u> provides language figures at several political levels, including villages in areas of language contact, so that a reasonably reliable source of data exists.[2] Third, linguistic autonomy has been an important political and social consideration in many parts of India since independence. Indeed, after the <u>Report of the States Reorganization Commission</u>[3] in 1955 the political boundaries in states in the study area were redrawn largely on the basis of language.

Analytical Procedures

In order to analyze the form of language boundaries in Central India, it was necessary to use a summary statistic which could be everywhere applied. An index of diversity was chosen because of its applicability in situations where varying numbers of languages existed. A diversity index is a probability statement of this nature: if a pair of individuals is randomly selected from a population, what is the chance that they will not exhibit the same characteristic? The most common index used by both linguists and sociologists is that developed by Greenberg[4] and modified by Lieberson.[5] The formula is

$$D = 1 - \sum_{i=1}^{n} x_i^2$$

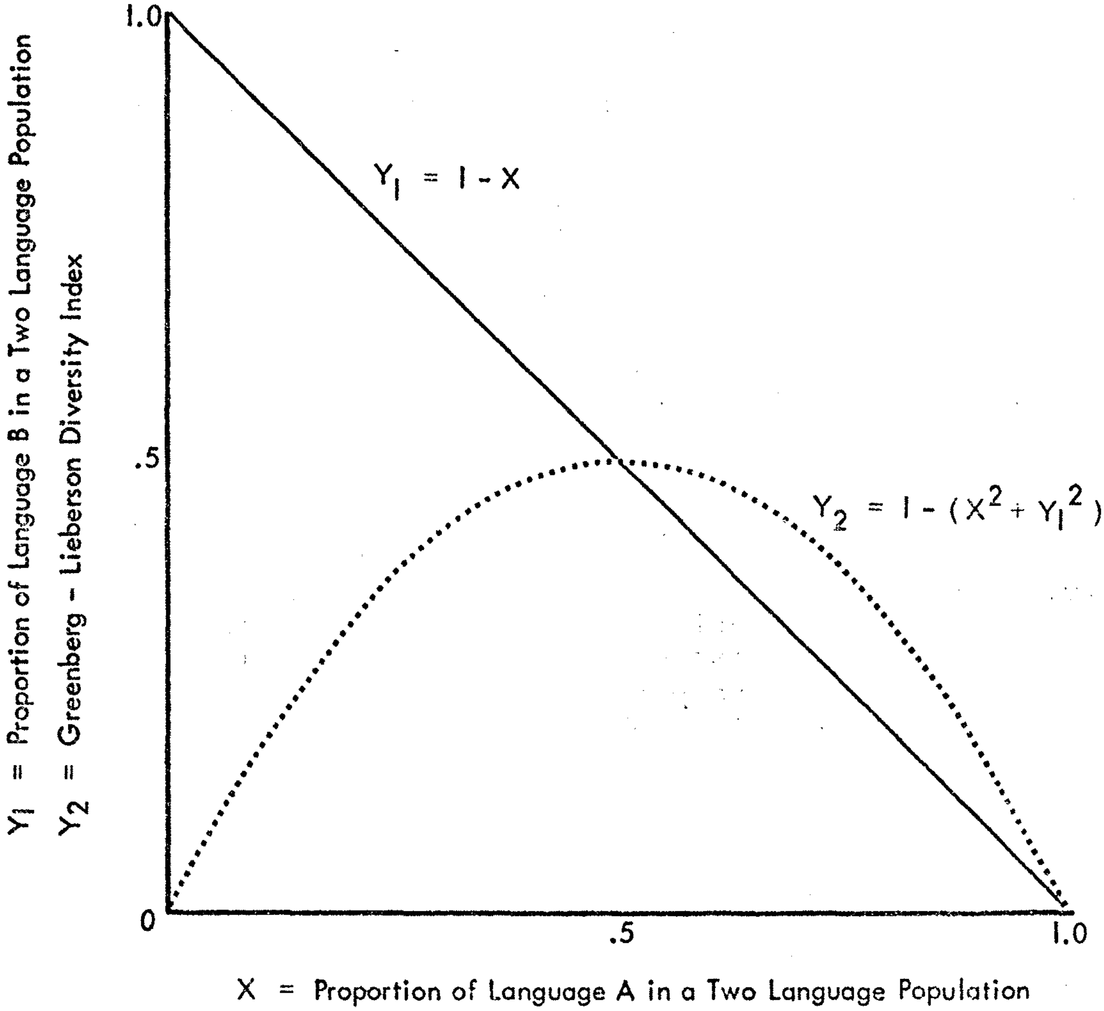
where each x_i represents the proportion of the total population which a subgroup represents. The basic assumption behind the use of this measure is that any population, measured on any characteristic, will be located on a continuum ranging from complete homogeneity (D = 0.0), when all members are the same, to complete diversity (D = 1.0) when no two members are alike. To illustrate these concepts, Figure 1 shows the proportions of two subgroups in a population by a diagonal line, and the corresponding diversity values. The Y_2 axis may also be considered the continuum of possible diversity. In the case of two groups, evenly divided, maximum diversity is 0.5. However, with three groups, evenly divided, maximum diversity would increase to 0.66. This increase continues until, theoretically, each person in an infinite population is different from all others, when D would equal 1.0.

The index of spatial segregation used in this study, "G'", is based on the "G" measure of spatial segregation which is calculated by the following formula:

$$G = \sum_{i=1}^{n} \frac{x_i}{t_i} \quad \frac{X}{T}$$

when $\frac{x_i}{t_i} > \frac{X}{T}$. x_i is the population of group X in the i^{th} cell in a region, and t_i is the total population of the i^{th}

FIGURE 1



1.0
.5
0
.5
1.0
$Y_1 = 1 - X$
$Y_2 = 1 - (X^2 + Y_1^2)$
Y_1 = Proportion of Language B in a Two Language Population
Y_2 = Greenberg - Lieberson Diversity Index
X = Proportion of Language A in a Two Language Population

cell, and $\frac{X}{T}$ is the proportion of group X in the total population, T, of the region. A characteristic of "G" is that its maximum value cannot exceed $1 - \frac{X}{T}$, although theoretically it may range from 0.0 when the subgroup is evenly mixed in the population to 1.0 when the subgroup is concentrated in one place. Because of this characteristic, "G" may be calculated. It is $G/(1 - \frac{X}{T})$, or the proportion of the maximum possible "G" which a calculated "G" represents.(6)

The Central Indian Setting

Figure 2 illustrates the study area, its location in India, and the gross distributions of five significant languages. Four of these, Oriya in Orissa State, Marathi in Maharashtra State, Telegu in Andhra Pradesh, and Kanarese in the far west of Andhra Pradesh and in parts of Maharashtra, are principal languages in India. The fifth language illustrated, Gondi, is a tribal tongue, but it is dominant in Bastar District of Madhya Pradesh and is, therefore, included. Additional tribal groups live in the study area, and their confounding influences on transition patterns will be noted below.

Linguistic Diversity

The east-west political boundary which separates Telegu-speaking Andhra Pradesh from the other states is the approximate 'divide' between Indo-European and Dravidian languages. The first step in discovering the form of the 'divide' was to calculate and map linguistic diversity for 147 <u>tahsils</u>.(7) The simplified results are presented in Figure 3. These show that diversity is generally higher along the state boundaries, although diverse areas are found in much of western Orissa and in Bastar District of Madhya Pradesh. The 'core' areas of linguistic homogeneity are seen most clearly in Andhra Pradesh, in the northern part of Orissa, and in northwestern Maharashtra. The diverse areas along the boundaries are a result of the mixing of major-language speakers and of tribals, while the diverse areas away from the state boundaries are largely due to the presence of many tribal groups in hilly, forested areas of the Deccan.

To further understand the nature of the boundary in different places, and to compare varying patterns of transition, several traverses were plotted, of which four (located on the map in Figure 2) are shown in Figures 4 and 5.

Traverse A, in both figures, illustrate the most regular

FIGURE 2

THE STUDY AREA IN CENTRAL INDIA

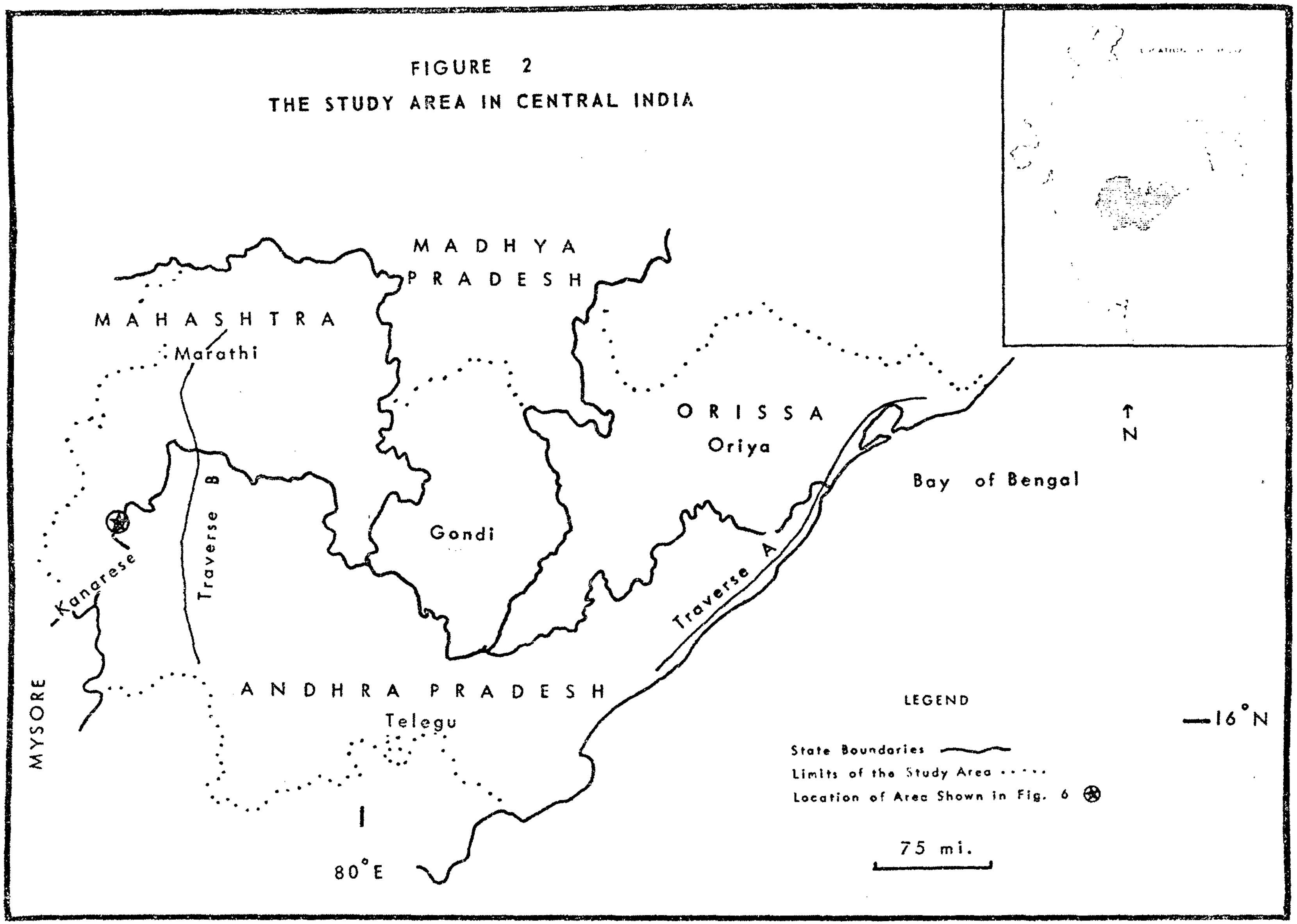
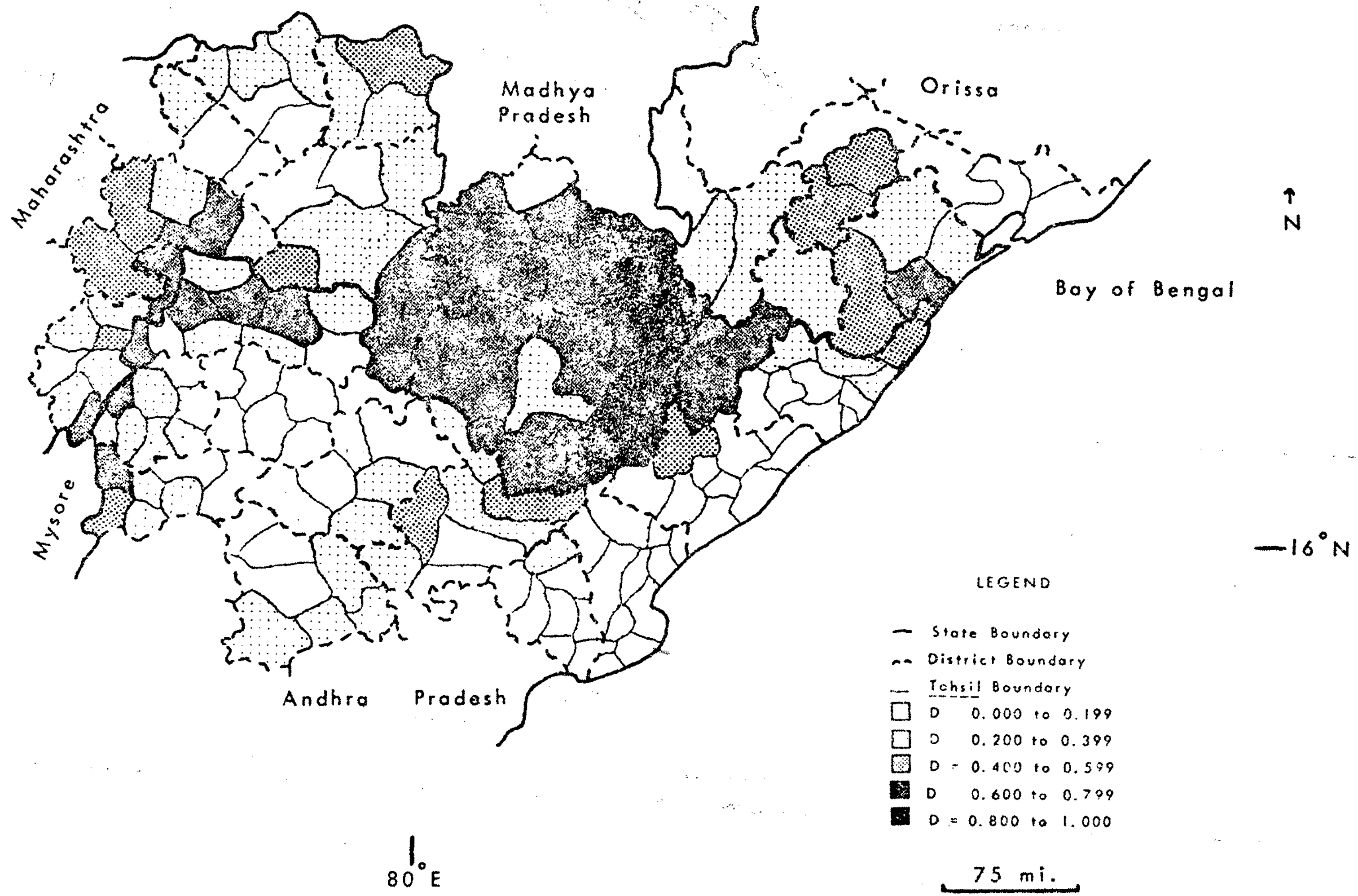


FIGURE 3

LINGUISTIC DIVERSITY



transition from one language group to another found along this boundary. The percentage speaking each major language decreases rapidly near the political boundary. The peak diversity in Orissa, to the north of the boundary, is partly due to the presence of a tribal group living in hills adjacent to the coastal plain. This suggests one of the disadvantages of including the tribal speakers in the diversity calculations. They do distort the relationship between the two major languages in question, yet they are a significant population in most of the boundary zone, and must be included in a discussion of it.

In Traverse B, Figure 5, the bimodal diversity curve is more characteristic of the transition patterns found along most of the boundary. In this area, a tribal group, the Gond, is found in the hills between two river valleys. To the north and south of the hills, the Telegu speakers are in the majority, although they give way rapidly to Marathi speakers to the north of the political boundary. Many of the other traverses exhibited similar patterns to those seen in this one. Many tribals live in the transition zones, acting as buffers between the two major groups and often occupying less desirable hill and forest land.

In order to obtain a more detailed impression of language distributions along the boundaries, the patterns on the village scale were examined.

Village Language Patterns

Village language data were only available for parts of the study area, and in Orissa State only a ten percent sample was recorded in the census so that figures for small villages are unreliable. Figure 6 is a map of several tahsils, located on Figure 2. Assignment of villages to language groups was done on the basis of simple majority, and the midpoints for traverses taken from the village maps was the line separating villages with different languages in the majority. These traverses are of equal length on each side of the midpoint so that comparisons can be made at different distances along different traverses. They are each six miles wide and at least fifty-one miles long, and each data point is the center of an eighteen-square-mile cell. (Villages were included in a cell if more than fifty percent of their area, or their symbol[8] fell in the cell.) Figure 7,A, illustrates the percentages of Marathi, Telegu and others along a traverse across the area shown in Figure 6, while Figure 7,B, shows diversity along the traverse. These graphs suggest that there is quite a smooth transition from one language to the other, with the exception of one data point where a large minority of "others", in this case Kanarese, offsets the pattern.

Also in Figure 7,B, the "G'" values for the Telegu

FIGURE 4 (A)

PERCENT SPEAKING EACH LANGUAGE

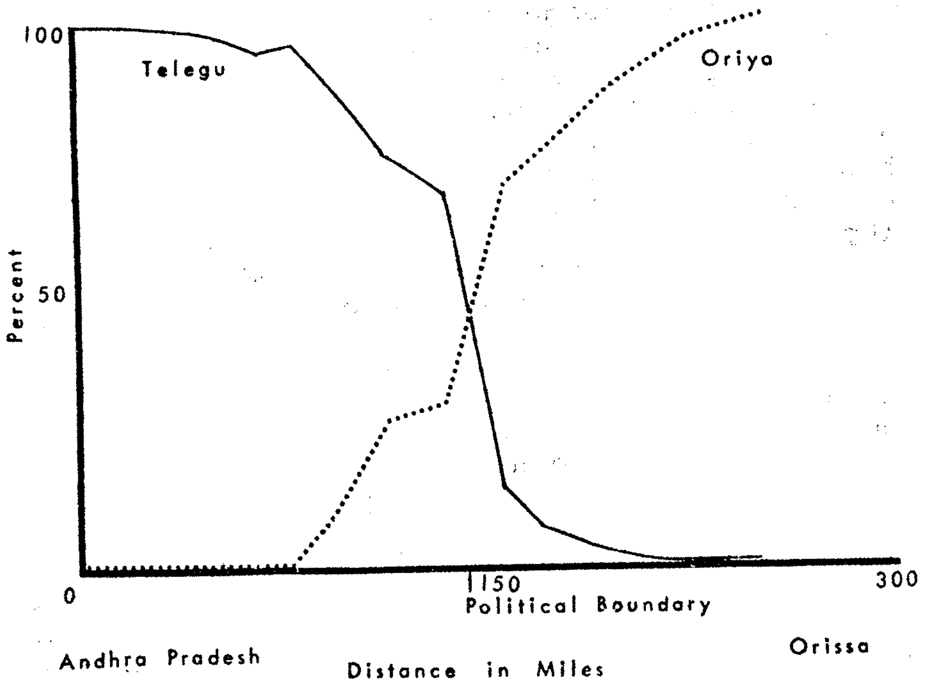


FIGURE 4 (B)

PERCENT SPEAKING EACH LANGUAGE

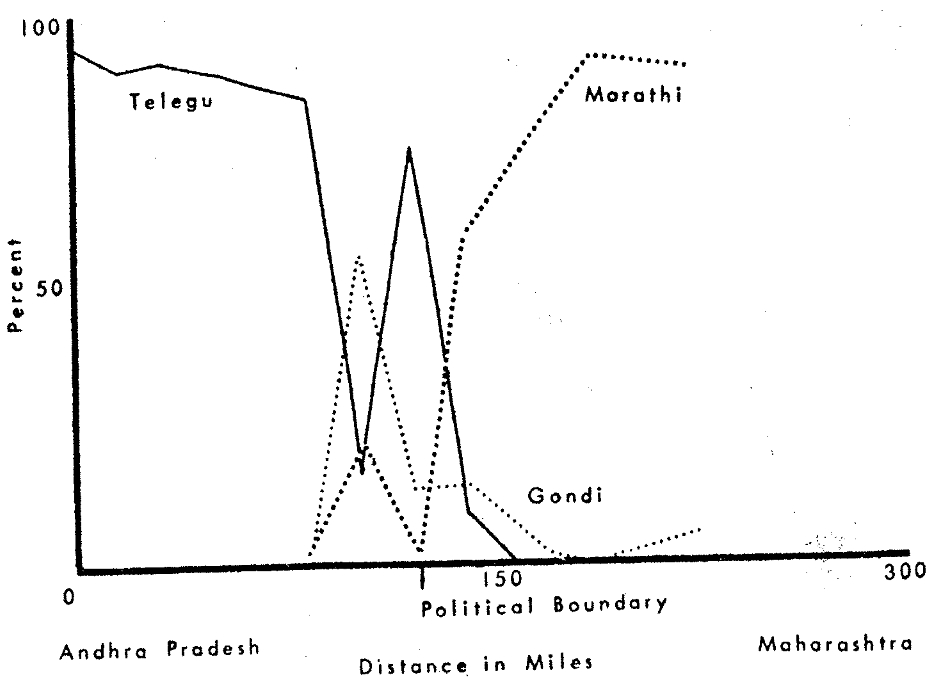


FIGURE 5 (A)
LINGUISTIC DIVERSITY

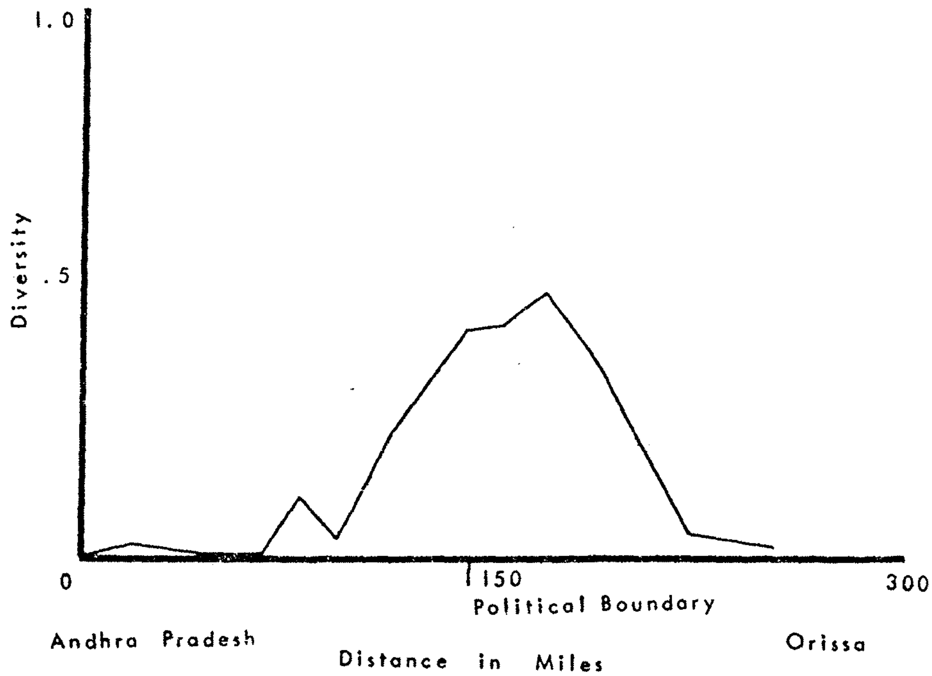


FIGURE 5 (B)
LINGUISTIC DIVERSITY

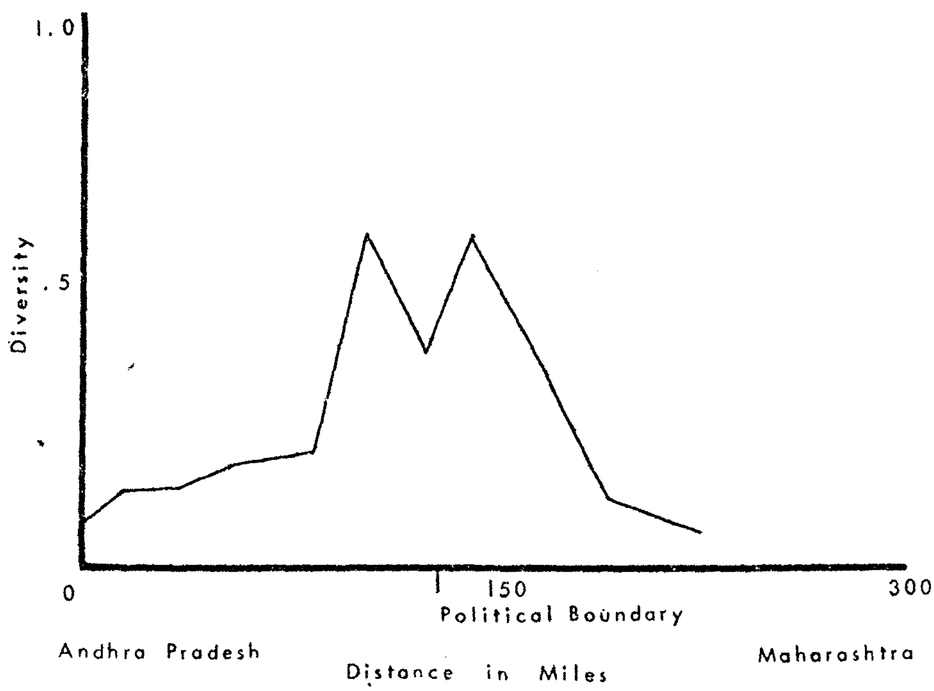


FIGURE 6

VILLAGE LANGUAGE PATTERNS

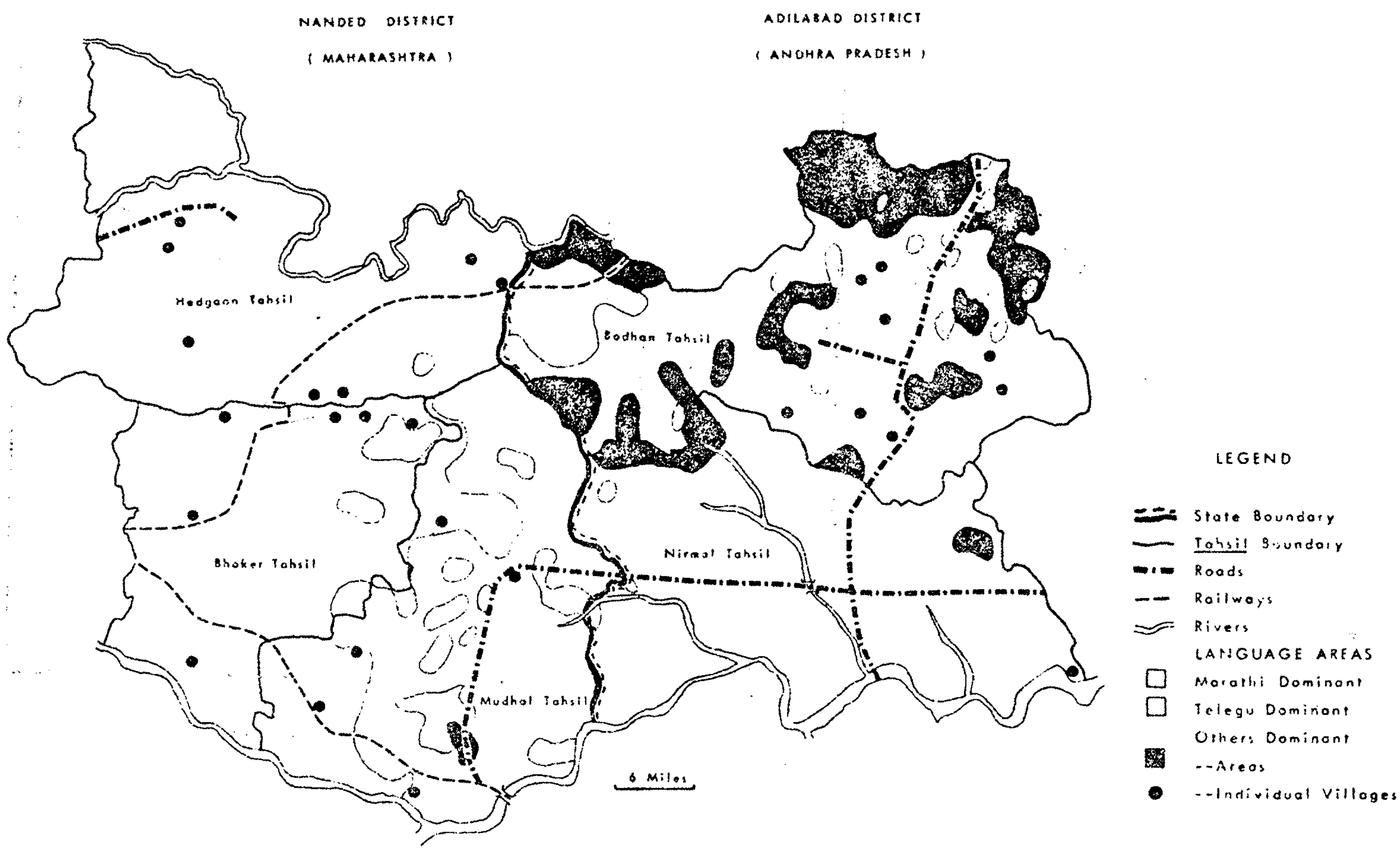


FIGURE 7 (A)

PERCENT SPEAKING EACH LANGUAGE

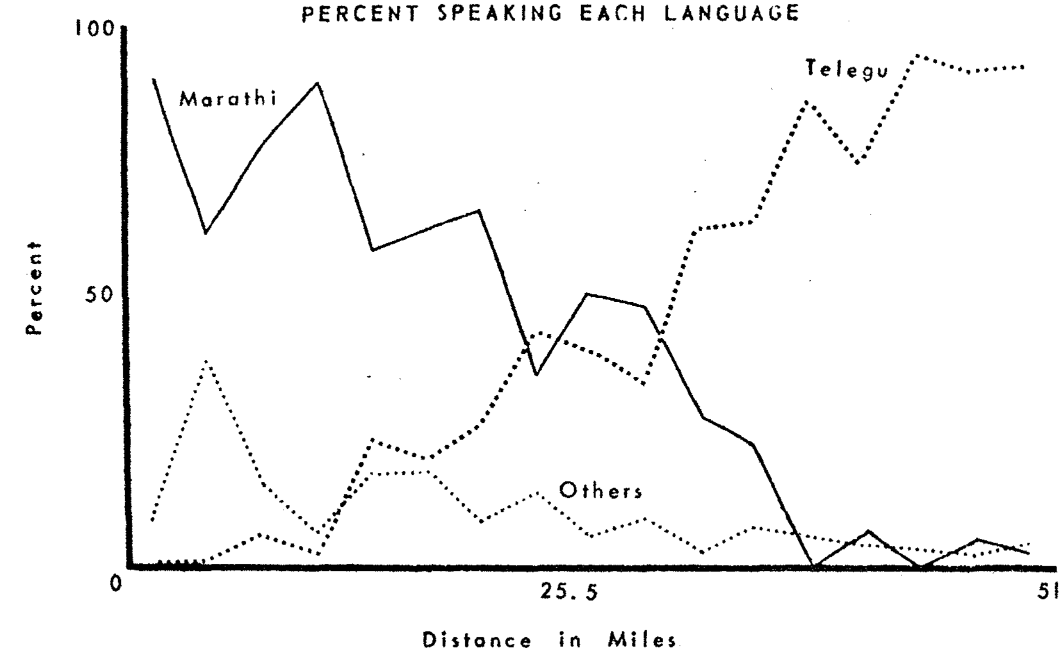
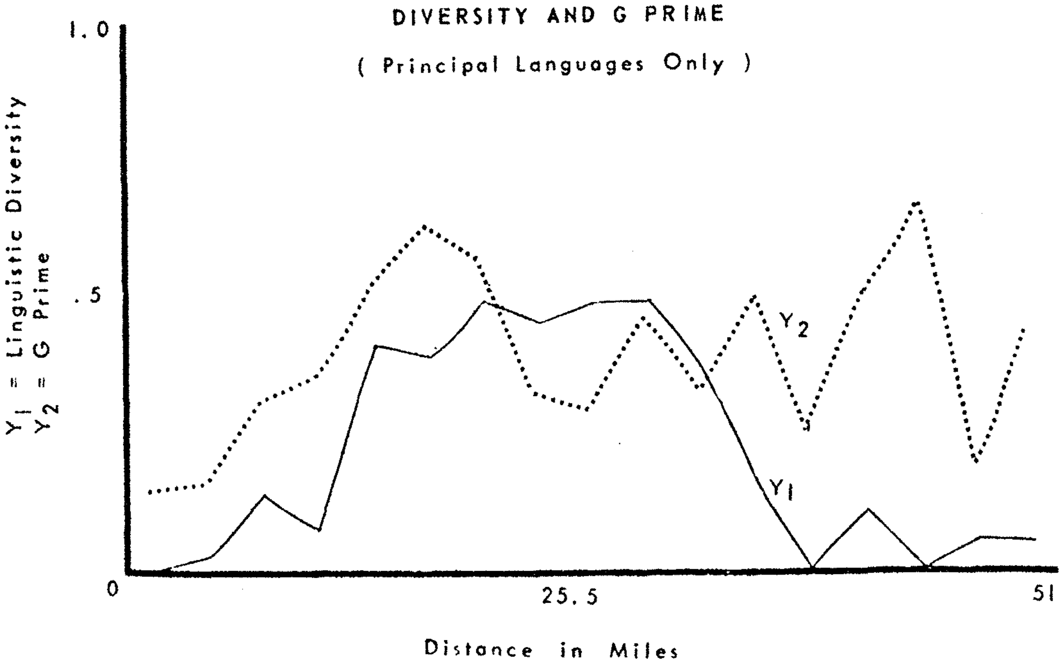


FIGURE 7 (B)

DIVERSITY AND G PRIME

(Principal Languages Only)



speakers and the Marathi speakers are shown. When compared with the diversity curve, the "G'" curve suggests (particularly in the western half) that segregation does increase as diversity increases, although the pattern is not consistant. Because only one traverse has been analysed at the time of this writing, it is too soon to propose any regularities. However, as more traverses are completed it should be possible to propose more concrete relationships between diversity and segregation in this part of India.

Although the preceding analytic and graphic techniques are the principle ones used in the main body of the research, several others which will help to summarize results must be mentioned. Correlation of traverses, for its descriptive value, will be used to compare traverses and to measure similarities and differences. In addition, a clustering algorithm may be used to group traverses, using diversity or segregation index values at different points along each traverse as variables. As a result of these procedures a morphology of language boundaries may emerge which can then be compared with studies from other areas, both in India and elsewhere. Also, it was suggested in the introduction that some kind of test of the relationship between the language boundaries and political boundaries would be valuable. Discriminant analysis[9] is a technique which can be used to achieve this end. It may be employed to assign a marginal observation (a village, or a cell along a traverse) to one group or another on the basis of $\underline{n}$ variables (language, for example). Although not described here, discriminant analysis is an efficient statistical means for allocation of villages to one language group (or state) or another.

Conclusions

There has been much emphasis on methodology in this paper, but the value of the methodology is only measurable in relation to the results in can produce. In the work outlined here, relatively simple statistical procedures yield concise impressions of complex spatial patterns, although only a few examples could be presented. Variations in the spatial duration and intensity of contact between groups emerges in comparable cartographic and graphic terms. Added to these is a measure of human response to this contact, in the form of segregation.

While such mathematical results cannot be interpreted as wholly representitive of human patterns, they do provide a valuable basis for formulation of hypotheses about human patterns of and response to contact with other, different, people. For example, questions concerning the distance over which a transition occurs may be tentatively answered in precise terms. In addition, comparison of diversity and segregation with economic, physical and other variables may procede in a systemmatic manner. While the ultimate human patterns may only be discovered in the field, the course of inquiry and analysis presented in this paper is an efficient first step in their discovery, and is particularily important because it may be applied to many kinds of social and cultural phenomena which are studied in a spatial context.

FOOTNOTES

1. This is Joseph Greenberg's use of the term, meaning "group identity." Greenberg, Joseph, H., "Urbanism, Migration, and Language," in Cohen, Yehudi, ed., Man in Adaptation, The Biosocial Background, Aldine Publishing Company, Chicago, 1968, p. 265.

2. India. Registrar General. Census of India, 1955 and 1961. Various volumes.

3. Government of India, Report of the States Reorganization Commission, Gov't. of India Press, New Delhi, 1955.

4. Greenberg, Joseph H., "The Measurement of Linguistic Diversity," XXXII (Jan.-Mar. 1956), pp. 109-115.

5. Lieberson, Stanley, "An Extension of Greenberg's Measures of Linguistic Diversity," Language, XL (Oct.-Dec. 1964), pp. 526-531.

6. I am indebted to Prof. David Sopher for his discussions of these indexes in a seminar at Syracuse University. Additional discussions of these measures may be found in Duncan, Otis D. and Duncan, Beverly, "A Methodological Analysis of Segregation Indexes," American Sociological Review, 20, (April, 1955), pp. 210-217, and in Lieberson, Stanley, "Measuring Population Diversity," American Sociological Review, 34:6 (Dec., 1969), pp. 850-862.

7. A tahsil is an administrative subunit smaller than a district. Tahsils are also called taluks.

8. For some districts, census maps showed village boundaries, while for others, villages were represented on the maps by dots.

9. The most recent discussion of discriminant analysis is in King, Leslie J., "Discriminant Analysis: A Review of Recent Theoretical Contributions and Applications," Economic Geography, 46:2 (Supplement, June, 1970), pp. 367-378.

ENVIRONMENTAL CONSERVATION IN WESTERN EUROPE: STATUS AND IMPLICATIONS

by

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The conservation idea is old stuff in Europe. Concern over environmental conservation problems and development of politics to deal with them have, in fact, a much longer history in Europe than in the United States. With a population density more than four times that of the U.S. and a centuries-old high resource consumption pattern, crowded Europe had long ago to turn its attention to resource management, pollution control and other important ecological issues. London is reported to have been concerned in the year 1285 by a smog problem induced by the burning of soft coal.(1) Many of the major contemporary conservation practices were developed by Europeans. Sweden pioneered in forest resource management and sustained-yield forestry. Norway, despite, or perhaps because of, its dependence on fishing, has been a leader in fish-catch limitation agreements and the prime mover in international efforts to save the whale. The heavily industrialized Ruhr River Valley has had streams clean enough to swim in for more than half a century.

Nevertheless, a new impetus is discernible in Europe which is bouying the conservationist cause and spurring action programs on an unprecedented scale. Three factors are largely responsible: a record economic level which, as in North America, places ever greater demands on the environment; the influence of the conservation-awareness explosion in the United States; and massive publicity, especially of recent spectacular disasters such as the Torrey Canyon and the Rhine River fish kill, all of which has begun to mobilize public opinion.

Though there is little of the protest demonstrations or near-hysteria which has gripped America during the past year, a greater sense of urgency is apparent and has spawned a number of new directions in environmental conservation in Western Europe. Much closer attention is being given to industrial plant location and construction design. Indemnity payments are increasing to those especially hard hit by pollution's consequences. The OECD is preparing an accord, with strict penalties for offenders, setting international tolerance limits for many major pollutants.

It is instructive to watch closely these growing efforts toward stemming environmental deterioration in Western Europe as a part of a world policy which should aim at forging serious international cooperation in conservation. Many of the answers and palliatives with which Europeans are grappling have relevance to the United States and to the not-too-distant environmental problems the developing countries will face. A few examples of recent developments which illustrate the new European concern with the "ecological crisis" follow.

As in the United States, environmentally oriented research and development are being pushed. The West Germans have nearly operational a new deep-freeze scrap salvage process which will help eliminate auto graveyards. Dutch experiments off the Hook of Holland with a treated sand spray technique to dissipate large oil spills hold out promise. Pollution is now a major issue throughout Western Europe. Italian experts are urging the government to undertake a massive 20 billion dollar pollution fight in the most radical terms. The Swedes, alarmed at the degardation of their lakes and rivers - not to mention the Baltic, which is now said to have large areas around Gotland which are lifeless - are tightening anti-pollution laws. Even Norway has had to recognize the serious effects which effluents from her giant electrometallurgical industries are having on heretofore pristine fiords. Public revolt against air and water pollution has led the West German government to intensify greatly efforts to clean up the Rhine and to attack other industrial and municipal waste problems. The North Rhineland - Westphalian state parliament adopted what is thought to be Europe's strictest smoke-control legislation last February. The French have readied a tough new water pollution control law. London has tightened enforcement of newly strengthened air pollution regulations.

Short recreational space and increasing affluence and leisure time have focused attention, as in North America, on another conservation problem area. West Germany, with a national average density of 610 people per square mile, has been pressing to open up choice private forest and lakefront holdings to free public access. In a number of cases state governments are setting aside much larger sums to purchase recreational grounds. Norway has just created her first four national parks, with inexpensive lodges for nature lovers. The spoliation of coastal areas, prime targets for increasingly popular second homes (increasing at the rate of 10,000 a year in Denmark alone), is a matter of particular concern.

On a regional and continent-wide level many new initiatives have been taken recently. At the prodding of Malta, a Seabed Committee under the U.N. was set up in 1968, culminating in the recent (June, 1970) Pacem in Maribus Convocation on that island. An International Mediterranean Sea Research Program, under UNESCO, is now being set up to focus in large part on the alarmingly increasing problems of pollution control in the mediterranean.[2] The Council of Europe has endorsed a voluntary program for the stricter control of pesticides, fifteen member nations subscribing. The Council has also proclaimed 1970 as European Conservation Year, declaring at its 17-nation conference in Strasbourg in February that attention to better environmental and resource management was immediately necessary. Its Declaration, a sort of environmental platform, offers a sound program. Its three principal points underline the urgent tone:

> 1. Rational use and management of the environment must have higher priority in national governmental policy, with adequate financing. Clear ministerial authority must be established.
>
> 2. Policies must be set up and strengthened to control pollution of air, water and soil. Internationally agreed standards must be established as soon as possible.
>
> 3. Environmental quality legislation and regulations must be harmonized at a European, i.e., multinational, level.

It is this final point which is especially important: attack at a European level. It seems to this observer that herein lies, at one and the same time, the kernel of both a uniquely European problem -- perhaps we can even say the uniquely European problem -- and a uniquely European opportunity vis-a-vis conservation of the environment.

In some ways, the problems of environmental quality are more severe in Europe than anywhere else. The fact that salvation, not to mention improvement, of our environment is a collective concern of all mankind could not be more obvious. Furthermore, the concept of the composite environment -- the interdependence and unity of all the resources we catalog under "natural environment" -- is absolutely fundamental to a rational approach to conservation problems. To tamper with one of these resources -- whether it be climate, soils, rock materials and structure, water, topography, flora or fauna -- produces a modification, more or less, in all. These basic axioms of the conservationist are as true for the Earth as a whole as they are for any specific region. We all share the finite supply of earth resources.

Nowhere is this global interdependence more obvious nor are the attendant problems more acute than in crowded Europe. The "crowded continent" must support 460,000,000 people (excluding the Soviet Union), or 13% of the world total, on less than

standard for greater worldwide unity in the common fight to head off ecological suicide. Europe has a great opportunity to lead humanity toward a one-world approach which we all recognize is so badly needed, yet continues to be so frustratingly elusive.

FOOTNOTES

1 Lynn White, Jr., "The Historical Roots of Our Ecological Crisis," in The Subversive Science: Essays Toward an Ecology of Man (p. 341-350), ed. Paul Shepard and Daniel McKinley. Boston: Houghton Mifflin Co., 1969, p. 343

2 Saturday Review, September 5, 1970, p. 55

3 Newsweek, August 17, 1970, p. 51

CONTRASTS IN THE INTERNATIONAL COMMODITY TRADE OF ISRAEL AND LEBANON: 1953, 1960 AND 1967

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INTRODUCTION

Problem Definition and Temporal Constraints The changes in the international trading patterns of the developing countries that are either unable or unwilling to cooperate in formal regional economic schemes form the basis for this study. More specifically, have developing countries excluded from regional economic integration experienced the same trends in commodity trade specialization that are characteristic of nations with union membership?

The period between 1953 and 1967 is chosen as appropriate for conducting the investigation. The year 1953 is regarded as the first normal trade year following the close of the Korean War[(1)] and the period 1967 is selected because it is the latest year for which complete international trade data are available. The year 1960 is used to divide the 1953-1967 period into pre-union and post-union periods. This distinction is based on the consideration that, while economic union in western Europe was formulated in the late fifties, it was not until the early sixties that the unions became effective.

The Testing Space There are a number of characteristics associated with Israel and Lebanon which establish them as suitable for the proposed analysis. First, the status of international trade and agreements is of the utmost importance to both countries if they are to realize their plans for economic growth and development. For example, the Israeli Economic Planning Authority stated in their 1968 evaluation of foreign relations that Israel must increase her exports to pay for her large requirements of raw materials and investment goods and that she needs trade to enlarge her effective market area and permit greater specialization.[(2)] It is expected, therefore, that many of the trading characteristics of the two countries will be similar reflecting their comparable stages of development.[(3)] and the limitations of their resource bases.

Second, both countries share a similar location within the Middle East and both have been reluctant to engage in strong economic alliances with neighboring countries. Because

Israel's neighboring Arab markets are closed to her, she is forced to conduct most of her trade with western Europe and North America. Lebanon, while expressing support of free inter-Arab trade and the free movement of capital and labor, has avoided strong regional ties that might necessitate substantial alterations in her economy for the sake of regional growth. Consequently, she conducts a large proportion of her trade with West Germany, France, the United Kingdom, Italy, and the Soviet Union. As a result of their relative locations and their aloofness from regional cooperation, both countries are encountering increased marketing and supply costs and both are increasingly susceptible to economic changes in European unions.

Third, both Israel and Lebanon have had trading ties with most of the European countries prior to European integration. Both countries, therefore, are in somewhat similar positions for evaluating the effects of formal union on developing countries outside the integration scheme.

Measuring Trade Specialization and Diversification
Trade specialization refers in this paper to the extent a country concentrates its exports and imports among the ten one-digit SITC classes (industry level trade) and among the fifty-one classes of the finer two-digit level (intra-industry trade). Using a modification of the Gini coefficient,(4) measures of deviation from a mean which represents theoretically absolute diversification are computed for each country's export and import trade at the industry and intra-industry levels for 1953, 1960, and 1967.(5) These deviation units indicate the extent to which a country's trade distribution among the SITC categories differs from absolute diversification, that is, an equal division of the total value among all SITC categories at either the one-, or two-digit level. The greater the deviation unit the closer the country approaches complete specialization where only one class of merchandise is exported or imported.

Expectations The expected changes in trade specialization for countries entering formal union membership are based on the empirical studies of the European Common Market (EEC) and the Nordek countries.(6) Both studies are useful in that the authors have analyzed the changes in specialization over a sufficient period of time to warrant an evaluation of the effects of economic integration.

It is expected that if Israel and Lebanon have experienced the same trends in commodity specialization that have characterized the EEC and Nordek countries between 1953 and 1967, that the following patterns will be manifested. First, the exports and imports of both countries will have diversified at an accelerating rate since 1960, particularly at the intra-industry level. This hypothesis, while supported by the empirical studies of the EEC and Nordek, is contrary to the traditional view which holds that agglomeration economies occurring after union lead to an emphasis on producing and exporting those goods for which comparative advantages are greatest. The range of goods exchanged after formation of the union is thereby reduced, although the total trade volume is increased.(7) In support of the findings of Balassa, Conkling and McConnell, it is noted that the increase in variety can be interpreted as an increase in intra-industry specialization and suggests that producers respond to rising competition within their bloc not so much by switching to wholly different lines of goods as by focusing more narrowly upon the manufacture of highly differentiated items within the same major industrial category. This form of specialization thus shows up statistically in the form of more diversified trade at the finer two-digit level.

Secondly, the country that was the most specialized prior to 1960 will have increased the diversification of its exports and imports more than the other. Thirdly, both countries will have relatively stable and similar commodity rankings prior to integration, but after 1960 will have become unstable and quite dissimilar. That is, the rankings of the export and import categories from the largest value to the smallest for each country will have undergone a variety of shifts following 1960 and each country's commodity ranking will have become increasingly at variance with the trade structure of the other's after 1960. This expectation, if confirmed, will be in accord with Nordek experiences but will differ from the occurrences recorded for the EEC by Balassa. He found that the export rankings of the EEC members became increasingly uniform at the intra-industry level.(8)

TRADE DIVERSIFICATION

Deviations from Absolute Diversification The units of deviation from absolute diversification at the industry and intra-industry levels are shown in Table 1 for the export and import trade of Israel, Lebanon, and the Nordek countries.(9) Several observations are noteworthy. First, the exports and imports of all six countries are more diversified at the industry level than at the intra-industry level, that is there is a much more even distribution of trade among the grosser categories.

Secondly, an inspectation of the elasticities of change(10) in the units of deviation from absolute diversification that are associated with the six countries (see Table 2) indicates that prior to 1960, only Israel followed the European trend toward increased diversification of exports. Lebanon became a more specialized exporter during this period. The elasticities also reveal that both Israel and Lebanon had greater rates of change toward increased diversification of imports during the pre-integration period than any of the Nordek countries.

A third observation is that there was an increase in the diversification of exports following integration at both the industry and intra-industry levels associated with all six countries except Israel. The exports of Israel became more specialized after 1960. Only Lebanon experienced the same general trend common to Nordek countries and Lebanon's relative increase toward complete diversification of exports was only exceeded by Denmark at the industry level and Norway at the intra-industry level.

At the industry and intra-industry levels the trends associated with the import trade of the two Middle East countries were similar to those of the Nordek countries. That is, following the 1960 period, both countries had minor increases in import diversification at the intra-industry level while both became more specialized in industry-level imports.

A final remark is made with regard to substantiating the hypothesis that the more specialized a country's trade prior to union the greater the change toward diversification following integration. An examination of the elasticities of change between 1953 and 1967 for Sweden, Finland, and Denmark (see Table 2) substantiates this assertion. This tendency is also applicable to Israel and Lebanon over the same period. In 1960 Lebanon's exports at the industry and intra-industry levels were more specialized than Israel's and Lebanon did experience the greater change toward increased export diversification between 1960 and 1967. The same positive association between the level of trade specialization and the direction of change toward increased diversification was also characteristic of the import trade for the two Middle East nations, although in 1960, Lebanon was more specialized at the industry level and Israel more specialized at the intra-industry leve. It is also of related interest to note that when either Israel or Lebanon did increase its trade diversification, the increase was greater for exports than imports.

<u>Actual vs Expected Deviations</u> An inspection of Table 3 indicates the extent to which the actual units of deviation from absolute diversification differ from an expected value computed on the basis of 1953 to 1960 trends. The theoretical Gini coefficients overestimate the export trade specialization of both Israel and Lebanon by predicting increases in trade specialization when in fact their export trade was more diversified.

TABLE 3

THEORETICAL AND ACTUAL COEFFICIENTS OF SPECIALIZATION FOR ISRAEL AND LEBANON, 1967

Industry Level Exports Predicted 1967	Industry Level Exports Actual 1967		Intra-Industry Level Exports Predicted 1967	Intra-Industry Level Exports Actual 1967
1.82	1.68	Israel	5.25	5.19
1.81	1.66	Lebanon	5.42	5.05
Industry Level Imports Predicted 1967	**Industry Level Imports Actual 1967**		**Intra-Industry Level Imports Predicted 1967**	**Intra-Industry Level Imports Actual 1967**
1.45	1.79	Israel	5.04	3.98
1.33	1.43	Lebanon	5.04	3.93

The theoretical Gini coefficients also overestimate the specialization of Israeli and Lebanese imports, but only at the intra-industry level. The industry level imports of the two nations were much more specialized in 1967 than predicted.

Thus the expected increases in trade specialization for Israel and Lebanon by 1967 did not materialize except for their intra-industry imports. Conditions after 1960 produced similar consequences among the Nordek members by overestimating the 1967 trade specialization for all Nordek trade except Denmark's exports and Norway's imports.

Rank Stability of Individual Trade Categories A measure[11] of the stability of export and import structures for Israel, Lebanon, and the Nordek countries between 1953 and 1967 is shown in Table 4. The correlations are shown for the periods 1953 to 1960, 1960 to 1967, and 1953 to 1967 at both the industry and intra-industry levels.

TABLE 4

RANK CORRELATIONS OF TRADE STRUCTURE: ISRAEL, LEBANON, AND NORDEK COUNTRIES, 1953-60, 1960-67, AND 1953-67.

Industry Level

	Exports 53-60	Exports 60-67	Exports 53-67	Imports 53-60	Imports 60-67	Imports 53-67
Israel	.78	.88	.94	.85	.90	.79
Lebanon	.95	.94	.87	.97	.98	.97
Denmark	.98	.93	.88	.95	.92	.90
Finland	.03	.97	.10	.97	.90	.87
Norway	.97	.92	.88	.98	.73	.75
Sweden	.95	.93	.87	.97	.82	.85

	Intra-Industry Level					
	Exports			Imports		
	53-60	60-67	53-67	53-60	60-67	53-67
Israel	.61	.70	.51	.46	.87	.40
Lebanon	.78	.88	.67	.82	.95	.79
Denmark	.92	.87	.74	.93	.87	.81
Finland	.93	.77	.73	.95	.82	.79
Norway	.96	.89	.85	.92	.84	.80
Sweden	.92	.80	.73	.84	.77	.79

Inspection of the industry level correlations suggests that the period of European integration had relatively little effect on the commodity rankings of Israel and Lebanon in comparison to the changes encountered by the Nordek countries. In contrast, the commodity shifts that did occur at the industry level for Israel and Lebanon between 1953 and 1960 were more excessive than those that occurred after 1960.

Fluctuations in the relative position of commodities at the intra-industry level were even more noticeable for the two Middle East countries. The lowest rank correlations for any of the six countries over the entire 1953 to 1967 period were associated primarily with Israel and to a lesser extent with Lebanon. More important is the fact that both countries experienced more of their commodity changes prior to 1960. This is in sharp contrast to the experiences of the Nordek countries.

The specific commodity changes at the intra-industry level for those commodities which accounted for at least 5 percent of a country's total value trade in any of the three years reveal the nature of the trade fluctuations. Although Israeli exports of fruits and vegetables (05)[12] and iron and steel (6 retained their prominence between 1953 and 1960, it is evident that exports of transport equipment (73) and textile yarns and fabrics (65) were replaced by exports of miscellaneous manufactured articles (89). By 1967, exports of non-metallic mineral manufactures (66) had replaced iron and steel as the most important value export. Even more dramatic shifts occurred in Israeli imports prior to 1960. From specializing in imports of live animals (00) and cereals and preparations (04) in 1953, Israel expanded her range of imports by 1960 to include transport equipment (73), non-electrical machinery (71), iron and steel (67), non-ferrous metals (68), and cereals and cereal preparations (04) by 1960. None of these had accounted for 5 percent of Israel's imports in 1953. By 1967, Israel had shifted again concentrating this time on imports of non-metallic mineral manufactures (66).

During the 1953-1960 period Lebanon's exports of fruit and vegetables (05) and textile fibres (26) remained the most important import items. However, changes did occur when textile yarn and fabrics (65), animal oils and fats (41), and hides, skins, and furskins (21) were replaced by tobacco and tobacco manufactures (12), iron and steel (67), and non-metallic mineral manufactures (66). By 1967, only exports of fruits and vegetables (05), textile fibres (26), and iron and steel (67) remained from 1960 as major export classes.

A significant trend in Lebanon's import structure was the continued addition of new and more items over the 1953-1967 period. By 1960, Lebanon had replaced imports of non-ferrous metals (68) by exports of live animals (00), iron and steel (67), and electrical machinery (72). By 1967, Lebanon had added fruits and vegetables (05) to her import structure and had changed from an emphasis on cereals and cereal preparations (04) and textile yarn and fabrics (65) in 1953 and 1960 to cereals and cereal preparations (04), live animals (00), and mineral fuels and lubricants (31) by 1967.

<u>Rank Similarities: Israel and Lebanon</u> The extent to which the two Middle East countries had similar export and import structures in 1953, 1960, and 1967 is revealed in Table 5. Several observations are evident. First the import structures of the two countries are more similar at both the industry and intra-industry levels than are their export structures. Second, the two are more similar at the industry level than the intra-industry level for both exports and imports. Finally, it is evident that while the trend of Nordek countries was in the direction of less similarity in their trading structures following union, this trend was only weakly associated with the import structures of the two Middle East countries and only at the industry level. Both Israel and Lebanon, particularly with respect to their export trade, became more similar after the 1960 period. This pattern seems closer aligned to the experience of the EEC countries after the 1960 period than it does to the Nordek records.

Table 5

SIMILARITIES BETWEEN THE TRADE STRUCTURES OF ISRAEL AND LEBANON, 1953, 1960, AND 1967.

Israel Exports with Lebanon Exports		Israel Imports with Lebanon Imports
1. Industry level		1. Industry level
0.47	1953	0.91
0.42	1960	0.89
0.58	1967	0.88
2. Intra-Industry level		2. Intra-Industry level
0.15	1953	0.41
0.23	1960	0.44
0.37	1967	0.43

Conclusions A summary of the findings regarding the verification of the hypotheses indicates that the first hypothesis can be accepted only with respect to Lebanon's export trade. That is, the acceleration of trade diversification that occurred in Europe following closer economic cooperation was duplicated only by Lebanon in her export transactions. The second hypothesis is verified and the conclusion is made that the more specialized a country prior to a period of investigation, the more likely that country is to experience a greater rate of diversification over a subsequent period of time. Finally, the third hypothesis is rejected and the conclusion is made that the performances of Israel and Lebanon over the 1953-1967 period more closely resemble those of the EEC rather than the Nordek group. That is, following 1960 the hierarchy of commodity classes became more stable for both Middle East countries and their structures became more similar.

IMPLICATIONS

Theoretical Inferences What similarities there are between the changes in trade diversification and commodity structures of Israel and Lebanon and the trading experiences of the EEC and the Nordek countries over the same time period lend some credence to the notions of those who would argue that changes in trade structure can be achieved without the potential dangers of rigid economic integration. However, the analysis indicates that the trade experiences of Lebanon more closely resemble those of the integrated European countries than do the patterns of Israel. It could be hypothesized, therefore, that Israel's trade structure is more likely to be altered by regional integration if such a venture were to be pursued. Additional investigations of non-union countries are needed to complete this assessment of regional integration.

It also seems necessary that additional studies be conducted on the influence of integration on the trading structures of other non-union members and on the relationships between trade diversification and the distinction between differentiated and standardized products. The increased similarities between the trade structures of Israel and Lebanon over time is identical to the experiences of the EEC and contrary to the changes of the Nordek group. The implication seems to be that the products of Israel and Lebanon are becoming increasingly differentiated at the intra-industry level as is the case of EEC products. This similarity between the two countries and the EEC in part explains why the trade structures of Israel and Lebanon did not become more dissimilar following the 1960 period as was characteristic of Nordek trade. The majority of commodities traded by the Nordek countries are standardized.(13) There seems to be a need for more analysis of the distinction among product types and more empirical study of the experiences on non-union countries.

Future Policy The policy implications for Israel and Lebanon seem somewhat different regarding the desirability of economic union and the directions of change in commodity structure. It has been argued, for example, that trade diversification is not always the best policy for developing nations since such a course of action necessitates entry into branches of production in which the profitability of exports may be low and where the risks of competition can be intensified. On the other hand, if there is an over-specialization of exports in a widely fluctuating market, the economic penalities are also formidable.

The export trade policies of Israel and Lebanon seem to be directed toward increasing diversification and it is probable that imports will continue to diversify with rising incomes. Israel's own projections call for greater emphasis on more intensive types of products dependent upon science-based industries and professional skills such as chemicals, vehicles, electronic equipment, clothing, and machinery.(14) While Israel's projections for imports forsee continued emphasis on processing and polishing rough diamonds there is also projected a strong shift toward imports of inputs to the construction and foodstuffs industries.(15)

The predictions of deviations from absolute diversification expected to be associated with Israel and Lebanon by 1974 are shown in Table 6. Using the changes between 1960 and 1967 as the basis for prediction, it is found that increased specialization at the intra-industry level is expected for the imports of both countries and for the exports of Israel by 1974. Only Lebanon's exports are predicted to become more diversified by 1974. In contrast, by 1974 it is expected that the industry level exports of both countries and the industry level imports of Israel will become more diversified.

Table 6

TRADE SPECIALIZATION COEFFICIENTS: ACTUAL 1967 AND PROJECTED 1974

Industry Level Exports			Intra-Industry Level Exports	
Actual 1967	Predicted 1974		Actual 1967	Predicted 1974
1.68	1.60	Israel	5.19	6.07
1.68	1.63	Lebanon	5.05	4.90
Industry Level Imports			**Intra-Industry Level Imports**	
Actual 1967	Predicted 1974		Actual 1967	Predicted 1974
1.79	1.37	Israel	3.98	6.08
1.43	1.56	Lebanon	3.93	4.13

FOOTNOTES

1 Hans Linnemann, *An Econometric Study of International Trade Flows* (Amsterdam: North-Holland Publishing Company, 1966, p. 57.

2 Economic Planning Authority, *Israel Economic Development: Past Progress and Plan for the Future, Final Draft* (State of Israel, Prime Minister's Office: Economic Planning Authority, March, 1968), p. 123.

3 For an investigation of the social and economic differences within the Middle East and an analysis of the potential for economic union see: James E. McConnell, "The Middle East: Competitive or Complementary?" *Tijdschrift voor Economische en Sociale Geografie*, Vol. 58, 1967, pp. 82-93.

4 For further elaboration on this particular modification of the Gini coefficient see Edgar C. Conkling and James E. McConnell, "Integration and Commodity Trade Specialization: The Case of Nordek," *Northwestern University Studies in Geography Series*, forthcoming.

5 The SITC commodity data were obtained from United Nations, *Yearbook of International Trade Statistics* and *Commodity Trade Statistics* (New York: The United Nations, 1953, 1960, and 1967).

6 The results of the EEC study are found in Bela Balassa, *Trade Liberalization Among Industrial Countries* (New York: McGraw-Hill Book Company, 1967), pp. 69-94. The Nordek study is reported by Conkling and McConnell, *op. cit.*, forthcoming. The treaty creating Nordek is to become effective January 1, 1971, and will unite Denmark, Norway, Finland, and Sweden in a type of integration much stronger than that of EFTA.

7 For further discussion see James C. Ingram, *International Economic Problems* (New York: John Wiley & Sons, 1966), p. 117; Erik Thorbecke, *Tendency Towards Regionalization in International Trade 1928-1956* (The Hague: Martinus Nijhoff, 1960), p. 125; and P.J. Verdoorn, "A Customs Union for Western Europe: Advantages and Feasibility," *World Politics*, Vol. 6 (October, 1953-July, 1954), p. 485.

8 Balassa, *op. cit.*, p. 89.

9 The experiences of the Nordek group were used for most of the

comparison since the analysis of their changes was done over the same time span as that of the present study.

10 The elasticity values range from less than 1.00, indicating an increase in diversification, to values greater than 1.00, measuring an increase in specialization. A value of unity implies no change from one period to the other.

11 The rank correlations are derived by ranking separately the one- and two-digit categories of SITC trade for each of the six countries according to the relative value of trade conducted at each category level. The one-digit category contains ten classes and the two-digit classification includes fifty-one classes.

12 The number in parentheses refers to the SITC associated with each commodity class. For further references see United Nations, SITC, Revised (United Nations Statistical Office, 1961).

13 Conkling and McConnell, *op. cit.*

14 Economic Planning Authority, *op. cit.*, p. 152.

15 *Ibid.*, p. 164.