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ABSTRACT

Each of the eight papers presented in this volume represents a special type of study carried out under the auspices of a working group of professional geographers involved with the High School Geography Project. The papers are written by geography teachers at the secondary level with the purpose of creating units of instruction, designing pupil activities, and locating suitable classroom and laboratory materials. A way in which the geographic method of inquiry can be applied to problems within the student's environment, a demonstration of how students develop an understanding of scale, a unit of study in physical geography, a regional approach to geography, and an exercise in problem solving related to food production, are topics of the first five papers. Changing attitudes on the part of the professional geographer, the classroom teacher, and the high school student involved in the projects are reported while the major challenges and responsibilities confronting those concerned with upgrading geography in secondary schools are observed in the next two papers. Finally, a guide to future participants in the Project comments on the structure of geography with reference to geographic fact, spatial distribution, and areal association. (Author/KSM)

GEOGRAPHIC EDUCATION SERIES NO. 4

Selected Classroom Experiences: High School Geography Project

Clyde F. Kohn, Editor

NATIONAL COUNCIL
FOR GEOGRAPHIC EDUCATION

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Clyde F. Kohn, Editor
Professor of Geography
State University of Iowa
Iowa City, Iowa

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Table of Contents

Introduction

The High School Geography Project

Clyde F. Kohn

"Of all the academic subjects that every civilized human being ought to learn well, geography is the most neglected in American colleges and schools. Many senior high schools do not teach the subject at all, and many colleges offer it only as an elective for a few students who plan to go on to graduate school to become professional geographers. Yet it seems obvious that the need for geographic knowledge grows as our planet shrinks, as people travel more, and as we are brought into ever greater dependence on the people of other lands."

This statement, reported in a newspaper article appearing in the Pittsburgh Post Gazette on June 29, 1959 and attributed to Dr. Paul Woodring, Education Editor of the *Saturday Review*, may well be considered a preamble to the High School Geography Project. It echoes an earlier statement of Dr. John W. Studebaker, a nationally prominent educator and a former U. S. Commissioner of Education, who once said, "Apart from rather backward nations, we are more illiterate geographically than any civilized nation I know. . . . Young people stop studying geography in about the seventh or eighth grade of the common school, if they get that far, and for the most part they are taught up to that time by teachers who stopped studying geography at about the same time in their school courses. If we can get out of that policy an intelligent understanding of the world on the part of those taught, I would like to know how to do it."

It is obvious from statements such as these that American students are not being provided with adequate instruction in the study of cultures and areas beyond the Americas, or for that matter, within the Americas.

For a nation which has assumed a major role in world affairs, and whose economic, social and political development in the second half of the twentieth century depends, to a remarkable degree, on establishing stable and peaceful working relations with highly diverse cultures, economies and countries in other parts of the world, it is paradoxical that so little attention is given to the study of these peoples and countries. The need for sound geographic instruction in our public schools was implied in a message of our late President, John F. Kennedy, to the American Geographical Society, New York City, on December 7, 1961. Contained in this message were the following statements "The work of geographers has always been especially meaningful to mankind. But never more than today. In the search for peace and for means to feed, clothe and shelter the world's populations, we need not only the precise and comprehensive knowledge that the geographer offers to us but also the breadth and variety of his many perspectives."

In 1958, the Association of American Geographers and the National Council for Geographic Education recognized the critical need for improving both the quantity and quality of geographic instruction and materials by establishing a Joint Committee on Education. This Committee was instructed to (1) recommend practical steps to be taken in improving the status of geography in education, (2) find means of putting into effect these recommendations, and (3) work closely with other educational organizations to promote geography as a discipline, particularly in the secondary school system. These goals reflected the conviction of the geography profession that instruction in geography needed to be thoroughly and critically reviewed in light of the advances in the discipline, and in terms of the growing need for a better understanding of peoples in all parts of the world.

After lengthy discussions of the ways in which the teaching of geography needed to be improved, the High School Geography Project was selected to be developed first. The objectives of the Project have been twofold: (1) to improve the content of courses in geography at the freshman-sophomore level, and (2) to develop new instructional materials for use in these courses. It is expected that the Project will lead, eventually, to the creation of a one-year "demonstration course," together with the necessary study aids, supplementary reading materials, classroom and laboratory exercises, programmed lessons, and suitable tests. It will be designed as a "model" course created to fulfill the objectives of modern geographic instruction.

The Project was initiated in the fall of 1961, with the appointment of a Working Group of professional geographers. This Working Group was asked to define basic ideas in geography, outline geographic methods of inquiry, and state the skills which it thought should be developed at the high school level. Out of these discussions came an *Advisory Paper* directed to teachers associated with the second phase of the Project.

During this later phase, ten experimenting and twenty cooperating teachers worked with the concepts, understandings, and skills outlined in the Advisory Paper, creating units of instruction, designing pupil activities, and locating suitable classroom and laboratory materials. The ten experimenting teachers were released from their regular teaching duties, except for one, or at the most two courses, in order to devote the remainder of their time to developing new ways of teaching geographic facts, understandings, and concepts. Each of the thirty participating teachers was assigned a "geography consultant"— a professional geographer in a nearby college or university. These professional geographers met regularly with their assigned teachers to discuss new research findings in geography, new methods of analysis, and new ways of looking at geographic facts, concepts and generalizations. Altogether, the participating teachers created some 100 units. Their work was coordinated during the academic year, 1962-63, by Professor Henry J. Warman, on leave from Clark University. Professor William D. Pattison served as Director of the Project throughout the first two years, 1961-1963. Funds were made available from the Fund for the Advancement of Education, Ford Foundation, to initiate the Project.

Each of the papers included in this volume represents a special type of study carried on during the academic year, 1962-63. The first by Dr. Bertha Boya Thompson is an example of an exercise in problem solving developed during a study of food production in the United States. Her students sought to find out why Ohio showed a notable decrease in wheat production when the figures for 1954 were compared with those for 1959.

John Neal's paper indicates a way in which the geographic method of inquiry can be applied to problems within the student's immediate environment.

The paper by Herbert H. Friedman demonstrates how students can develop an understanding of scale as an instrument whereby successive levels of generalization can be reached.

The fourth paper by Frederic A. Ritter describes a unit of study in physical geography. It outlines the learning experiences of the students as they worked with earth-sun relationships, the elements and controls of weather and climate, the characteristics and areal distribution of climatic types on a world scale, and the associations existing between and within climatic types.

The fifth paper presents a regional approach to the study of geography at the high school unit and was contributed by Peter Greco. It demonstrates still another way of organizing a course in the discipline. The focus is on the localized associations of phenomena which make an area distinctive, that is, a "region."

Dr. Pattison presents some changing attitudes that he observed on the part of the professional geographer, the classroom teacher, and the high school student during the second phase of the project. Dr. Warman presents ten questions most frequently raised by school administrators regarding the role of geography in the high school program of studies. He gives his answers to these questions, but suggests them as additional challenges and responsibilities confronting all those concerned with the upgrading of geography in our secondary schools.

The final paper, *Some Comments about a Structure of Geography with Particular Reference to Geographic Fact, Spatial Distribution and Areal Association*, was presented by Professor Edwin N. Thomas at the Cleveland Seminar for the ten experimenting teachers in August, 1963, and served as guide to many of the teachers during the ensuing year.

The editor is indebted to all those who have contributed to the success of the first two phases of the High School Geography Project. Without the help of the professional geography consultants and others, the classroom teachers who have contributed to this volume would not have been able to create the units of instruction they describe.

Paper No. 1

An Experiment in Problem-Solving

Bertha Boya Thompson

In the experimental high school geography course developed at Talawanda High School during the academic year, 1962-63, the problem-solving method of instruction was introduced in a unit of study on food production in the United States. As one of their assignments, students were asked to construct a dot map showing the distribution of wheat production in the fifteen leading wheat producing states for 1959. While collecting data from the agricultural census for that year, the statistics for wheat production in Ohio for 1954 and 1959 were noted by the students. A question arose as to why wheat production in Ohio had decreased from 45 million to 29 million bushels during this five-year period.

One student asked if he might make two dot maps of wheat production for Ohio, one for 1954 and the other for 1959, to see whether or not the decline was general throughout the state (Figure 1). Upon completion of the two maps, the student concluded that a decrease did occur in all counties, but that in some counties the decline appeared to be significantly greater than in others. The student's failure to hold an identical or uniform dot size caused some slight inconsistencies in his observations.

The following "explainers," or hypotheses, were suggested by the class to account for the general decrease in production for the years 1954-59, and for the place-to-place differences observed on the completed maps:

1. The decrease in wheat production in Ohio from 1954 to 1959 was associated with a decline in the demand for United States wheat on the world market.

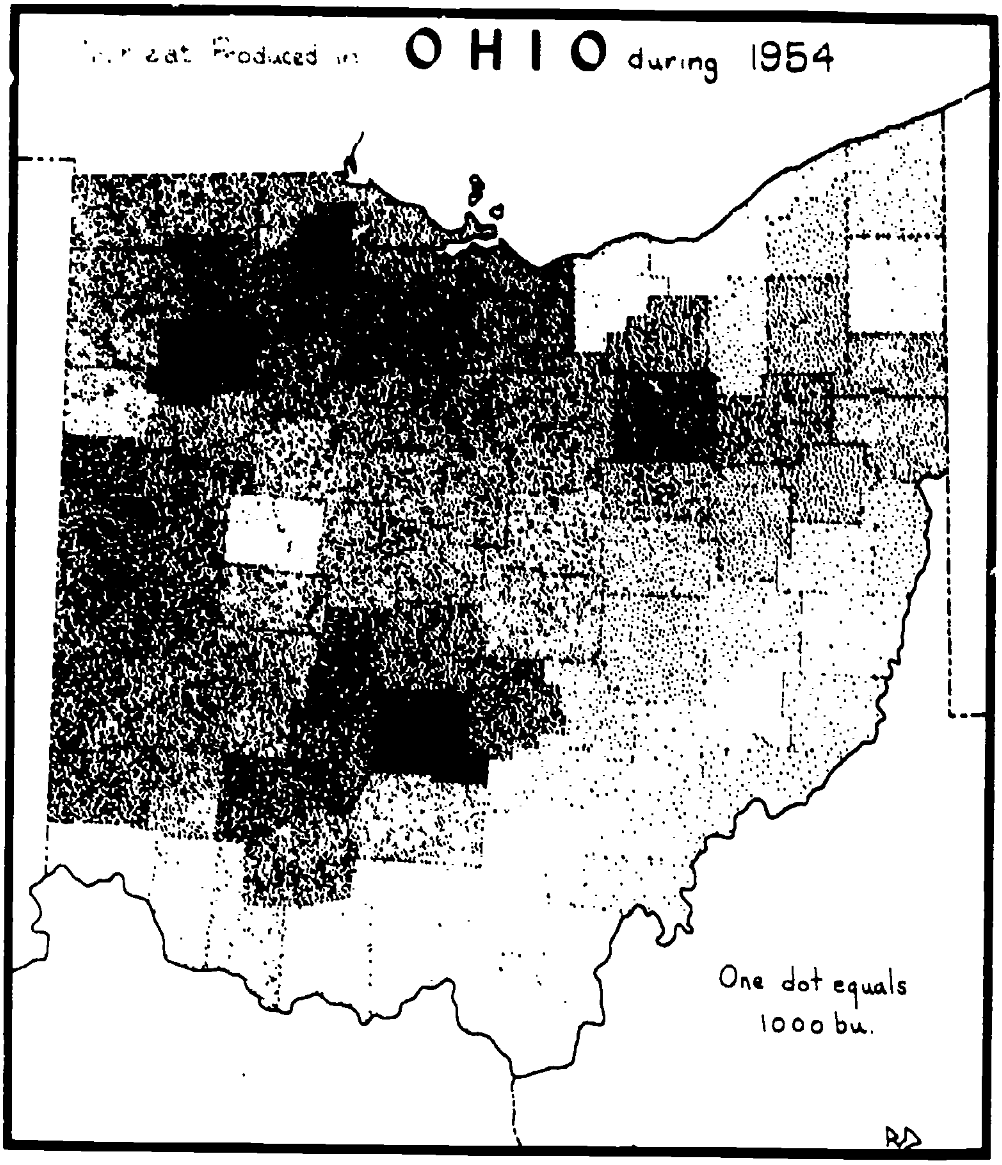

Figure 1A. Wheat Produced in Ohio during 1954.

2. The decrease in wheat production in Ohio from 1954 to 1959 was associated with a change in the diet of the American people.
3. The decrease in wheat production in Ohio from 1954 to 1959 occurred because 1959 was a non wheat year in the crop rotation pattern.
4. The decrease in wheat production in Ohio from 1954 to 1959 was associated with a decline in county wheat acreage allotments.

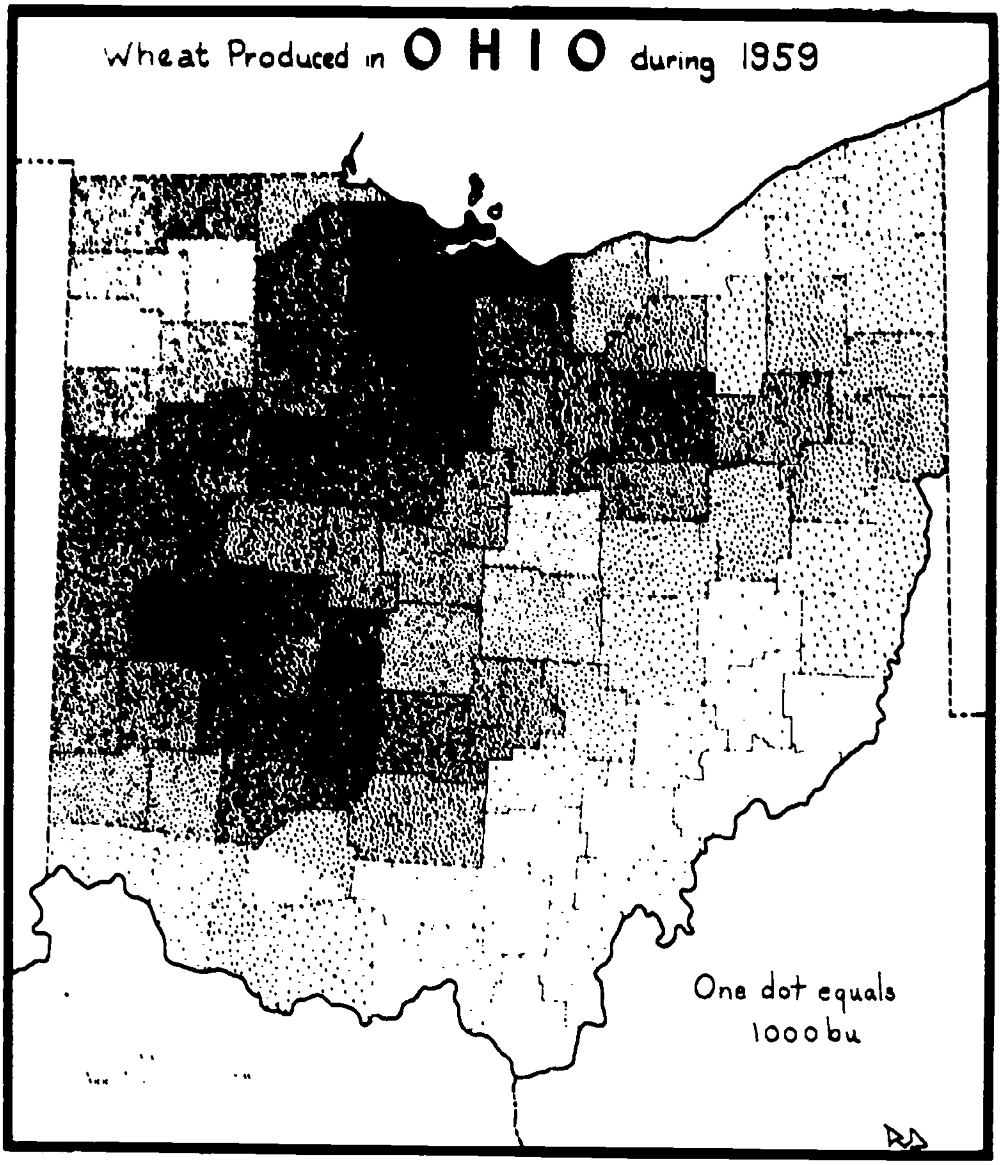

Figure 1B. Wheat Produced in Ohio during 1959.

5. The decrease in wheat production in Ohio from 1954 to 1959 occurred because other crops were able to compete successfully for acreage previously used for wheat.
6. The decrease in wheat production in Ohio from 1954 to 1959 occurred because farm land had been taken out of crop production and used for other activities such as manufacturing, urban development, recreation, and mining.

Testing the Hypotheses: Rejection and Acceptance

After examining available data, a student reported that the United States had exported 562 million bushels of wheat in 1958, 623 million in 1959, and 712 million in 1960. He regretted his inability to secure data for 1954, but on the basis of the data obtained concluded that the increased sales from 1958-1960 did not indicate a decline in world demand for United States wheat. Hence, the first hypothesis was rejected. In other words, the decline in wheat production in Ohio between 1954 and 1959 was not due to any decline in the demand for United States wheat on the world market.

The instructor then placed the following production and sales data for Ohio on the chalkboard:

The Production and Sales of Wheat
In Ohio 1954 and 1959

Production	1954	45,202,350 bushels	1959	29,499,714 bushels
Sales	1954	38,365,231 bushels	1959	26,115,667 bushels

It was quickly noted that a larger percentage of the wheat produced in 1959 had been sold than in 1954. The class recognized that this indicated no decrease in the percentage of sales and thus rejected the second hypothesis. It was concluded that the decline in wheat production in Ohio from 1954 to 1959 did not reflect a change in the diet of the American people.

The student who proposed the third hypothesis secured wheat production data for the ten-year period, 1950 to 1959. He analyzed and graphed these data in order to determine whether or not the decrease was recurrent in any kind of recognizable pattern. He recommended that the third hypothesis be rejected, and that the class accept the conclusion that the decline in wheat production in Ohio from 1954 to 1959 was not associated with a non-wheat year in the crop rotation pattern.

To test the fourth hypothesis, which most students thought was the major reason for decreased production, data were obtained from the Agricultural Stabilization and Conservation Committee in Columbus, Ohio. Based on their analysis of these statistics, the class decided to accept the hypothesis as one of the important causes of decreased production. They were surprised to find, however, that the decrease in county acreage allotments was not so significant as they had anticipated. The following table gives some examples in which large production decreases were accompanied by relatively small declines in acreage allotments:

	Wheat Production in bushels		Wheat Acreage Allotments in bushels		
	1954	1959	1954	1959	Difference
State Total	45,000,000	29,000,000	1,753,914	1,557,896	196,018
Paulding Co.	654,765	110,609	26,701	26,553	148
Adams Co.	308,018	71,532	13,423	12,296	1,127
Ashtabula Co.	335,821	87,280	13,109	12,769	340

It was decided that the other hypotheses had to be investigated in detail, particularly when it was noted that the farmers of Ohio actually planted less than the county acreage allotments permitted, as follows:

Comparison of Allotted and Planted
Acreage in Ohio, 1954 and 1959

Year	Allotted Acreage	Planted Acreage	Difference
1954	1,753,914	1,740,000	13,914
1959	1,557,896	1,264,000	293,896

One student argued that these data could be explained by increased technological knowledge, that is, farmers could get more from less acres, so less was planted to wheat. Since many thought this was the explanation, the instructor gave wheat crop yields as 27 bushels per acre in 1954 and 24.5 for 1959. The students were surprised. The instructor then asked them to multiply the 1,264,000 acres planted in 1959 by the difference in yields between 1954 and 1959. The students readily saw that more would have been produced in 1959 if farmers had been able to reach the 1954 yield. It was at this point that the students decided that unfavorable weather conditions might have accounted for the decreased yields. Hence, a seventh hypothesis was introduced: "The decrease in wheat production in Ohio from 1954 to 1959 was associated with an unfavorable growing season during the year in which the 1959 census was taken." An interview was arranged with the vocational agriculture teacher and his class to secure information relative to critical periods in the growth of winter wheat and, in addition, possible crop competitors for wheat acreage. The students then checked the acreage for other crops for 1954 and 1959. Only corn and soybeans showed an increase, with corn increases too small to be significant. It was decided that further testing of the fifth hypothesis relative to crop competition would be necessary, and that a soybean map should be made to see if areas of decreased wheat production were also areas of increased soybean production.

In order to supply relevant data for testing the sixth hypothesis, it was noted that the number of farms in Ohio declined by 37 % from 1954 to 1959. To the unbelieving students, the instructor explained that 7,000 of these were attributed to a redefinition of the term, "farm." Some of the decline, however, was attributed to the merging of farms, for the average farm size of Ohio increased from 112.9 acres to 131.9 acres in the five-year period from 1954 to 1959. Other contributing factors suggested were increased urban sprawl, the development of new parks, and strip mining. The field consultant on the High School Project, Professor Henry J. Warman, suggested that the decline in proportion of all land in farms or the change in the number of acres of farmland cultivated might be used as indicators of competition from other activities.

Committees were selected to map the dependent variable, that is, the phenomenon whose spatial variation was to be explained. In this instance, the dependent variable was the variation in changed wheat production from 1954 to 1959 in Ohio by counties, and the tentative independent variables (the possible explainers) were: (1) county wheat acreage allotment changes, (2) monthly differences in temperature and precipitation, (3) changes in soybean acreage, and (4) changes in farm acreages. Changes in wheat acreage were mapped to depict the dependent variable and to facilitate visual correlation.

A simplified quantitative system was devised for constructing the necessary maps (Figure 2). The differences between the 1954 and 1959 data were determined for each county, for both the dependent and independent variables (with the exception of the temperature and precipitation changes). The average county change was calculated for each variable. The symbols +, −, and 0 were placed upon each map according to fixed criteria. For example, in the case of farm acreage changes, a "+" was placed in a county if the county decrease was equal to the state average or greater; an "O" was placed in a county if the decrease was less than the average for the state. A "−" was placed in a county if an increase occurred.

The "weather data committee" placed its information upon each of their maps using areas determined by the state climatologist. Two different colors, blue for 1954-55 and red for 1958-59, were used in recording the temperature and precipitation data on each of the climatic maps constructed. The 1954 data were placed above the 1959 data as shown in Figure 3. Five-inch and six-inch isohyets for a 48-hour period were placed on the January map.

After all the maps had been constructed, they were placed upon the bulletin board. Students were urged to check the extent of spatial covariance visually. Later a class period was set aside to test hypotheses 5, 6, and 7 using this method of visual correlation. During this period students concluded that the map depicting changes in wheat production indicated that all counties had experienced a decrease in wheat production with the greatest declines in the southwestern, the central, and northwestern parts of the state (Figure 4). Similar results were noted using the map showing changes in wheat acreages.

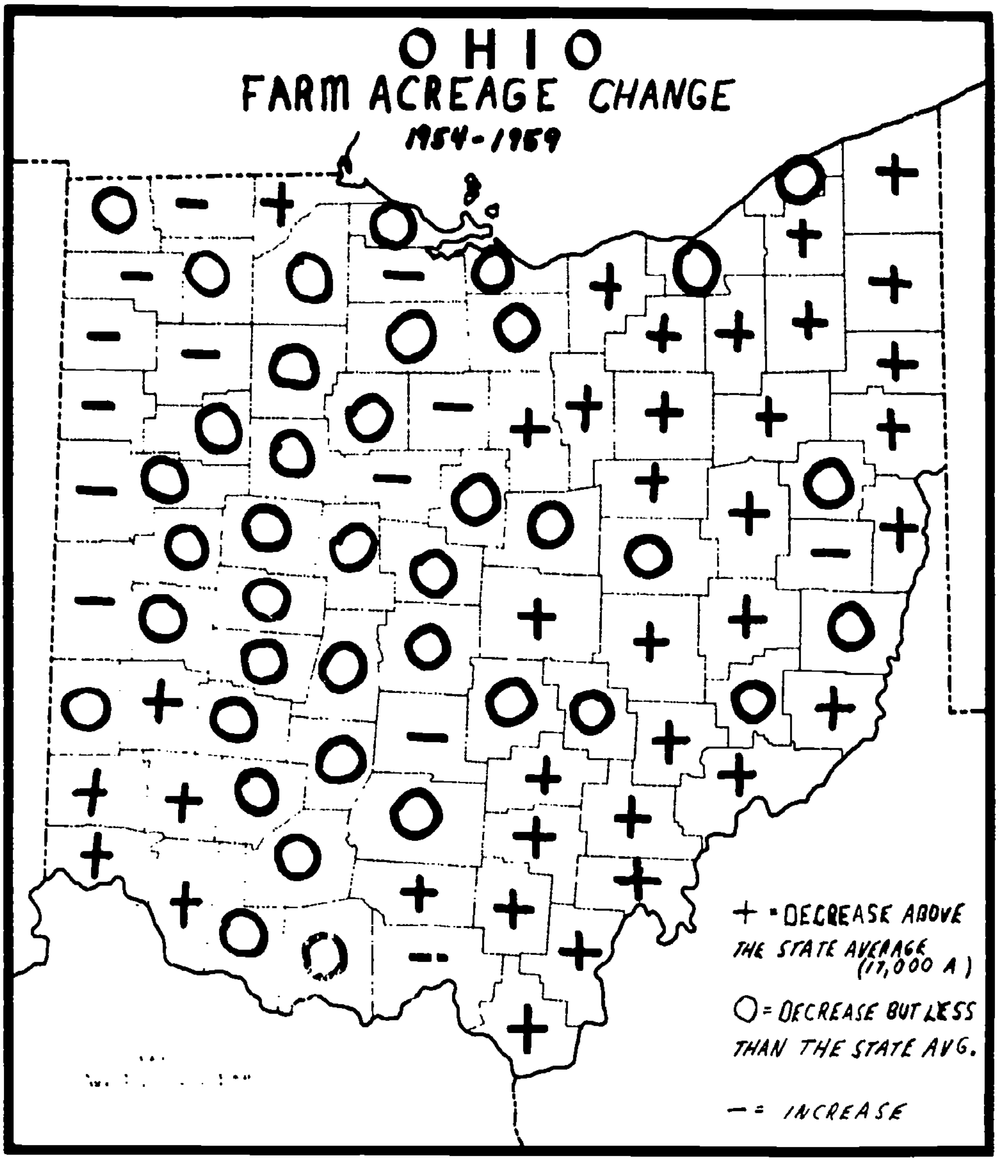

Figure 2. Farm Acreage Change, Ohio, 1954-1959.

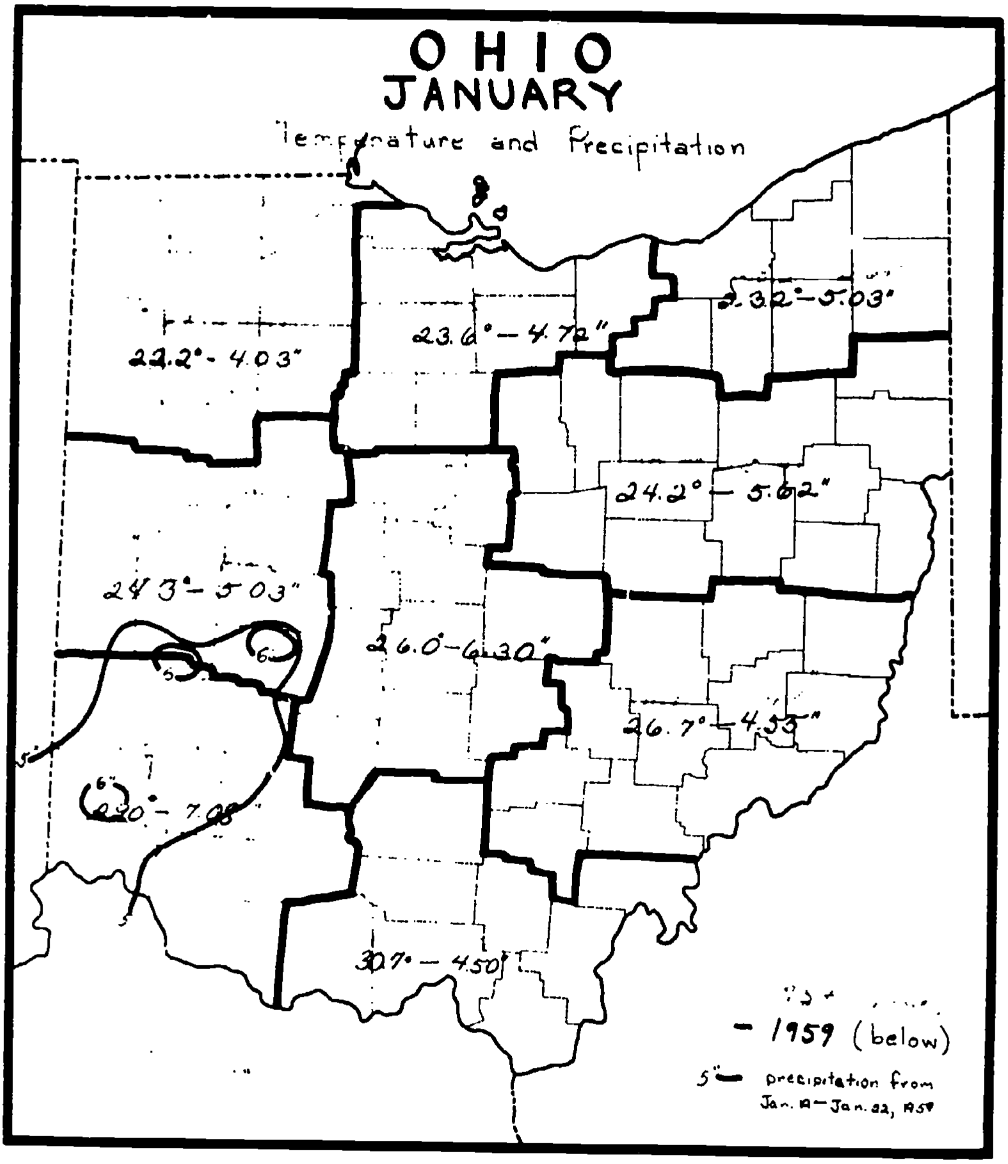

Figure 3. January Temperature and Precipitation, Ohio, 1954-1959.

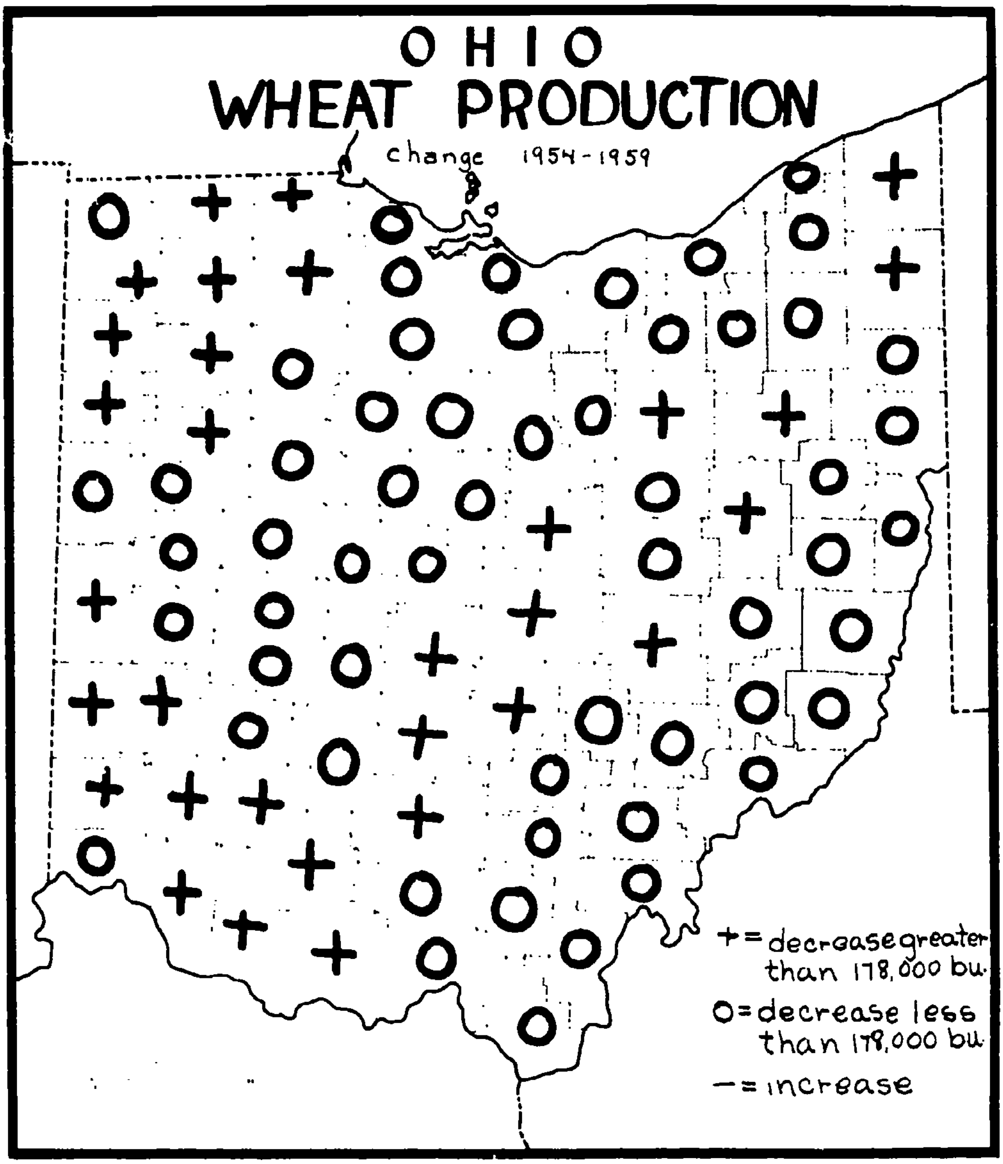

Figure 4. Wheat Production, Ohio, 1954-1959.

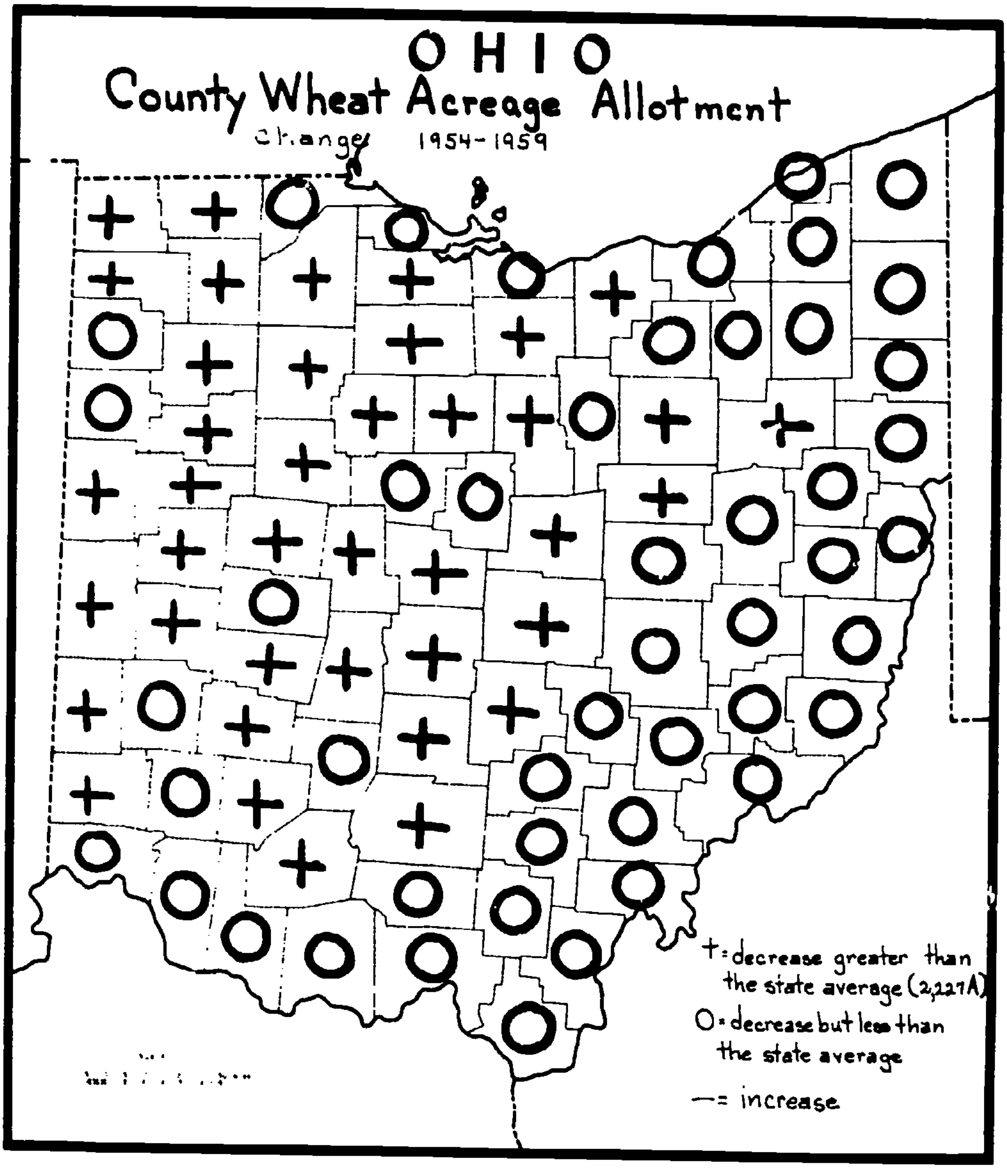

Figure 5. County Wheat Acreage Allotment, Ohio, 1954-1959.

One student noticed that the greatest decrease in wheat acreage allotment occurred in areas where the greatest changes in wheat production occurred (Figure 5). In light of this observation, the students' previous judgment relative to the wheat acreage allotment hypothesis (hypothesis 4) was reaffirmed. However, one exception was noted in the southwestern part of the state where a greater than average decrease in production occurred but where government allotment decreases were less than the average for the state. Students also observed that a less than average decrease in wheat acreage allotment change and a less than average decrease in wheat acreage change occurred in the southeast. Here, however, there was an above average decrease in total farm acreage. These observations plus their knowledge of urban sprawl, park development, strip-mining, and reforestation in Ohio led to the acceptance of the sixth hypothesis. It was concluded that the decrease in wheat production in Ohio from 1954 to 1959 was positively associated with competition for land by other activities.

In looking at both the wheat acreage and soybean acreage maps (Figure 6), the students concluded that where greater than average wheat acreage decreases occurred in western Ohio, soybeans showed an increase. Thus, on the basis of these observations they accepted the fifth hypothesis and concluded that the decrease in wheat production in Ohio from 1954 to 1959 was associated in part with the successful competition of other corps for acreage once planted in wheat. This judgment was reaffirmed when weather conditions were later investigated. The students proposed that the winter wheat crop might have been destroyed by inclement weather conditions, and that a spring planting of soybeans might have replaced the wheat crop.

Some wetness in the northwest was noted in November, 1958, for those counties where an above average decrease occurred; severe temperatures with much less precipitation and no snow cover in December of that year might have caused freezing; and flood-like conditions occurred in January of 1959 in two of the areas of greater than average decline. The isohyets of 5 and 6 inches for a 48 hour period include most of these areas (Figure 3). Frozen flood waters in lowland areas possibly caused suffocation of the wheat plants. The above average precipitation of May and June, 1959, did not covary with an above average decrease. The "adverse weather condition hypothesis" was therefore accepted, and the class concluded that the decline in wheat production in Ohio from 1954 to 1959 was associated with an unfavorable growing season for the year on which the 1959 figures are based.

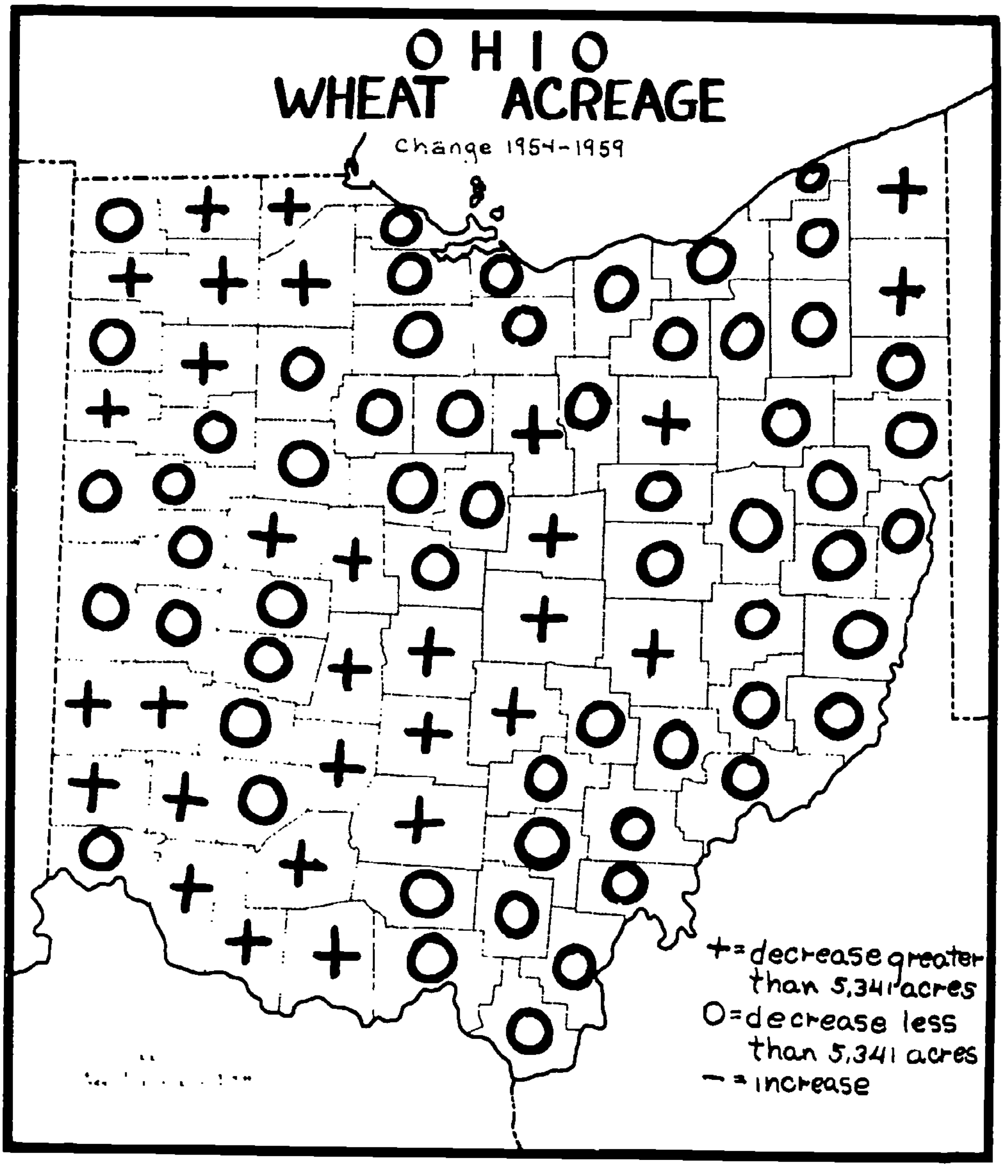

Figure 6A. Wheat Acreage, Ohio, 1954-1959.

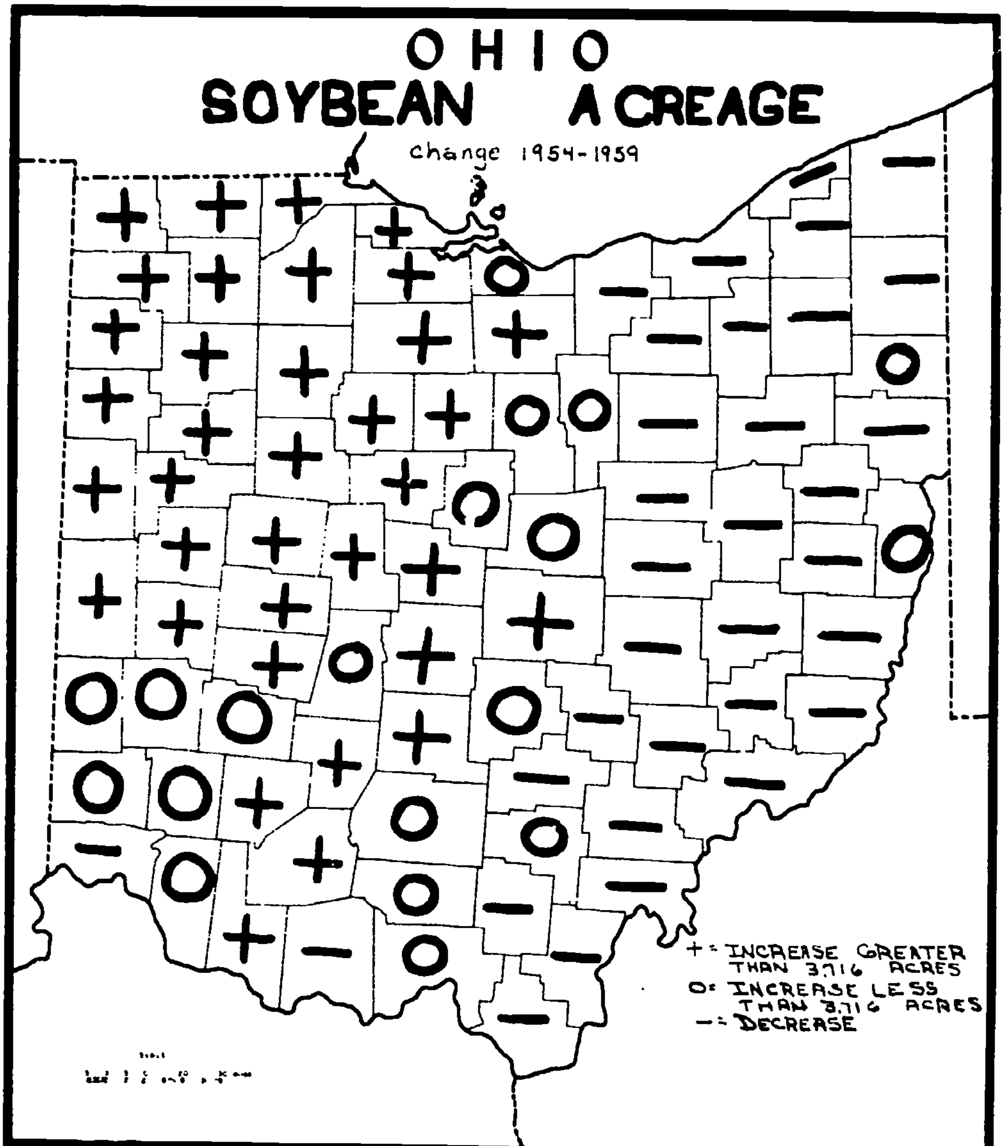

Figure 6B. Soybean Acreage, Ohio, 1954-1959.

Summary

Of the seven hypotheses proposed by the students, three were quickly rejected, but, on the basis of available data, four were accepted as possible "explainers" for changes in wheat production in Ohio between 1954 and 1959. Whereas, in the beginning, several students believed that their particular hypothesis was the *only* explanation, they all agreed that the solution was much more complex than they had anticipated originally. They were satisfied, however, that through the use of statistics and the process of visual correlation they had determined the major factors contributing to the decline in wheat production in Ohio for the years indicated.

Paper No. 2

Teaching the Principles of Industrial Location

John P. Neal

During the academic year, 1962-63, two experimental courses in geography were taught at Newton High School, Newtonville, Massachusetts, as part of the High School Geography Project. Both classes were offered at the twelfth grade level. The 58 students in the two classes were enrolled either in the commercial or lower college preparatory curricula, and had been selected and grouped homogeneously by the IBM data process. The median I.Q. for these students was 101. Of the total only three had taken a prior high school course in geography. At midyear a letter-grade breakdown of all marks received by these students within the social studies department showed that 6 per cent had received A's; 29 per cent, B's; 35 per cent, C's; 21 per cent, D's; and 5 per cent, F's.

The learning experiences discussed in this paper arose out of a local incident. In the fall of 1962, the Raytheon Manufacturing Company, an electronics firm employing approximately 36,000 workers, experienced the loss of several governmental contracts, thereby causing a general reduction of employees. As a result, the life-motif of many of the students of Newton High School was disrupted by a sharp decline in parental income. For youngsters reared in a overall atmosphere of affluence, such an event was catastrophic. Class questions were raised as to reasons for this situation. From a pedagogical standpoint, the "felt-need" for some rational explanation was readily apparent, and the class was motivated to find answers, if possible, for the questions raised.

Few of the learners realized, however, that here was a problem with distinct geographic overtones. The students, like many other groups, were confronted with a problem, the geography, economics, and politics of which dwindled in significance before the problem itself. Since the business of the class was to learn geographic principles and concepts, the geographic dimensions of the problem received center stage. The instructor made it a point, however, to refer to other aspects of the issue whenever it seemed appropriate.

After the problem had been defined with clarity, the students indicated their desire to know why particular industries locate in or migrate from specific locations; why California firms could affect Massachusetts payrolls, and why some locations seem to attract particular kinds of industries having like problems. After introductory remarks by the teacher and class discussions based on readings in several economic geography textbooks, the students listed the generally accepted criteria for industrial location presence of natural resources, markets, and power. In addition, they noted that some industries appear to be "footloose." Other criteria, including political stability, a developed circulatory system, availability of skilled labor and investment capital, and general cultural advantages of one site over another were ruled secondary to the problem, and thus omitted from the investigations.

The Study of Resource-Oriented Industries

To study the relations of natural resources to plant location, the paper and pulp industry, the frozen concentrated juice industry, and the fishing industry were selected. The "case study" approach was used in all instances. In studying the fishing industry, field work in the Boston-Gloucester area by a class committee proved to have a high educational value to both students and teacher. Following an initial investigation, the shellfish aspect of the fishing industry began to intrigue the field workers to a marked degree. As a result, fishermen were interviewed; the executive officers of Howard Johnson's, a major buyer of fish, were consulted; and an executive of a leading fish packing house, Gorton's, was contacted. The class also reviewed a copy of a study sent to the then Governor of the Commonwealth, Governor Volpe, including recommendations for improving Massachusetts fisheries. As the class expanded its study to include the fresh waters of the Charles River, the teacher was contacted by a member of the Massachusetts State Legislature who wished to duplicate the class room method of using 95 vertical aerial photographs to reconstruct the Charles River Basin for an indoor "field trip." The state legislator was also concerned with offshore fishing and river pollution.

It was during this activity that the class became aware of the many facets entering the matrix of the problem. Pollution of clam flats and lobster beds, applications of the Pure Food and Drug Act, impact of Canadian imports, unionism, urban sewage disposal practices, and conservation organizations were found to be elements in the distribution of commercial fisheries. The opportunity for exciting digression was always present. For example, in the Gloucester case, the question was raised as to why Italian descendants tended to go on one-day fishing runs whereas Portuguese descendants tended to go on four-day, or more, voyages? Or, whatever became of the "Old Yankee" fisherman so dominant during the nineteenth century? The field workers required an entire class hour to report findings and to give a limited demonstration of equipment related to this resource-oriented industry. The findings which follow indicate the many geographic avenues the class pursued during the investigative process.

1. **Changes in dietary habits is a part of the changing American culture.** This fact was established by asking students and their parents, "Did you, when you were young, take cod liver oil in your orange juice every morning?" The affirmative response of the parents, speaking from their childhood experiences, and the negative response of the students gave evidence of a change in dietary habits. The results were inverse when fried clams, now in short supply, were placed in the paradigm.

2. **The feeding areas of fish are changing.** According to several of those consulted during the study, the temperature of the North Atlantic appears to be getting warmer. The fish, therefore, are migrating farther north to maintain the same temperature and feeding habits. This means that a New England fishing vessel must range farther from home port in order not to return a "broker," that is, a vessel whose catch does not meet expenses.

3. **The technology of fishing is changing.** New ways of catching fish with larger nets mean that there may be fewer fish in the future to catch. One "old salt" reported that thirty years ago it was difficult to see the shallow bottom of the Grand Banks because the fish were so plentiful. Now fishermen not only see the bottom, they can also see the few fish that remain there to feed. Modern dragging nets scoop up seaweed and other plant life along with the fish!

4. **Foreign fishing fleets are changing in composition.** Because the oceans belong to all nations to share alike, several nations have fished the North Atlantic for centuries. Recently the appearance of Soviet fishing vessels in increasing numbers has been reflected in smaller American catches and in an increase in the number of "brokers." Since monetary profit is not a direct factor in the Soviet governmental motive, their vessels fish in concentrated numbers and follow a checkerboard pattern. This pattern is efficient in cleaning out an area, but it cannot be utilized by profit-seeking fishermen.

The use of the word "changing" in these findings was seized upon by the teacher in order to introduce the dynamic character of industrial geography. Although not related to the principles of resource-oriented industries, the class was quick to note that the cotton textile industry is a classic example of a migrating industry. They had heard about the impact of this migration on the local economy of such industrial towns as Lowell, Lawrence, and others in the Merrimac Valley. It so happened that a series of television debates between two candidates for the United States Senate spotlighted this very topic at the time it was being discussed by the class.

To map the migration of the cotton textile industry, data on spindles in operation were obtained from several volumes of the *Statistical Abstract of the United States*. It may be noted that slower learners were helped to visualize this migration by constructing a chronological series of dot maps or bar graphs. When secured by staples these maps could be flipped rapidly with the fingers and gave a motion picture effect of the movement of spindles in operation from the New England states to the Southern Piedmont. The more advanced students studied other aspects of the migration of the cotton textile industry.

The Study of Market and Power Oriented Industries

In addition to studying industries which were resource-oriented, such as the paper and pulp industry, the frozen concentrated juice industry and the fishing industry, the class studied an industry which was market-oriented and one that was power-oriented. For a market oriented industry, the class selected for study the location of a Coca Cola Bottling plant. Such plants are generally small in size, and have limited market areas. Thus they tend to be located quite near their customers.

The power principle was examined by studying the aluminum industry. In this instance, readings and brief lectures were relied upon, although aspects of the historic location of early New England textile mills at small waterfalls were introduced to tie this principle to the dynamic role of man's changing technology. The old Lowell mill, built at a falls on the Charles River in Waltham, Massachusetts, is only a few miles from the high school. Using this mill as an example, the power principle and the dynamic nature of our culture were related.

The concept of "footloose" industries developed rapidly out of the foregoing studies. The Commonwealth of Massachusetts was defined by the students as a political unit within an industrial region of such plants. The case of the now defunct Waltham Watch Company was used to focus student attention on problems related to footloose industries. Another, and extremely interesting reason for selecting the Waltham Watch Company, was the fact that the present Raytheon Manufacturing Company, the industry which motivated the study of industrial location in the first place, now occupies the site formerly occupied by the Waltham Watch Company. The class was quick to recognize this fact as an example of industrial sequent occupance.

At this point, a chalkboard chart was constructed by the teacher to show the "geographer's way" of developing locative principles. The chart was predicated on cost-distance-per-ton-mile of inputs of raw materials and outputs of finished products. The chart aided in summarizing locative principles in terms of the "value added" concept. It appeared to be helpful for reflecting on understandings developed during the actual case studies.

Although the chart completed the formal classwork on the problem of industrial location and change, later units of study, both topical and regional, afforded opportunities to evaluate the student's ability to apply the principles learned to new situations. It was gratifying to note that many students did refer to them during the remainder of the course, and in several instances used them in their oral and written work.

As a concluding note, however, it should be stated that not all the class mastered all the concepts and principles. Courses have a way of ending before they are really through. Nonetheless, the learning experiences did provide new insights into industrial location and changes in the location and distribution of industrial plants.

Paper No. 3

An Approach to the Teaching of Generalization Relative to Map Scale

Herbert H. Friedman

The concept of scale is an intrinsic part of all geographic considerations. It is first encountered by a student as a mathematical expression, a distance ratio. Later, it is presented as a modifier, a cartographic tool of generalization. It is this latter conceptualization of scale with which the classroom experiences discussed in this paper are concerned.

The conception of scale as an instrument whereby successive levels of descriptive generalization can be reached is central to the understanding of all cartographic presentation. Hence, the degree of generalization possible about a section of reality should be seen by the student as a function of the map scale. In this sense, the map scale both defines an order of magnitude, in terms of area, and an order of generalization in terms of the phenomena under study.

In his *Perspective on the Nature of Geography* (p. 126), Hartshorne refers to the concept of generalization in the descriptive sense "in which it is necessary to generalize in textual, or cartographic presentation, by describing characteristics true of the greater part of an area regardless of variations or small exceptions." The experiment on the teaching of generalization relative to map scale, as here reported, was part of a larger unit developed during the academic year 1962-63. This unit was entitled, "Man's Changing View of the Earth as Seen Through Maps." A brief description of this unit is appropriate here to establish the background for the more specific learning experience.

The unit of work, during which the concept of scale as a cartographic tool of generalization was developed, was designed to introduce the student to the world of maps, their creation and use. The philosophy which the unit sought to transmit was that a map is, beyond its value as a geographer's tool, a mirror of reality about the earth as man perceives it to be at any given time in history; that a map is intimately associated with man's groping and progress reflecting this movement throughout history; and, finally, that a map is a dynamic thing which is never definitive in scope but changing in perspective as man changes his. For example, a world map of the year 2460 may conceivably be as strange to behold as the T in O maps of the Middle Ages are to contemporary man.

In this unit of study, history was called upon to serve as the handmaiden of geography. The unit began with a study of the origins of map making, wherein the concept of a map as a quantitative and qualitative instrument for recording earth features was developed. A working definition evolved out of a comparative study of ancient descriptive and cadastral maps. This procedure provided the foundation for an historical approach to the study of cartography through the ages. A time line, representing some twenty-seven centuries, served as the historical backdrop upon which the history of map making was projected. Important cartographic concepts and skills such as sphericity, earth measurement, projection, map scale, scale-area relationships, and coordinate systems came into focus as the time line was drawn. The teaching of generalization relative to map scale followed this section and was succeeded by a concluding subunit on topographic map and aerial photographic interpretation.

The experiment on the teaching of generalization relative to map scale began when students in the ninth grade geography class were presented with a set of eight maps of the city of Baltimore, ranging in scale from 1:24,000 through 1:40,000,000. Students were asked to become familiar with as many qualitative and quantitative details as possible on all eight maps. Twenty symbols, reflecting significant areal characteristics, were selected by the class from the maps under study. These included, among others, primary and secondary roads, docks, airports, county boundary lines, contour lines, and city outlines. A chart was constructed (Figure 7) which required students to place all visible symbols beside each of the eight scale references of the city of Baltimore in a column headed "identifiable." Symbols not visible at each of the eight scale references were to be placed in a column headed "unidentifiable." It was stressed that all twenty preselected symbols had to be accounted for as either identifiable or unidentifiable for each of the eight scale references and recorded in the appropriate columns. As the map scale was further reduced from 1:24,000 through the series of eight scale references to 1:40,000,000, and their symbols recorded, it became apparent that important changes occurred in the representation of the physical, biotic, and societal features of the area under study. While most features could be depicted at 1:24,000 (only the city outline was listed as unidentifiable), a considerable number of them dropped out with each reduction in scale. It was observed that an important break occurred somewhere between maps drawn to the scale of 1:62,500 and 1:250,000. Symbols

BALTIMORE AND ADJACENT AREAS	IDENTIFIABLE SYMBOLS	UNIDENTIFIABLE SYMBOLS
R.F. 1:24,000		
R.F. 1:31,680		
R.F. (1904) 1:62,500		
R.F. (1944) 1:62,500		
R.F. 1:250,000		
R.F. 1:1,000,000		
R.F. 1:5,000,000		
R.F. 1:40,000,000		

Figure 7. Chart used in listing symbols found on each of the eight maps of Baltimore drawn to different scales.

for schools, buildings, gas and oil depots, cemeteries, and single track railroads moved from the identifiable column at 1:62,500 over to the unidentifiable column at 1:250,000. At the smallest scale, 1:40,000,000, all symbols moved into the unidentifiable column except the point symbol for the city of Baltimore. At the conclusion of the exercise, an inversely proportional pattern of symbolization was apparent between the two columns. The concentration of symbols had shifted from the identifiable column at the largest scale to the unidentifiable column at the smallest scale. The exercise visibly demonstrated that a change in map scale resulted in a change of symbolization which in turn altered the descriptive capacity of the map under study. The student's ability to generalize from maps, that is, to describe salient areal characteristics true of the greater part of an area under study, was clearly seen as a function of map scale. The inverse relationship of large scale—small area and small scale—large area was additionally reinforced in this exercise.

Two of the set of eight maps of the city of Baltimore were on the same scale: 1:62,500. However, they were made 40 years apart, 1904 and 1944 respectively. This set of two maps provided an excellent opportunity to compare and record significant differences over a 40 year span of time. Differences in city outlines, harbor facilities, central business districts, and suburban areas were immediately apparent. On closer study, students noted the expansion of the highway system, the increase in the number of railroads, the addition of an airport, and the enormous growth of the city's core region over the 40 year period. The elements of time and change were added to the concept of generalization relative to map scale.

Conclusions

The conceptual construct employed in this exercise attempted to expand the concept of scale beyond its immediate reference to comparable earth-map distances. It sought to help students view scale as the agent of geographic generalization. Since all problems in geography have a built-in scale factor which modifies a kind and order of descriptive generalization, the importance of understanding this conceptual construct becomes apparent. Each scale reference to the city of Baltimore had a corresponding reference to a certain level of descriptive generalization as indicated by the number of symbols recorded in the identifiable and unidentifiable columns. Movement up and down the scale afforded the student a view of a changing order of generalization.

The opportunity to put this learning to a practical test came later in the year in a unit dealing with the regional study of Southeast Asia. At the chorographic or regional scale, our reference to reality was on a broad order of generalization involving such element complexes as landform types, elevation, climatic types, and population density. At the topographic or local scale, the kind of generalization increased in complexity and involved element complexes related to such elements as slope, drainage, transportation, crop acreage, and farm and urban communities. At this point, it was observed that students were able to move with greater facility from chorographic to topographic scales and back with a correct reference to appropriate levels of generalization. Geographic horizons were considerably expanded as students began to consider and evaluate areal differences on the broad continuum from the planetary, or world scale, to the topographic, or local, scale in their investigations.

Paper No. 4

A Teaching Unit in Physical Geography

Frederic A. Ritter

The city school system of Baltimore, Maryland, offers a rather extensive program in geography at both the junior and senior high school levels of instruction. The High School Geography Project proved to be an important enriching and experimental adjunct, therefore, to an on-going program of content improvement and revision. In addition to providing a fund of geographic knowledge and a better understanding of geographic methods of inquiry, the experimental program gave senior high school students deeper insights into the kinds of contributions which a sound program in geographic education can make. The course was oriented topically in order to provide students with a wide range of experiences necessary for the accomplishment of this goal. Units were designed to integrate skills, attitudes, and understandings so that those enrolled in the course could work at progressively higher levels of complexity and geographic sophistication as each unit of work was introduced.

General Characteristics of the Course

The course was composed of seven units of work. The first four dealt with basic geographic knowledge, i.e., those aspects of the physical world necessary for an understanding of the economic and cultural patterns studied during the last three units. The first of the four introductory units dealt with the nature and scope of geography. Various definitions of geography were compared and contrasted, a brief historical sketch of the development of geographic thought was introduced, and students were led to examine the manner in which geographers solve problems and study areas. The purpose of placing this material at the beginning of the course was to acquaint students with the kinds of phenomena they were going to study, and more important, how they were going to study them. Emphasis was placed on the geographic methods of inquiry. Geographic terms were introduced and related to important concepts, thereby providing a foundation for the elaboration of these concepts in later units.

The second unit, focussed on the use of maps, was designed to develop proficiency in map reading and map interpretation. It included a review of latitude and longitude, an introduction to projections, a simple analysis of air photos, a study of topographic maps, and instruction on field mapping and map making. Since emphasis was to be placed on the use of maps in succeeding units, it was thought essential that students develop map-reading and map making skills at the beginning of the course.

A Unit on Climate

Following the unit on map understandings and the development of map-reading skills, students were exposed to an analysis of the physical elements involved in geographic studies. Unit three dealt with weather and climate. The basic objective of this unit was to help students better understand (1) earth sun relationships, (2) the elements and controls of weather and climate, (3) the characteristics and areal distribution of climatic types on a world scale, and (4) associations existing between and within climatic types. In the second part of the unit, emphasis was placed on weather processes in order to establish necessary insights into the cause of weather and climatic differences. The relations of weather and climate to human activities and to other natural conditions were also investigated. The necessity for including material of this nature was reinforced in Project seminars. Pitfalls in geographic reasoning often result from the overemphasis of physical elements, as well as the perpetuation of notions of cause and effect relationships between human and natural elements of the landscape. To further the development of the desired "indeterministic" attitude, time was taken at the start of the unit for class reports and discussion of articles which presented various views of the role of climate as related to the activities of man. This class activity proved to be a highlight of the unit from the standpoint of student participation and interest. In addition, it presented an excellent opportunity for the exorcism of residual deterministic attitudes of mind.

Succeeding lessons dealt with a general review of earth motions, causes of seasons, and characteristics of the atmosphere. Despite the fact that causes of seasonal temperature changes had been covered in detail in a required eighth grade geography course, it was found that very few students actually understood them. It may be pointed out that much of the difficulty associated with learning these causal relationships often arises out of the exclusive use of two-dimensional diagrams showing the orientation of the earth and sun, particularly at the time of the equinox. A device which admirably copes with this problem is a commercially produced, moveable, three-dimensional model of the earth and sun. This planetarium consists of a sphere representing the sun, mounted on a stand with a moveable arm supporting an inclined globe. When the arm is moved, the globe revolves around the sun, and at the same time a system of chains and gears rotates the globe maintaining the parallelism of the axis. By moving the globe to desired positions in relation to the sun, important variations in surface orientation can be demonstrated. The combination of this device and a chalkboard diagram helps students better understand the causes of seasons with greater ease (see Figure 8).

Succeeding lessons dealt with those aspects of the elements of weather considered basic to an understanding of climatic variations from place to place. Though each element was studied separately, relationships existing between elements and world patterns were emphasized. In the section on temperature, the following topics were considered: differences in latitudinal heat potential, horizontal and vertical distribution of temperature, adiabatic heating and cooling, causes and effects of the differential rate of heating and cooling of land and water, and primary methods of heating and cooling the atmosphere.

In the section dealing with pressure and wind, generalized world "models" were introduced early in the discussion to insure understanding of world weather patterns as well as weather processes. These "models" were used as a basis for a discussion of modifying agents in succeeding lessons. Such an approach proved effective in making the study of maps showing January and July temperature and rainfall differences more meaningful. While criticism has been leveled at the use of these "models" of pressure and wind, it is felt that they serve as a valuable tool in the classroom. They do not create erroneous impressions in the minds of the students so long as adequate treatment is given to (1) their highly generalized and stylized nature, (2) the modifications which are needed to reproduce realistic patterns, and (3) the amount of uncertainty presently existing concerning the real nature of circulation patterns. In addition to becoming acquainted with world patterns, *per se*, students were held responsible for a knowledge of these and other diagrams used in explaining various climatic phenomena.

Home assignments were concentrated on the development of broad patterns. They were closely keyed to textual materials and class discussions. Evaluation methods relied heavily on "pop" quizzes of more factual information. The major test at the end of the section on climatic elements was an essay type test aimed at measuring the degree to which students understood how the several climatic elements were related, and the level of their understanding of major generalizations.

Figure 8. Two students use the planetarium to explain the seasons.

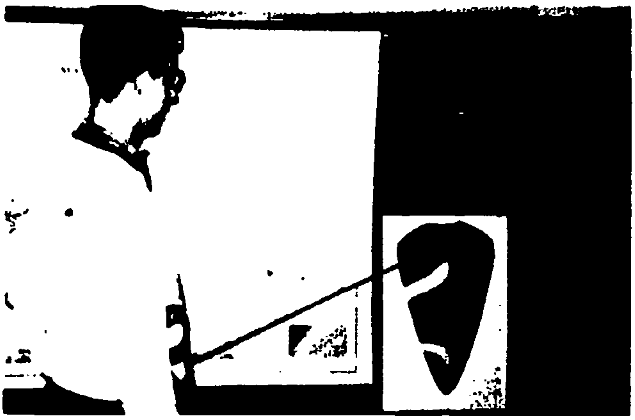

Figure 9. Charts were used to explain the mechanics of applying the Koeppen classification.

Figure 10. The hypothetical and actual distributions of world climates are compared on classroom-sized charts.

It was in the study of climatic controls, which followed the section on climatic elements, that amalgamation of factual knowledge into working generalizations was achieved. The controls were listed and discussed in detail in terms of component elements. Their relationship to world climatic patterns was demonstrated by use of a large diagram showing the distribution of climatic types on a hypothetical continent. Working from the background of the elements studied, and relying on retention of at least some of their previous contact with climate in the eighth grade, students were led through a deductive analysis of the pattern of climates as shown on a hypothetical continent (see Figure 9).

Once the hypothetical distribution was understood students were exposed to the actual patterns as shown on the map based on the Köeppen classification of climate. A comparison of the hypothetical and the actual climatic distributions led to questions concerning the meaning of letter symbols and the basis of the classification.

The background and basis of the Koeppen classification were presented and discussed in terms of the use of this classification. Mention was made of other classifications, but time was not taken to examine them in detail. Once the rationale of the Köeppen system was explained, copies of the classification were distributed and the mechanics of its application discussed. Classroom size charts with temperature and precipitation data were prepared for stations representative of humid climates (Figure 10). The classification of each station and the steps followed in making the classification were shown on the charts. Using these and duplicated data for other stations, students were taught to use the classification system for the humid climates. Consideration of dry climates was postponed until a fair degree of competence in dealing with the A, C, D, and E climates had been achieved. For the majority of the students it took several class periods to reach this level, although some students were able to grasp the mechanics of the classification system with remarkable speed.

Classifying stations having dry climates proved to be more difficult. Three factors seemed to cause most of the difficulty: improper selection of the correct formula for the rainfall regime; misunderstanding of the numerical values arrived at for the boundaries between humid and dry, and semi arid and arid; and simple errors in arithmetic. The following steps brought the majority of students to a point of efficiency in handling the entire system of classification:

1. Sheets describing the use of the formulae with examples of several stations.
2. Home assignments using the classification system.
3. Classwork with the system.

It is only fair to note here that for the slower students in the class, the system remained almost a complete mystery. Although they were able to understand its purpose, the mechanics lay outside the limits of their ability.

Cognizance was taken of the limitations and disadvantages of using the classification out of context with subject material. In order to make the system meaningful to the students, it was presented and used as a tool designed to assist in understanding the world pattern of climates. Emphasis was placed on its utility as a device for handling data and climatic descriptions, and for making comparisons within and between climatic types.

Students were not required to commit the classification system to memory. They were permitted, instead, to use descriptive sheets whenever they were classifying climatic data. Several stations were used to introduce each of the climatic types studied. These were supplemented with a climatic graph of a representative station. It was found that the combination of these two devices served adequately to introduce each of the climates studied, and to fix in the minds of the students key characteristics of each type. In addition to the rainfall and temperature regimes, students were held responsible for the major features of other weather elements, controls, and areal patterns. General associations of soil types, vegetation, and human activities as related to each of the climatic types were also studied. The important factors of each climate were listed on charts developed individually by the students as the study progressed.

The unit test was objective in nature and measured specific as well as general knowledge of world climatic patterns. The results were favorable and substantiated the impression that a high level of comprehension was achieved in all phases of the unit.

Conclusions

The students in the experimental program were generally average in ability (mean I.Q. of both classes was 99.7) although both slow and bright students were involved (the I.Q. scores ranged from 82 to 122). Much of the material presented and many of the understanding developed were above the level generally expected of average high school geography students. Because of this high level of attainment, and as a result of the enthusiasm evidenced by the students, it is believed that results indicate the feasibility of a general and rather substantial upgrading of high school geography courses.

Paper No. 5

A Regional Approach to the Study of Secondary School Geography

Peter Greco

Each autumn, secondary school geography teachers inherit groups of youngsters who have had little prior experience with geography. Their interests in the social studies have been very much influenced by history; their method of inquiry and first written presentations attend specifically to chronology. One event begets another. Time unfolds incessantly and perhaps quite clearly but like a vagrant, without a certain place of habitation. To be sure, the student properly informs his reader of the places in which events occur. He might even catalog, *seriatim*, as an unrelated introduction to his paper, the place characteristics which serve as the setting for the historical play. Seldom, however, does he mention and demonstrate how the elements of place are related to the historical occurrence and interrelated among themselves.

The facts that such an accumulation of uncoordinated facts has been referred to as "trash can geography" has no more caused its demise than have insistent pleas for unity in the social studies removed the barriers between its member disciplines. If the contents of a trash can cannot be presumed to be related simply because they share the confines of the same container, secondary school geography cannot merely assort descriptive facts into neat national boxes into which one dumps sundry details upon exposure. Unless relationships are shown, the course cannot be really geographic. Furthermore, as Isaiah Bowman once suggested, disciplines and departments are only academic conveniences. All social sciences attempt to assess the mainsprings of behavior of man and society, and since men and societies exist in time and are also vitally linked to the elements of place, history, geography, and the other social sciences not only have the right but also the obligation to trespass into each other's baliwick. Unless relationships with other social studies are shown, a course in geography cannot fully play its part in the general, non elective, high school curriculum.

In order to organize geographic facts, or things that tell us something about place, either a topical or regional emphasis might be followed. In the first instance, primary attention is given to a certain phenomenon, its distribution around the world, and the relationships between this distribution and the areal patterns of other phenomena. In the case of regional geography, on the other hand, the emphasis is less on a phenomenon and more on a specific area. The focus is on the localized associations of phenomena which make that area distinctive, or a "region."

For the purpose of experimentation within the High School Geography Project it seemed reasonable to develop a course focused on the world of nations, which are at the outset vaguely familiar to secondary school students. Accordingly, to serve the goal of assessing the mainsprings of social behavior and to develop "world-mindedness," a regionally-oriented course rather than a topically-organized course was developed.

The regional framework selected was that of culture areas.[1] For each region the class examined how people occupied the land, what physical or cultural characteristics distinguished that area from other areas, and how these localized associations of phenomena might be explained. We analyzed national and subnational areas for elements which, when synthesized, furnished us with the area's personality or what Redfield called "a persisting integration of dispositions to behave," the way of life of a people. This integration was comprehensive and useful, providing students with practical understandings of societies and their public policies. To that end, the delineation of the character of a place drew upon any related subject in physical and social science to the extent the students and teacher were capable.

To illustrate how this was accomplished, let us inquire into a portion of the performance of one student to whom was assigned the task of (1) analyz-

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[1]Roy Price (ed.), *New Viewpoints in the Social Sciences*, Twenty-eighth Yearbook of the National Council for the Social Studies (Washington: The Council, 1958), chap. iii.

Preston James (ed.), *New Viewpoints in Geography*, Twenty-ninth Yearbook of the National Council for the Social Studies (Washington: The Council, 1959), chaps. i, ii, x.

American Council of Learned Societies and the National Council for the Social Studies, *The Social Studies and the Social Sciences* (New York: Harcourt, Brace and World, Inc., 1962), pp. 42-87.

Jesse Wheeler, J. Trenton Kostbade, and Richard Thoman, *Regional Geography of the World: An Introductory Survey* (Second Edition; New York: Holt, Rinehart and Winston, Inc., 1961).

Rhoads Murphey, *An Introduction to Geography* (Chicago: Rand McNally and Co., 1961).

Preston James and Nelda Davis, *The Wide World: A Geography* (Second Edition, New York: The Macmillan Co., 1962).

Clyde Kohn and Dorothy Drummond, *The World Today: Its Patterns and Cultures* (New York, McGraw-Hill Book Co., Inc., 1963).

ing the development of the Humid Pampa as a great food-producing area, and (2) comparing its localized associations with those of the American Middle West. In this paper, for reasons of brevity, that portion of student inquiry on the comparisons is omitted. This does not mean that comparison is unimportant in regional studies. If, however, the distinctive stamp of a place is revealed through a number of meaningful interrelationships, likenesses and differences between it and other comparable places can be accomplished readily enough.

During the era of Spanish colonization in South America, the level Humid Pampa of Argentina was for a long time tributary to the Andean highlands. In the latter area, precious ores were exploited by large local Indian populations. Beef cattle and sure-footed mules were bred on the tall grassland country south of the Rio de la Plata to meet the needs of highland communities for food and beasts of burden. As time passed, the Spanish longhorn, as a result of the moderate climate and rich pastures, increased in number.

Meanwhile, in Europe, the people of Britain made the fateful decision to become an island of factories and began to look for overseas food producers to feed the new industrial workforce. The Spanish longhorns were rounded up on the huge *estancias* of Argentina and their chilled flesh was shipped to Britain on newly invented refrigerator vessels (1877). The quality of the beef, however, was inferior to British standards and, consequently, in Argentina there began a program of careful stock-building with imported pedigreed animals.

Improved stock required improved pasture grasses. In the deep, well-drained, well-structured, and rich alluvial and loessial soils of the Humid Pampa, long-rooted, nutritious alfalfa can be grown with relative ease. How could the tall native bunch grass and the thick sodded European grass be replaced? The *estanciero* had only the desire to enjoy the luxury made possible by his many thousands of acres. While he relied upon his crude and hardy gauchos to manage his herds, they too showed disdain for agriculture.

Another historical phenomenon provided the solution to this problem. When southern Europe began to disgorge hundreds of thousands of landless poor to the Americas, Argentina was one of the destinations in the movement. Especially in the 1880's, the *estanciero* was able to avail himself of numerous sharecroppers who, by breaking the ground, planting wheat, and promising to leave the land under alfalfa after a short tenancy, gradually improved the pasture. The alfalfa crop, harvested and fed to the improved stock was the basis for great prosperity. By the 1880's, British capital, flowing to Argentina, influenced the rise of industries related to the pastoral economy and also funded essential economic overhead such as railroad development. In an area where road-building materials were not available in the fine deep soil and where the terrain was quite flat, railroad construction became very significant. Beginning in 1857, railroads more effectively tied the Humid Pampa to its overseas markets and contributed to the rise of Buenos Aires as a primary shipping center in the wester hemisphere. A whole variety of physical and cultural factors, unfolding consecutively or concurrently thus made the Humid Pampa great. It *is* Argentina.

There are many implications in such a classroom exposition of what constitutes the Argentine heartland. They might be specifically related to the Humid Pampa or Argentina or related more generally to world-wide events. They may be physical, cultural, or physical-cultural. For example, does the student understand how the Pampa soils came to be almost one thousand feet deep in places, so pebble-free, so rich, so well-drained? Can the student empathize with the Argentine land baron who lives sumptuously while he frustrates great numbers of land-hungry tenants from acquiring land of their own? Can the student offer reasons for the support of the dictator Perón by the urban industrial labor force?

The analysis of open ended questions couched in a culture area context permits the student to be free-wheeling in his investigation and allows him to understand societies against a background of a great range of related phenomena, not the least of which are geographic. The pursuit of the hows and whys of things, to the extent they can be known or surmised, makes inquiry worthwhile and understanding real.

Paper No. 6

Changing Attitudes and the High School Geography Project

William D. Pattison

On the basis of my tenure as director of the High School Geography Project, 1961-63, I wish to make some general observations on relationships between geographers, on the one hand, and high school teachers and students, on the other.

First, the professional geographer's attitude toward both the high school teacher and student is now undergoing unmistakable change. Not surprisingly, during the past fifty years or so of parallel growth on the part of the high school and of professional geography, separateness has been the rule. The Association of American Geographers, with a journal aiming "to stimulate scholarship and to provide a medium for the exchange of findings," has been little concerned, for most of this period, with the needs of high school instruction. But with the founding, a few years ago, of the Joint Committee on Education of the Association of American Geographers and the National Council for Geographic Education, these professional organizations began to take cognizance of those needs, and more recently, through the High School Geography Project, to deal in detail with them. Of course, such a committee and such a project always run the risk of isolation, since the parent organizations, relieved of the responsibilities assigned to them, become free to turn their attention elsewhere, but in the present instance a strong "follow-through" has operated against this possibility. Specifically, geography in the high school has been made a regular subject of discussion at annual AAG and NCGE meetings, project newsletters have gone out to all AAG and NCGE members, laying a record of progress before them, and, at the annual meeting of the AAG in September, 1963, high school teachers were placed on the program and accorded special listing in a campaign for expanded membership. Partly, at least, as a result of these measures, the geography profession in general has begun to adopt a new image of the high school teacher as a crucial interpreter of the profession's thought and work to the American society at large, including not only college-bound youth but also those who will not go on to higher levels of education.

In speaking of changes in the profession's attitude toward the high school *learner*, I must confine my evidence to conferences and conversations to which I have been a party, and through which various professional geographers have contributed to the Project during the past two years. At the beginning of the project's life, the prospective learner was seen by many of these professionals as a recipient, who was to learn largely by watching demonstrations. As time passed, and especially during the academic year 1962-63, the learner came to be seen more and more as someone acting rather than being acted upon. Finally, in the project's *Response Paper* (August, 1963), I was able to report that training of the student to demonstrate that he can "do the things that geographers do" had won acceptance, from substantially all geographers carrying responsibility for the project, as *the central objective* of the project's efforts. The high school student thus emerged as a prospective producer, quite as much as a consumer—a creator of research papers, maps, regional delimitations and hypotheses.

Second, attitudes in the reverse direction, from high school teacher and student to professional geographer, deserve comment. Although ideas entertained about geography and geographers are not known to be altering yet in any appreciable fraction of the nation's twenty or so thousand high schools, I feel confident that the Project has greatly advanced the development of a particular technique that can promote future favorable change. This procedure is based upon explicit reference, in formal instruction, to "the geographer's way" as a model or type of behavior believed to be accessible to the well taught high school student. In a newsletter released toward the end of the project's second year these comments appeared:

> In inducing participation in "the geographer's way," most of the teachers have tended to rely primarily on a liberal, varied, and frequent use of maps, [leading to] demonstrations of effective student thinking in terms of location and spatial distribution.
>
> The teachers have been able to show that there are many roads open to the geographer's goal of flexible, non-stereotyped thinking about the relations between man in society and his natural environment. In general, they have been able to guide their students toward an appreciation of earth materials as resources, and hence as variables dependent for their significance upon the "attitudes, objectives, and technical skills" of the social organizations putting them to use.

The favorable reaction of experimenting project teachers to "the geographer's way" as a broad concept conditioning institution is reflected in each of the papers contributed by teachers to the present volume.

The most important consequence of this expressed concern with geographers would appear to have been a shift, first among the teachers and then among their students, from a view of geography as subject matter to be acquired to a conception of geography as a field of inquiry and a manner of knowing. Promoting this shift in several cases was the direct classroom use of current geographic literature, including articles from the *Annals* of the AAG and the *Journal of Geography* of the NCGE.

Third, and last, an observation is in order on the possibility that the proceedings of the Project, during its first two years, will have a lasting effect on the self image of American professional geography. I can say that for myself, at least, a new vision of the field has taken shape during this time, resulting directly from the discharge of my duties as a broker, so to speak, for ideas passing between geographers and teachers. In this view four distinct but affiliated traditions are seen as binders that operate in the minds of geographers, preventing disarray in their collective efforts. Adequate identification of these traditions promises to expedite greatly the task of strengthening the tie between professional and pedagogical geography, but more to the present point, it promises to have constructive effects within the profession itself. The traditions are:

1. *A spatial tradition*, the key to which is mapping. Thought, in this tradition, concern itself with positioning and layout on the surface of the earth, together with movements from place thereon.
2. *An area studies tradition*, made familiar to many Americans during the past twenty years, in principle, by interdisciplinary area studies programs. Within geography, the aim of area studies has long been recognized as that of character determination, the task, in this kind of organization of knowledge, being to establish and communicate the individuality of parts of the earth.
3. *A man land tradition*, in which the purpose of investigation is to illuminate the significance of habitat in human affairs and the role of man-in-society in changing the face of the earth.
4. *An earth science tradition*, embracing study of the earth, the waters of the earth, the atmosphere surrounding the earth, and the association between earth and sun. From this tradition springs what is, almost without a doubt, morally the most valuable concept in the entire geographic heritage, that of the earth as a unity.

In general, geographers have tended to rally to differing definitions of their field, with divisive consequences, any single definition usually having allowed one of the above-listed traditions to dominate over the others or even to exclude its fellows. If in the future American geographers should move toward acceptance of the pluralism that is inherent in their field, the Project will probably have a strong claim to gratitude. This may be said even granting that eventual acceptance may not rest upon ratification of the particular four part legacy described above. Of the literally scores of representative geographers who have come together to offer help to the high school through the Project, many have gained conviction from their experience that no single point of view ought to prevail, and that both school and profession will best be served by a multiplicity of approaches.

Paper No. 7

Additional Challenges and Responsibilities

Henry J. Warman

It was my privilege and responsibility, during the academic year 1962-63, to serve as field coordinator for the High School Geography Project. In this capacity, I worked directly with the ten experimenting and twenty coordinating teachers, their administrative officers, and the thirty professional geographers in nearby colleges or universities who had been selected to serve as consultants. I was able to visit each classroom teacher at least twice, and several as many as five times during the ten-month period. On these visits, units of study were discussed and analyzed in light of suggestions put forth in the *Advisory Paper*. At first, very little information, if any, was transmitted to each of the teachers concerning units of study developed by others in the Project. This policy was adopted in order to give each participant in the Project an opportunity to create a course on his own. Later in the year, however, as new, different, and often quite exciting units were developed by several of the teachers, a different policy was followed. Thereafter, the more challenging ventures were shared with everyone involved in the Project.

During the course of the year, a number of questions were raised by school administrators concerning the place of geography in the high school curriculum. These questions, which I attempted to answer as they were asked, merit the consideration of the Geography profession as a whole. For the most part they pertain to the nature of Geography, to the kinds of concepts and understandings that need to be developed at the high school level, to the geographic method of inquiry, and to means of evaluating the student's mastery of both concepts and methods of analyzing problems geographically. Specifically, the ten questions asked repeatedly follow:

1. Why is geography in itself important?
2. Why should geography be introduced into the program of studies at the high school level?
3. If so important, why hasn't more been done about introducing geography into the high school curriculum before now?
4. Why not research present endeavors to teach geography?
5. How might experts in geography bridge or mend the split between physical and cultural geography?
6. Should geographers write textbooks in Physical Geography, Economic Geography, Political Geography, and Cultural Geography so that secondary school leaders can make a choice among them?
7. What do geographers think secondary school leaders need, or ought to establish, as courses? How long should a course be?
8. a. How and where can administrators find materials and geographers to assist them in determining scope, content, and placement of geography courses?
   b. Where can administrators find specialists and teachers who will do the kind of job the geography profession wants done?
9. a. Where can administrators and teachers-in-service be schooled in the new ideas developing in geography?
   b. Do we not need specialists in geography education?
10. What might be the nature of a geography "Advanced Placement Test" to be given to prospective and entering college freshmen?

In responding to these ten questions, I drew most liberally upon the work of the Joint AAG-NCGE Committee on Education, the Working Group drawn from the geography profession, the Advisory Paper of the High School Geography Project, and on my own experience and commitments. While it would be presumptuous to think that the questions were answered fully and adequately, some kind of a response was expected and consequently made.

Question #1: Why is geography in itself important? In response to this query, items such as the following were used to verify the importance of the discipline: the human desire to know about other places and peoples; the critical importance of a knowledge of geography to any nation in formulating its domestic and foreign policies; the need for geographic understandings in planning community development and growth; and the contributions which a knowledge of geography makes to planning one's own future. The exact and relative location of peoples, places, and things, and the significant interrelationships among phenomena, plus other factors in regions of varying scale, are often topics of popular concern. The spatial associations of physical and cultural phenomena, and their variations from place to place call for careful study before they can be understood. The need for establishing areal associations, rather than for providing a mere collection of facts, was discussed at great length with a number of the school administrators. The ramifications of these discussions are so vast that space does not permit a full treatment of them in this chapter.

Question #2: Why should geography be introduced into the program of studies at the high school level? When this question was raised, I generally responded to it by raising alternative questions. For example, I would ask, "When a high school senior is awarded his graduation diploma what does he know about those parts of the world where well over half the world's people live—the Near East, the Far East, Southeast Asia, Africa South of the Sahara?" If the answer was, "Very little," or "Nothing," then the next question I would ask was, "How can a student obtain such information when the standard high school courses in the social studies, or social sciences, are Civics, American History, World History, and Problems of Democracy?" Still another question related to this was, "If information of this nature is to be obtained in World History classes, how much time will be allocated to acquiring it?"

School administrators were quick to recognize that if the United States is to become a world leader, American students will need to know more and more about the nature of the world in which they are living, and, in particular, more about the cultural geography of its inhabitants.

One of the experimental units developed during the course of the year dealt with the "Un" problems of the world—the uneducated, the undeveloped, the under-nourished, and the under-developed. Are these problems not worthy of serious study by high school students, giving their geographic aspects adequate attention?

Question #3: If so important, why hasn't more been done about introducing geography in the high school curriculum before now? Reference to the history of geography teaching at the high school level was found helpful in responding to this question. When the world, and especially our nation, was being settled and developed, first a physical and then an economic geography were made available. As time went on, the content of the physical geography course was incorporated into an Earth Science course; the economic geography course was commonly downgraded until only the poorest students elected it. The kind of course now proposed by the High School Geography Project is quite a different sort of program. It calls for a modern treatment of modern problems, but more significantly, it invites the better mind, not just the potential dropout or noncollege-bound student. The study of element-complexes and of culture worlds and culture realms, the construction of models, and the treatment of growing urban areas and of population explosions are a far cry from the so-called "old" physical, economic, or regional geography courses of the past. In other words, the kind of geography instruction needed for today and tomorrow is not the kind that was offered yesterday or yesteryear. Modern techniques also go along with modern subject matter.

Question #4. Why not research present endeavors to teach geography? In responding to this inquiry, it was pointed out that considerable work along these lines has already been accomplished, and that the Working Group of the High School Geography Project had concluded that geography was not playing an adequate role at the secondary school level. It was also noted that in those instances where instruction in geography was being offered in "fused" courses in the social studies, attention was generally given to the physical environment—landforms, climate, soils, minerals, vegetation and animal life—with a perfunctory nod to map reading. The spatial relationships and interactions of physical and cultural phenomena, with mankind as the catalyst or controlling factor, simply did not appear. As coordinator, I am delighted to report that in some school systems serious efforts are being made to upgrade the teaching of geography, and that there is an eagerness on the part of several school adminis rators to reorganize the school program to include the teaching of geograpl y.

Question #5: How might experts in geography bridge or mend the split between physical and cultural geography? Replies to this question varied according to the school offerings, and the sequence of these offerings. For example, if a school offered Earth Science, followed by a course in Geography, it was suggested that this sequence be offered in the 8th-9th grades, or 9th 10th grades. If both were offered in the same year, then closer cooperation between teachers was suggested. In fact, in some instances, this was already being accomplished in an effective manner. Where no clear-cut lines between the two courses were visible, the units suggested by the Advisory Paper were discussed.

Question #6: Should geographers write textbooks in Physical Geography, Political Geography, and Cultural Geography so that secondary school leaders can make a choice among them? Quite obviously an easy answer to this inquiry might be, "the more the better." But "better" instruction in geography is not necessarily achieved by multiplying the number of textbooks available. The burden of selecting the "right" text for a particular course still rests upon the persons assumedly competent to make such a choice. The treatment of restrictive environments, politically-defined regions, culturally oriented areal units, urban agglomerations, and geographic techniques should affect the decision.

Question #7: What do geographers think secondary schools need, or should establish, as courses? How long should a course be? The answer to the first of these two related questions has already been indicated. It was pointed out that the High School Geography Project, through its *Advisory Paper*, had suggested that certain units be tried by the experimenting and operating teachers. I was able to point out, as the year progressed, that units had been developed which together would require more than one semester course in Geography to complete. For example, one unit on France took three weeks to prepare and three weeks to teach. A unit on the Soviet Culture Realm took one third of a semester.

Although some units of study might be included in World History courses, it is not possible to accomplish the objectives set forth in the High School Geography Project in a course that does not extend for a full year.

Question #8: How and where can administrators find materials and geographers to assist them in determining the scope, content, and placement of geography courses? And, where can administrators find specialists and teachers who will do the kind of job the geography profession wants done? In responding to this question, it was pointed out that just as new mathematicians and physicists had to be trained and old ones "re-treaded" to teach the new mathematics and science programs, so too would teachers of geography have to be retrained. Summer institutes and work shops will be needed to accomplish this objective. The several professional geographic publications are carrying more information than ever before concerning the availability of these institutes. A new curriculum guide[1] for geographic education has been published and many Liberal Arts Colleges and Universities are beginning to supply new substantive courses as well as work in methodology for geography teachers.

Question #9: Where can administrators and teachers-in-service be schooled in the new ideas developing in geography? Do we need specialists in geography education? A portion of this question has been answered above. Lists of Earth Science and Social Science propects, grants, and proposals may be obtained from the National Science Foundation, the Ford Foundation, and the Cooperative Research Branch of the U. S. Office of Education. School administrators have been invited to cooperate in many of these efforts to upgrade our secondary school programs of study. It should be pointed out that there is a real need for specialists in geography education. Relatively few professional geographers are giving enough time or conducting needed research in the teaching of geography at the elementary and secondary school levels.

Question #10: What might be the nature of an Advanced Placement Test in geography to be given to prospective and entering freshmen? During the course of the year, I became impressed with the ability of high school students to handle materials originally prepared for the college level. Textbooks, workbooks, map exercises and the like were

[1] Hill, Wilhelmina, *Editor*, "Curriculum Guide for Geographic Education," *Geographic Education Series No. 3*, National Council for Geographic Education, 1964.

used by many of those studying under the direction of the thirty experimenting and cooperating teachers. Naturally the question arose about having these youngsters repeat their learning experiences at the college level. Advanced placement tests are now being given in several fields of learning including English, the foreign languages, mathematics, and in some of the sciences. Surely a test in geography would be as appropriate. Those who pass the courses now being developed for the high school student should be given an opportunity to take an Advanced Placement Test in Geography before registering for some of the courses offered at the freshman-sophomore level. The Joint Committee on Education, as well as the Liberal Education Committee of the Association of American Geographers, have evidenced an interest in the preparation of such a test.

The foregoing answers to the ten questions most frequently asked by school administrators during my year as field coordinator for the High School Geography Project need to be considered further by those interested in upgrading the teaching of geography at all levels of instruction. They present many new challenges and responsibilities that should not be ignored.

Paper No. 8

Some Comments About a Structure of Geography with Particular Reference to Geographic Facts, Spatial Distribution, and Areal Association

Edwin N. Thomas

The discipline of geography is changing. Burton has called this change a "quantitative revolution" and has asserted that the revolution is over.[1] Whether we agree with his position or not we cannot turn our backs on it. It is with us and its eventual appearance seems to have been inevitable, arising as it does from the basic nature of man's quest for knowledge. The answers to initial, simple questions more often than not stimulate more sophisticated questions, answers to which call forth expanded frames of reference and more incisive analytical tools.

What are some of these changes? Marble has specified that there is a growing tendency for geographic research to be motivated by a desire to understand certain theoretical structures of a general nature rather than to continue the emphasis on studies whose goal is primarily the description of a small portion of the earth's surface. In many of these studies, great care has been taken to specify that the motivation for the particular undertaking arises out of interests that geographers have maintained for many years.[2]

As an outgrowth of the conscious desire to maintain continuity between past and present research, certain very basic concepts have been identified and certain terms representing these concepts have been incorporated into our geographic vocabularies. The attempts to maintain continuity have not been altogether successful because much of the discipline has not been informed of the terms or the definitions that have been developed. The goal of this paper is to present and discuss three of these basic concepts: geographic fact, spatial distribution, and areal association.

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[1]Burton, Ian, "The Quantitative Revolution and Theoretical Geography," *The Canadian Geographer*, Vol. 7 (1963), pp. 151-162.

[2]Marble, Duane F., "Some Remarks on the Training for Professional Geographers," a paper delivered to the National Council for Geographic Education, unpublished.

An Overview of a Structure of Geography

The limited number of concepts which have been considered recently by geographers have been selected according to one common professional stimulus. This stimulus is the need to identify, within the vast corpus of geographic thought and research, a logically consistent conceptual system. By this, I mean a system in which a limited number of basic concepts are identified and then employed or synthesized to define additional terms of a more sophisticated or complex nature which then are employed to define even more complex terms, etc. The topics to be discussed in this chapter are introduced in approximately the same sequence as they occur in the conceptual structure.

Let us now try to provide a general overview of the entire conceptual system. We will attempt to do this in only the most general way hoping this overview will provide a framework upon which to place the various concepts to be discussed.

In general, the system follows this structure. First, we have the basic notion of a *geographic fact*. Geographic facts, once defined, may be expanded into the concept of the *spatial distribution*. The notion of the spatial distribution may be developed, in turn, into the concepts of *spatial interaction* and *areal association*. Then the concept of the *region*; may be synthesized from the notions of the spatial distribution, spatial interaction or areal association, depending upon the type of region one wishes to treat, i.e., its degree of complexity or sophistication. However, the definition of the term, region, is such that there is no logical inconsistency when one develops the regional concept from the notions of spatial distribution, spatial interaction or areal association. The concept of *scale* may be treated as another basic concept which enters the system at an elementary level and then continues to operate throughout it, modifying particular geographic facts, areal associations, spatial interactions and regions.

Diagrammatically, we have

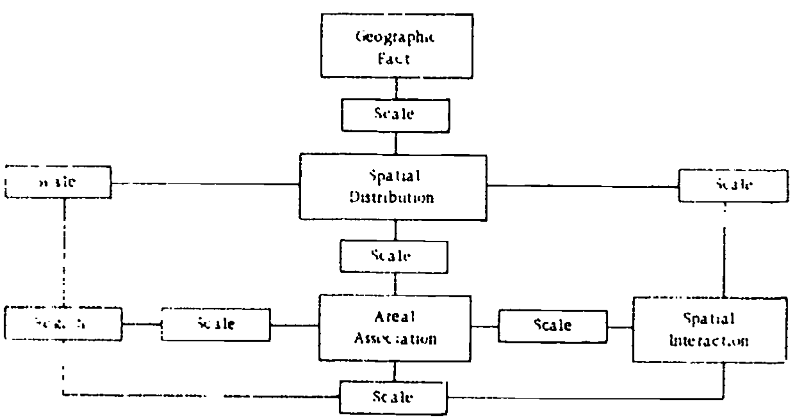

Figure 11. A Structure of Geography.

Geographic Facts, Spatial Distribution and Areal Association

Having briefly surveyed a general structure of geography let us now treat geographic fact, spatial distribution and areal association in some detail. This discussion will be primarily definitive and descriptive; the logical pattern and the substantive, geographical precedents recognized in developing the concepts will not be specified because of the orientation of the paper and because of space limitations. However, concrete examples of the notions will be provided.

Geographic Facts. To provide a sound and complete, extended definition of the term geographic fact we should first appraise the efforts of science in general and the philosophy of science in order to establish a rationale in which to couch our definition. Next, based on our considerations of the philosophy of science, we should define the meaning of facts. Finally, we should state and support the premise that geography is a science and following, we should consider geographic facts as a kind of scientific facts. Restrictions of time or interest do not permit us to follow this intellectually satisfying procedure. We must begin directly with a definition of geographic facts built upon our intuitive understanding of the terms employed in the definition.

To begin our definition of geographic facts we must accept one general statement: there are no facts which are exclusively and uncontestably within the domain of the geographer to investigate or treat. This is the case, in part, because of the nature of geography and partially because of the unified nature of science. As a manifestation of the latter character, one may note the emergence in in recent years of such interdisciplinary areas as bio-chemistry, bio-physics and astro-physics. Alternately, we may note that there are certain kinds of factual statements in which the geographer has no professional interest and with which he cannot deal. In this category, are the kinds of facts which, *as they are stated*, have no explicit locative element. "Butter sells for 79 cents a pound" is an example of the kind of fact in which we find no explicit statement of location. Contrariwise, "Butter sells for 79 cents a pound in Tempe, Arizona" is an example of a factual statement which may have utility to geographers. Clearly, the two statements are not identical; we have more information in the latter than we do in the former.

It should be noted at this time that the argument, "All events take place somewhere and hence, everything is subject to geographic inquiry," is invalid within this framework. To be sure, all "real world" events do take place somewhere but until the geographer is provided with a statement in which the location of the event is made explicit, he does not have the information of a kind which has *utility* to him. Summarily and in a general way, we may state that geographic facts are those facts in which the geographer has had a traditional professional interest although he may not have an exclusive right to deal with them.

We have not, as yet, provided a crisp definition of geographic facts. We have merely asserted that there are kinds of facts which are of interest to geographers and other kinds which are not of use because they have no locative elements. More precisely, we will now state that *geographic facts are facts which refer to the character of a place of the quantity or quality of some phenomenon which occupies a place at a given time.*

It is a definitive characteristic of geographic facts that they have three components. First, we have the event or occurrence, the character or the quantity or quality of some phenomenon; second, we have its location, the specification of its place or place of occurrence; and third, we have the time at which the event was observed.

Additional commentary about place is in order. Thinking about its most general application, we state that *place is a portion of two dimensional space.* Traditionally, geographers have been concerned with portions of earth space but, in the future, the study of other celestial bodies may be possible and should aero-geography, the geography of Mars, develop, our definition will still be appropriate. Defining place as a portion of two dimensional space has another advantage. We must remember that while studying places on the surface of the Earth, or other celestial spheres, utilizes two dimensional space, places also may be studied in three dimensional space, e.g., portions of three dimensional space are subjects of inquiry in astronomy. Defining place in two dimensions shows cognizance of the connections between geography, astronomy and other disciplines which have a spatial orientation while, at the same time, differentiating between geography and some of the others.[3]

Having considered place, let us now focus attention on location. A place can be identified, i.e., its location specified, in one of three ways. First, we have mathematical specification--by either grid or polar coordinates. Grid coordinate locative systems are the ones with which we are most familiar: places are specified as being positioned north or south, and east or west of some origin. Using polar coordinates, the location of places is specified by distance and direction from some origin point. To state that Swamp Hollow is 78 miles northeast of Central City is specification of the location of a place by the polar method.

It is apparent that distance is essential to specifying location by the polar coordinate method. It seems worthwhile to note, therefore, that we can identify at least three different distance notions, each of which is important to geographers. First, we can identify direct earth distance defined as the number of earth distance units, e.g., miles or kilometers, separating two places. Second, we can note economic distance in which the separation between places is expressed in monetary, dollar, or time, hour, units. Maps showing the dollar and time distance relationships between places have proved to be

[3] The connection between geography and astronomy was early recognized by Sten De Geer in "On the Definition, Method and Classification of Geography," *Geografiska Annaler*, (1923), pp. 1-37.

useful for research and teaching in various aspects of economic and urban geography. Psychological distance is the most difficult distance concept to define and the one about which we know the least. In general, what we are referring to is the way people perceive various earth and economic distances. We suspect that individuals may perceive distances differently; in response to a great many factors, e.g., their income, the time of the day, or according to weather conditions. However, we do not know the full category of factors which affect the perception of distance nor do we know the extent of the effects. Unfortunately, the limitations of space and knowledge do not permit a more complete discussion of distance here.

Let us now return to our consideration of location. A second method of specifying the position of places is relative location. This method is similar to that used when specifying by polar coordinates but is much less precise. In this method we merely specify generally the location of a place relative to some other, such as closer or farther, or upstream or downstream from some reference point. To state that New Orleans is south of Chicago is to specify the location of New Orleans relative to Chicago. Finally, we can recognize nominal location, in which reference is made merely to the name attached to some place, such as Chicago or the Tennessee River Valley.

Nominal and relative locations frequently can be translated into mathematical locations and *vice versa* (by reference to an atlas or reference map), e.g. the nominal location, Detroit, can be prescribed mathematically as latitude 42.20 N. and longitude 83.W, whereas latitude 36.2N and longitude 112.8W can be translated into the Grand Canyon.

We also note that relative location and location by polar coordinates contain a reference to at least two places. To give the location of New Orleans relative to Chicago (New Orleans is south of Chicago), involves reference to the nominal locations, New Orleans *and* Chicago, whereas giving the location of Chicago relative to Detroit and New York City (Chicago is nearer to Detroit than to New York City) requires three nominal locations.

It seems worthwhile, at this point, to clarify and contrast what is meant by character, quality of phenomenon, and quantity of a phenomenon as these terms relate to a place. First, let us consider the quality of a phenomenon; in this instance we are merely considering the *kind* of event (within some general category) that has occurred. For example, we may be considering the general category, vegetation, and identify that a particular farm field (place) is occupied by corn; corn being a particular kind of vegetation. Similarly, suppose that our goal is to prepare a land use map of a particular urban place. During the preparation of the map we determine that a particular parcel of land is devoted to commercial use. In this instance, the general category involved is the way land is used; the specific kind of use is for commercial purposes.

Treating the quantity of a phenomenon involves determining, first, whether the kind of phenomenon is present or absent and then measuring its magnitude. Let us again use corn production as an example. As contrasted with the qualitative problem discussed above, now we are interested not only in the mere presence of corn, but also in the amount which is produced. For a particular parcel of land the parcel may be a farm field, or it may be a county because the size of the area is not an issue here) we establish first that corn is produced and then determine "how much" is grown. Depending upon our problem, we may inquire into "how much" in terms of acreage, total yield or yield per unit of area. Similarly, if we are interested in the human population of an area, we first inquire into the presence or absence of human beings in the various parcels and then we may determine the total number of people occupying the parcels or the number of people per unit of area.

Characterizing a particular place involves synthesizing information about several phenomena which occupy it. An example of a geographic fact which characterizes a place would be the statement that the area near the mouth of the Mississippi River is swampy. To assert that the particular area is swampy, it is necessary to synthesize information concerning the condition of the soil, vegetation, relief, etc.

Synthetic statements which generally characterize places are of necessity less precise than statements relating to the quality or quantity of the phenomena which occupy them. However, while losing precision about one category or kind of phenomenon which occupies a place, we gain greater general information about many phenomena which are present. If our knowledge about a place is meager, there may be advantages in establishing this more general information. Employing the earlier example in which we characterized a particular place as swampy, we can see that if little is known about the place there may be greater utility in knowing this more general informational fact than there is in knowing precisely the density of cypress trees.

Spatial Distribution. Scientists in general do not deal with one fact. They assemble many of them and then attempt to make generalizations concerning the behavior of the phenomenon which these facts represent.

Geographers also pursue research in this way. In fact, assemblages of geographic facts have been a focus of the discipline of geography and certain assemblages have been of such great significance in the discipline that they have been given a special name, i.e., *spatial distributions*. Most simply, *a spatial distribution is defined as a set of geographic facts representing the behavior of a particular phenomenon or characteristic of many places.* We must recognize the existence of both "real world" spatial distributions such as those portrayed on most maps and hypothetical distributions such as those shown in Figure 13.

The definition given above is recommended by its brevity; however, three points require considerable amplification in order to explicate the more subtle connotations of the term, spatial distribution. The first point to be specified is that the relationship between the concept, geographic fact, and the concept, spatial distribution, is close and direct. Spatial distributions are defined as sets or assemblages of geographic facts. Thus, many geographic facts concerning the behavior of some phenomenon must be determined in order to establish what the spatial distribution of the phenomenon is.

The second point that must be emphasized is that the locative, temporal and indicative or characteristic information about the behavior of the phenomenon in question must be maintained. This is the case because of the definition of geographic facts which was employed earlier. That all three elements of each geographic fact in the set must be maintained when considering a spatial distribution is sometimes overlooked. For example, when inspecting a choropleth map entitled "Hog Production in Iowa by Counties: 1960" we are very much aware of the presence of two elements of the geographic facts, i.e., (1) the quantity of the phenomenon, hog production, and (2) its place of occurrence, a county. However, we may tend to overlook the fact that the production occurred in 1960. The first two elements are maintained in the body of the map whereas the third, the temporal element, is specified in the title. Where on the map the element is maintained is immaterial; the important aspect is that it is specified somewhere. The temporal element of a spatial distribution is frequently maintained only casually, as in the above example where it appears only in the title. However, when treating spatial distributions which are highly dynamic temporally or when executing a geographic study in which the changes in the spatial distribution are the essence of the investigation, such as in migration or innovation studies,[4] maintainence of the temporal element is absolutely essential.

A third point about spatial distributions which requires specification involves their portrayal. If geographic facts are collected and then portrayed in some way so that one or more of their basic elements is lost then the resulting collection is no longer a spatial distribution. For example, assume we have available to us a set of geographic facts indicating the behavior of some hypothetical phenomenon, X. If we graphically array the facts in a graph, as in Figure 11, we have lost the locative element even though we may maintain the characteristic and temporal information. A graph like the one shown in Figure 12 is called a histogram.

Many times the geographer is confronted with the problems of assembling geographic facts from diverse areas of the earth's surface into a special distribution and then portraying this distribution without losing its basic characteristics. Traditionally, the map is the device which the geographer has employed when facing this problem. By utilizing a map the geographer can graphically array a spatial distribution without losing the important locative, temporal and indicative information contained in each component geographic fact while maintaining information concerning the general shape, distance,

[4]For an example of this type of geographic investigation the reader is referred to Hagerstrand, Torsten, "The Propagation of Innovation Waves," *Lund Studies in Geography*, Series B, *Human Geography*, Royal University of Lund, Lund, Sweden (1952).

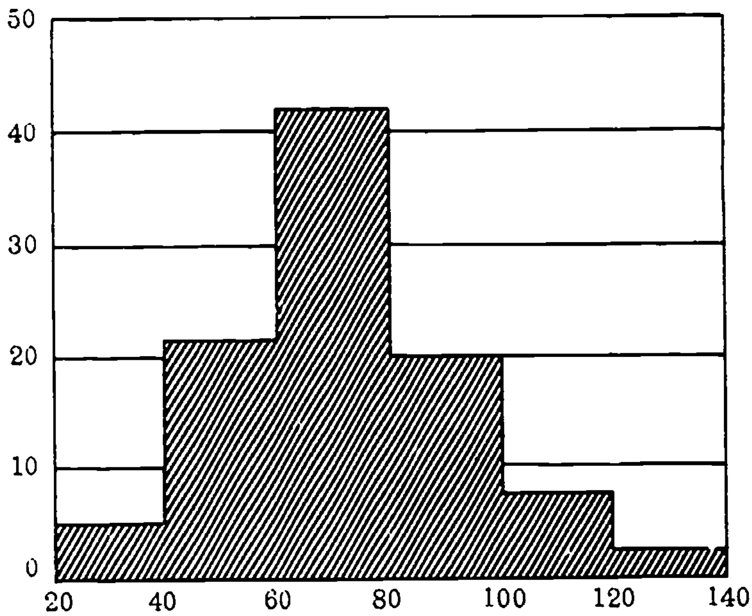

Figure 12. **Histogram: Phenomenon X, Area A, 1950. Source, hypothetical.**

direction and size of relationships which exist in the "real world" between the individual facts. These latter general relationships give the spatial distribution being investigated its specific character.

The relationship between map and spatial distribution, is very close. In fact, a good basic definition of a map is: a map is a graphic portrayal of one or more spatial distributions in which the areal and spatial relation between the geographic facts comprising the individual distributions is maintained. We must bear in mind, however, that a map and a spatial distribution are not synonomous. A map of a particular spatial distribution is merely a particular kind of graphic portrayal of the distribution and frequently more than one spatial distribution is portrayed on a single map.

Because the map maintains the elements of each part while also maintaining the general areal and spatial relationships which occur between the facts, it provides the geographer with a clearer visualization of the "real world" spatial distribution than he could secure from other methods of portrayal.

The map may be of great assistance to a geographer in two ways. First, the map of a spatial distribution may be valuable to a geographer when he is attempting to describe that particular distribution; second, the map may also be helpful when a geographer is attempting to explain the distribution.

The latter use of the map is especially common in the initial phases of an investigation about the behavior of a phenomenon which is only vaguely understood and is exemplified in a recent report on the incidence of jaw cancer in African children and leukemia in American children.

> The African disease offers the best chance to date of proving a relationship between a virus and a form of human cancer. and may help to explain why American leukemia cases sometimes appear in clusters-- a phenomenon that has led to suspicions of an infectious element in leukemia.
>
> What makes the African tumors interesting to researchers is their geography. They occur clear across the continent, and down the east coast as far as Lourenco Marques. Since they are found in children of all races, their cause is not likely to lie in ethnic facts. But there are two cutoffs: the tumors do not occur in children living above about 5,000 ft., or in areas with less than 20 in. of annual rainfall. The map of African tumor occurrence, with its highland islands of tumor free children, almost matches the maps for yellow fever and one form of sleeping sickness.[5]

By portraying the occurences, or geographic facts, of jaw cancer on a map, scientists were able to see the "real world" spatial distribution and thereby formulate an explanation which was not readily forthcoming from other methods of inspecting the data.

Having defined and discussed the characteristics of spatial distributions in a general way, we now may turn our attention to their basic elements. All spatial distributions are composed of three elements, each of which is independent of the others and by which distributions can be generally characterized.

The three elements which all spatial distributions share are pattern, density and dispersion. *The pattern of a spatial distribution is defined as the areal or geometric arrangement of the geographic facts within a study area without regard to the size of the study area. The density of a spatial distribution is defined as the overall frequency of occurrence of a phenomenon within a study area relative to the size of the study area. The dispersion of a spatial distribution is defined as the extent of the spread of the geographic facts within a study area relative to the size of the study area.*

The definitions given above can be illustrated by comparing and contrasting six simple hypothetical maps which are shown in Figure 13. The difference between pattern and density and their independent effect is exemplified in Figures 13a and 13b. On both maps the patterns of the phenomenon is uniform because all dots are arranged so as to be equally spaced from each other. However, the densities, or frequencies of occurrence relative to the size of the areas, are different. For the map shown in Figure 13a there are 27 dots per sq. inch while on 13b there are only 12 dots per sq. inch. Contrariwise, on

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[5]"Children, Virus and Cancer," *Time*, October 5, 1962, pp. 56-57.

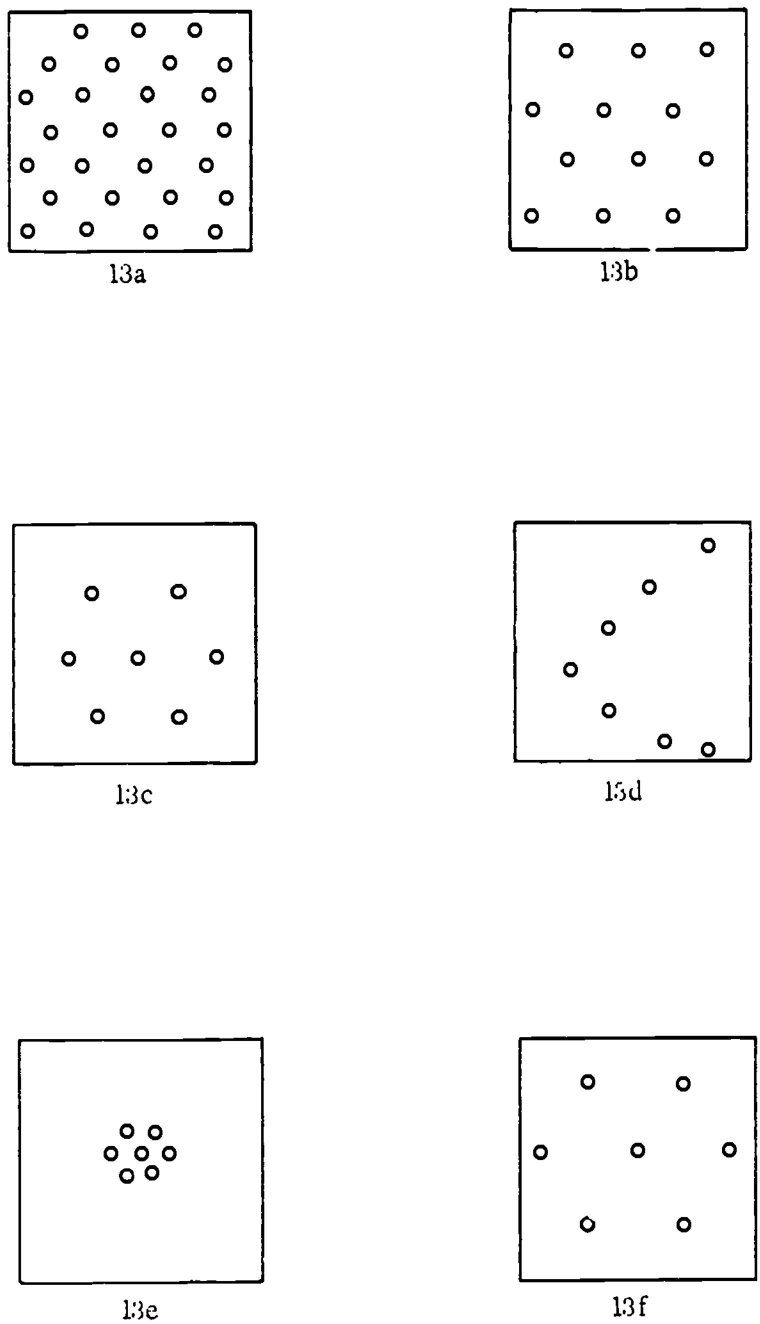


Figure 13. An Illustration of the Differences between Pattern Density and Dispersion of a Spatial Distribution.

the maps shown in 13c and 13d different patterns are shown but the densities are the same. Clearly pattern and density are characteristics of spatial distributions which may operate independently of each other. On Figures 13e and 13f, attention is focused upon dispersion. On both maps, the density of dots is the same, 7 per sq. inch. The patterns are the same also because pattern is defined as arrangement without regard to the size of the study area. However, the dispersion of the dots, the extent to which they are spread over the study area, differs. Clearly, dispersion also may operate independently of pattern and density.

It appears worthwhile to note briefly at this time that geographers subscribe to the notion that by analyzing, comparing and contrasting the elements of spatial distributions for a particular phenomenon in different study areas or for several phenomena in the same study area, basic understandings of the phenomenon or the relationships between phenomena may be suggested that are not readily brought to mind by other forms of analysis. This notion is very important; it appears to provide an indispensable part of the foundation for the entire discipline of geography. It seems reasonable that one of the teaching goals of geographers sincerely concerned with general education in the public high schools would be to provide students with an understanding of this aspect of the discipine of geography so that the students would have this general approach available for the solution of some of the problems which they will encounter in the course of everyday living.

At this point we have defined spatial distributions in general and have discussed their basic characteristics and elements. For the purpose of completeness, it now is necessary to identify two basic kinds of spatial distributions which we may encounter. One kind of spatial distribution is the continuous, and may be defined as a spatial distribution in which occurrences of the phenomenon in question occur at all points within a study area. Air temperatures, barometric pressure and elevation above sea level are phenomena which form spatial distributions fulfilling this requirement because at any and all points within a study area temperature, pressure and elevation are present. The other kind of basic spatial distribution is the discrete, and is defined as a spatial distribution in which occurrences of the phenomenon in question are separated by areas of nonoccurrence within the study area. Maps of gravel pits are maps which form discrete spatial distributions because each pit in the area is separated by a finite distance from all others.

Whether a particular phenomenon is treated as a discrete or a continuous spatial distribution is to a considerable extent a function of factors other than the intrinsic character of the phenomenon. Such practical considerations as the goals of the investigation, the availability of data, and the costs attendant to executing the study may affect the way in which a particular phenomenon is treated. Very frequently, phenomena which occur discretely in the "real world" are considered within the context of a specific problem as being continuously distributed. This situation may be exemplified as follows. We know that most manufacturing is done in buildings and that these buildings are separated from each other. The value added by manufacturing (defined by the Bureau of the Census) might be studied geographically, building by building, but this is not done because such data are difficult to secure. However, the value added by manufacturing is available by county units and a number of geographers have studied the value added by manufacturing by counties in the United States. In this latter case, "value added" is for practical reasons treated as a continuous variable.

Spatial distributions which are composed of geographic facts which are truly discrete in the "real world" but which are treated in the context of a particular study as continuous are said to be logically discrete but treated continuously.[6]

It is important to note that spatial distributions of the same phenomenon within the same study area for the same time period may appear differently depending upon whether the phenomenon is treated as spatially discrete or spatially continuous. In addition, even if a particular phenomenon is treated as a continuous spatial distribution, differences in appearance also may occur if the size of the unit areas for which the data are collected is changed. For example, information concerning "value added" is available by State Economic Areas and states as well as by counties and the spatial distributions based upon these different-sized unit areas have different appearances.

These points are easily seen if we refer again to geographic facts. A geographic fact is the character of a place or the quality or the quantity of a phenomenon which occupies a place at a particular time. By modifying the sizes of the places for which we secure information we may in effect change the data concerning character, quality or quantity. Now, spatial distributions are defined as sets of geographic facts; hence if we have changed the individual facts in the set we may also change the appearance of the overall assemblage, i.e., the spatial distribution.

Areal Association. To this point we have been discussing geographic facts and spatial distributions. We must note at this time that determining geographic facts or mapping spatial distributions are not the sole aims of geographic research. These two activities, although necessary, may be considered as aspects of the data collecting and descriptive portions of the discipline.

The research aspects of geography also include analytical phases. In fact, it is the analytical endeavors of geographers which hold the greatest promise for the continued development of the discipline. One of the concepts which provides the philosophical rationale for much geographic analysis, both past

[6]This perspective on spatial distributions is analogous to the treatment given statistical series in which data are considered to be discrete, logically discrete and continuous. These notions as they relate to statistical sereis are discussed by Edward E. Lewis in *Methods of Statistical Analysis in Economics and Business*, pp. 68-69.

and present, is that of *areal association.* It is to a discussion of this important concept that the remainder of this paper is devoted.

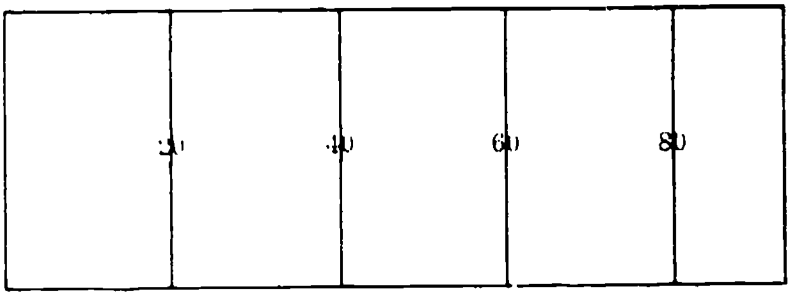
One of the basic notions to which geographers subscribe is this: If, within a given study area, the spatial distributions of two or more phenomena are similar, then those phenomena are somehow related. We may go somewhat further and state, as a corollary, that the greater the similarity between spatial distributions, the closer will be the relationship between the phenomena which they represent. It is from these straightforward and simple notions that the concept of areal association arises.

Most succinctly, *areal association is defined as the similarity within the same study area between two or more spatial distributions determined by information collected for the same unit areas.* The notion can also be defined in terms of geographic facts. Remembering that spatial distributions are assemblages of geographic facts, we may in turn define areal association as the similarity between the two or more sets of geographic facts collected for the same unit areas.

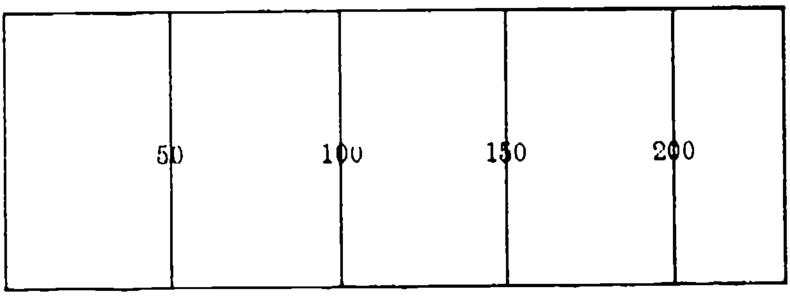
Additional comment about the definition of areal association is required in order to provide more complete understanding about the concept. First of all, we must make explicit what is meant by the similarity of spatial distributions. We can readily see that if the highs and lows of two spatial distributions coincide, that those distributions can be considered as being similar. This situation is exemplified in Figures 14a and 14b. In this instance, the association between phenomena Y and X is said to be positive. However, when the relationship between phenomena is negative, the spatial distributions also may be said to be similar. In this instance, high values of Y occur in the same places as low values of X, as illustrated in Figures 14c and 14d. In the former, we may state that the areal association between Y and X is positive and in the latter that it is negative.

Let us next turn our attention very briefly to the instances when the concept of areal association provides an appropriate research rationale. In the definition presented earlier, we referred to spatial distributions or sets of geographic facts determined by information collected for the same unit areas. This means that each of the phenomena for which we are collecting information occurs, in general, within each unit area into which the study area is divided. For example, when studying total population and the number of retail establishments in the Middle West, using county-sized unit areas, we expect both phenomena to occur, in general, within each of the counties located in the study area. Hence, an inquiry into the similarity of these spatial distributions is appropriately cast within the analytical framework provided by the concept of areal association.[7]

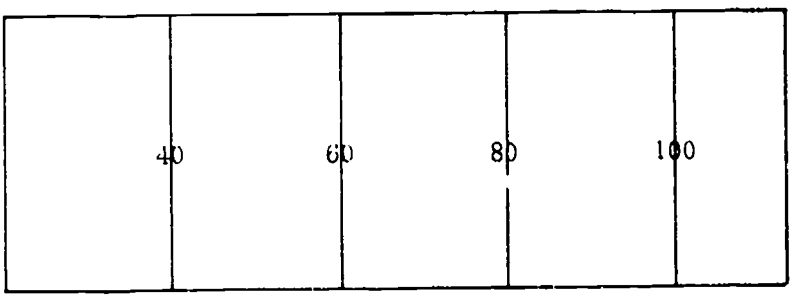
[7]If the phenomena being considered, in general, do not occur within the same unit areas, then another analytical rationale is required. One such framework which frequently is employed is spatial interaction. Within this framework, we may consider the relationship between events, geographic facts, which are separated by some "real world" distance.



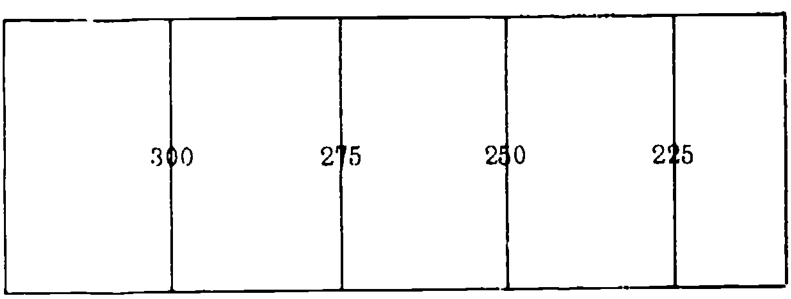
14a. Isopleth Map of Hypothetical Phenomenon Y, Study Area A, 1962.



14b. Isopleth Map of Hypothetical Phenomenon X, Study Area A, 1962.



14c. Isopleth Map of Hypothetical Phenomenon Y, Study Area B, 1962.



14d. Isopleth Map of Hypothetical Phenomenon X, Study Area B, 1962.

Figure 14. Similar Spatial Distribution which Illustrate Positive and Negative Areal Association.

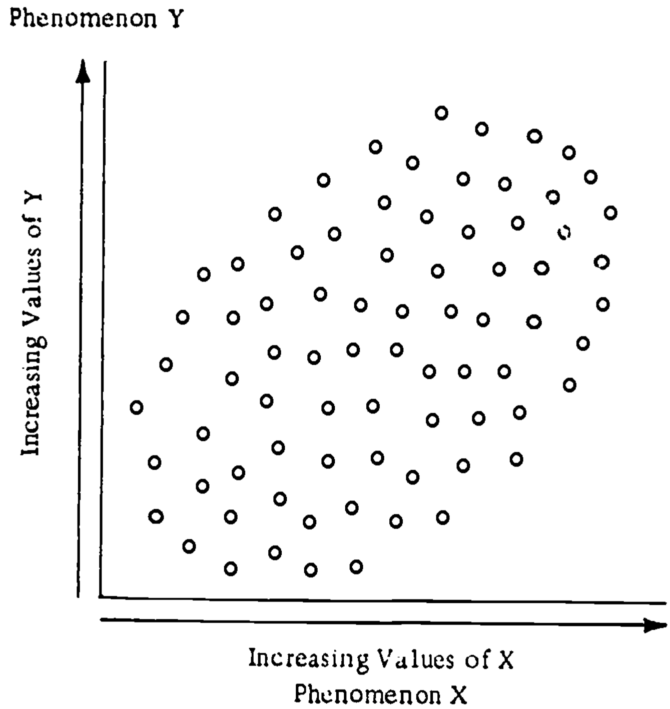
The discussion in the preceding paragraph is related to the circumstances under which the concept of area association is appropriately applied. Let us now consider briefly how the concept may be employed. The concept is most frequently employed to secure information about a particular spatial distribution. By comparing the particular spatial distribution with others, the geographer is able to identify a single phenomenon or several phenomena which are areally associated with that one which is the central focus of the investigation. Those phenomena which are areally associated with the particular phenomenon are said to "explain" it. However, within the context of a particular research project, the geographer is not satisfied with merely establishing that two or more spatial distributions are similar. He also strives to determine the process which leads to the similarity. For example, a geographer may note that within a particular study area, a map of population growth looks very much like a map which portrays growth in the number of persons employed in manufacturing. He then may note that people are apt to migrate to places to secure jobs and, hence, assert that the desire for employment accounts for the similarity between the two maps.

Before concluding our remarks on the concept of areal association it is necessary to discuss, at least generally, how areal associations are established, i.e., how we may determine whether or not two or more spatial distributions are, in fact, similar.[8] For our purposes, we may identify two approaches: one general set of techniques involves visually determining whether or not spatial distributions are similar; the other general approach involves the use of statistical techniques to establish the similarity.

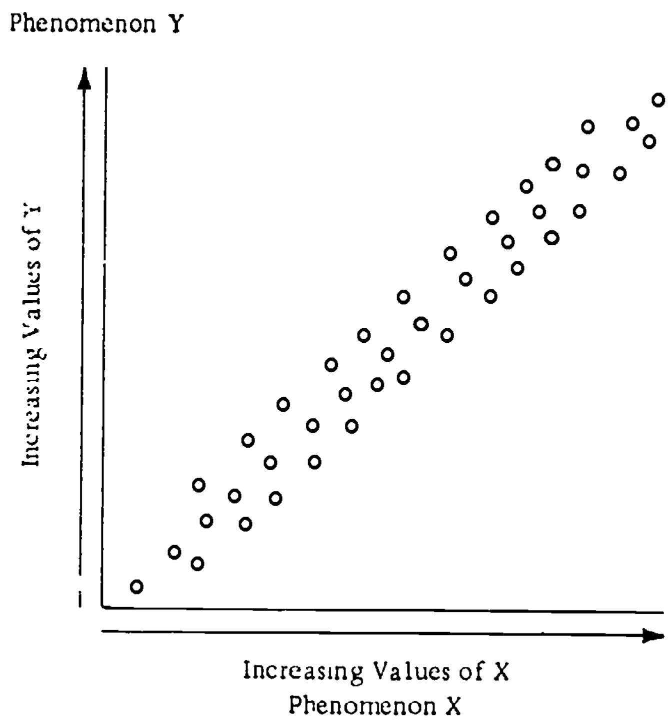
One of the visual approaches is traditional in geography: it involves the visual comparison of two or more maps. Using this approach, maps of several spatial distributions are prepared and then inspected to determine whether or not the various phenomena, when mapped, form distributions which appear to be similar. Another visual approach for establishing areal associations involves the use of the scatter diagram.[9] On a scatter diagram two sets of data may be portrayed. If the various dots which represent values of both phenomena appear to be widely scattered over the entire area of the graph, as on Figure 15a, then the two phenomena are considered to be only slightly related; the patterns of the spatial distributions will be dissimilar and the areal association between the distributions is slight. Contrariwise, if the dots representing the values are grouped closely around a straight line or some recognizable curved line, as on Figure 15b, then the conclusion is that the phenomena are quite closely related, i.e., that the phenomena are closely associated areally. When the patterns of spatial distributions are complicated, the scatter diagram may be a more effective tool for determining areal associa-

[8]The writer sincerely apologizes for the very cursory treatment given this topic. However, there is a voluminous literature on the methods of establishing areal associations, much of which is quite technical. This section of the paper is devoted merely to introducing the topic.

[9]The use of scatter diagrams is discussed in most elementary statistics books.



15a



15b

Figure 15. Scatter Diagrams Showing Spatial Distributions which are Slightly and Closely Areally Associated.

tion than a map because on a scatter diagram the extent to which the highs and lows of the distribution correspond is more easily seen.

Use of statistical methods to determine areal associations adds a great deal of precision and concreteness to a particular investigation and allows the geographer to cope with research situations which otherwise might frustrate his efforts. For example, by using statistical techniques the geographer can handle the problem which frequently arises in geographic research in which several spatial distributions which are only vaguely similar are considered. In this case, no firm statements can be made about the areal association obtaining between the distributions. However, using statistical techniques, this problem can be overcome.

The statistical methods used most commonly to measure areal associations are simple and multiple regression and correlation. These techniques are discussed in most elementary statistics books. Any further discussion of them would be inappropriate in this paper.[10]

[10]The preparation and visual analysis of maps and scatter diagrams appears to be clearly within the ability and commensurate with the training of high school students. It is doubtful that more than a very few upper division students could cope with the arithmetic manipulations involved in the statistical treatment. This is an additional basis for dispensing with the statistical approach summarily.