

RELOCATION AS AN ADJUSTMENT TO
FLOOD HAZARDS

By

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PREFACE

This study is concerned with the residential relocations undertaken by the victims of the flood caused by Hurricane Agnes in the Wyoming Valley, Pennsylvania. The primary objective is to determine any relationships that may exist between these relocations and the victims' perceptions of the hazard, their past experiences with flooding, and their incomes.

I would especially like to thank Dr. Richard D. Heacock, my major advisor, for all of his assistance, cooperation, and understanding. I also want to thank my other committee members, Dr. Douglas C. Kent and Dr. John F. Rooney, Jr., for their valuable input to this study.

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CHAPTER 1

INTRODUCTION

Flood Plain Development Patterns

Man has historically been attracted to flood plains as areas in which to carry out his activities. The fertile alluvial soils characteristic of river valleys have been a primary reason for the development of thriving agricultural industries. For example, "some of the world's great civilizations have developed in the bottom lands of major rivers, notably along the banks of the Tigris and Euphrates, the Nile, the Indus, and the Yangtze" (Sewell in Chorley, 1969, p. 121). In addition, rivers are frequently used as transportation corridors, thus influencing the development of the flood plain. "Many of today's urban giants originated as small settlements on navigable rivers..." (Yeates and Garner, 1971, p. 48). This was especially true at "break of bulk" points where goods and materials had to be transferred from one mode of transportation (waterways) to others (roads, railways).

Once settlements on flood plains arose, they prospered because of several other attractions offered by these areas. Flood plains provide level land for the construction of houses, businesses, and factories. They are close

to a constant source of water for domestic and industrial uses. In the past, prior to the adoption of water quality standards, the proximity to rivers made waste disposal an easy task. Yet, flood plains do not offer areas that are merely economically attractive for development. They also provide a social enticement to development. More specifically, in many areas, these are prestigious locations for private homes (Sewell in Chorley, 1969, p. 121).

All of these factors have served to encourage and stimulate the development of flood plains. In fact, it is estimated that approximately ten million people in the United States presently reside on flood plains (U.S. Office of Emergency Preparedness, 1972).

Problems with Flood Plain Development

Yet, "to flood is a natural characteristic of rivers and a flood is defined as discharge in excess of channel capacity. Thus the flood plain is a normal part of the river during times of exceptional discharge" (Leopold and Langbein, 1960, p. 44). Therefore, ten million people in the United States are subject to flooding at some time or another and to the losses that may result from this flooding. "Flood losses are direct or indirect, according to the action..." (Hoyt and Langbein, 1955, p. 78). Direct damages are the most obvious in that they consist of losses to physical property and loss of life.

Indirect damages, on the other hand, are not immediately evident. They include such things as the loss of business, profits, and income. In addition, indirect damages involve the costs of safeguarding health during a flood, social distress and dislocations, and such things as the added costs of rerouting mail and traffic (Hoyt and Langbein, 1955, p. 78-79).

Table I shows the trends in both property losses and the loss of life due to floods.

TABLE I
DIRECT FLOOD LOSSES

	1936- 1945	1946- 1955	1956- 1965	1966- 1969	1970	1971
Lives Lost	953	808	557	N.A.*	135	74
Property Losses (in mil. dollars)	1484	3350	2721	N.A.	225	288

* Not Available

Source: U.S. Bureau of the Census, 1974

Although statistics of losses for 1972 and 1973 are not included in this table, it appears that these will be the highest ever recorded for any single flood event. The U.S. Department of Commerce estimates that the catastro-

phic floods of June, 1972 caused 236 deaths and over \$100 million in damages at Rapid City, South Dakota. The eastern states experienced 118 deaths and \$3.8 billion in damages from flooding caused by Hurricane Agnes. In addition, the heavy losses in the Mississippi Valley in April and May, 1973 have added substantially to the total. "There is evidently a slow decline in the death rate from floods, but per capita damages have certainly not fallen and may well be rising sharply in spite of high levels of expenditure on flood control..." (Visvader and Burton in White, 1974, p. 225).

Moreover, urbanization has had several unfortunate effects with regard to flooding. The construction of parking lots, roads, sidewalks, and the like merely serve to waterproof the ground. Before such developments, part of the rain water percolated into the ground and was absorbed. Now, however, most of this rain water cannot be absorbed because the soil is covered. Instead it becomes runoff. This runoff has a greater volume and a much faster flow, thus increasing the flood hazard in times of unusually heavy or prolonged rains. Storm sewers were introduced in order to keep the streets from flooding. They, too, add to the increase in volume of runoff. "Lagtime -- from the peak of rainfall to the peak of runoff -- is decreased by the impermeable surfaces and by storm sewers" (Thomas, 1969, p. 23). Downstream developments may experience increased flooding

because of this. In addition, they may experience mudflows (a mixture of sediment and rock that is supersaturated with water) if there is not an upstream debris basin to intercept the flow (Rantz, 1970, p. B 10).

The construction of buildings, bridges, pipelines, and sewer outlets become obstructions for the flood waters. They prohibit these waters from finding "...their way to the sea in the natural channels and over their normal flood plains" (Hoyt and Langbein, 1955, p. 9). Greater damage can be caused by this retarding action. In addition, the most popular means of controlling floods involves the construction of dams. Whereas they may succeed in reducing the damage from normal flooding situations, they may also serve to increase the damage in severe flooding situations. Possible difficulties with this method of flood control "...are the occurrence of adverse third party affects, either upstream or downstream from the protected area and the probability that the designed level of protection will be exceeded and catastrophic losses will occur" (Sheaffer, Davis, and Richmond, 1970, p. 24). In addition, intensified downstream development often results because of an instilled false sense of security due to the presence of a dam located upstream.

In summary, it appears that the more intensified development of flood plains is causing a rise in property losses due to floods, although it is difficult to

distinguish between true flood damages and reported flood damages (as affected by inflation). On the other hand, improved warning systems have served to reduce the toll that floods have taken on human lives.

Perception of Natural Hazards

People perceive floods and other natural hazards differently. According to Robert Kates,

Variation in the perception of a specific natural hazard (expectation of future occurrence and of personal vulnerability) can be accounted for by a combination of: the way in which characteristics of the natural event are perceived, the nature of personal encounters with the hazard, and factors of individual personality (Kates, 1970, p. 441).

He states that the characteristics of natural events that may cause such variations are the victims' perceptions of magnitude, duration, and frequency, and the perception of the temporal spacing of the event.

As might be expected, hazard perceptions differ significantly among cultures. Thus in comparing a pre-industrial farming area in Nigeria (Dupree and Roder in White, 1974) to a developed area such as Florida (Ward in White, 1974), it was learned that the farmers near Yelwa, Nigeria believe that they are "...at the mercy of the elements and in the hands of God" with respect to drought (Dupree and Roder in White, 1974, p. 118), whereas the citrus growers of Florida adjust and respond rationally to the hazard. Once the growers

have assessed their alternatives and made their decisions concerning responses to the frost hazard they review the consequences of their actions and this becomes an input that will influence their subsequent decisions (Ward in White, 1974, p. 145).

Perceptions of natural hazards may vary among areas within the United States. A study of the ways in which Northerners and Southerners cope with the tornado threat, undertaken by John Sims and Duane Baumann, revealed that "...Southerners place more weight than Northerners on a force external to themselves - God - as a causal agent in their lives. They consequently feel themselves to have relatively less power in the determination of their own futures" (Sims and Baumann, 1972, p. 1389). In addition, the Northerners (as represented by residents of Illinois) proved to be more action-oriented than the Southerners (Alabamians).¹ Perhaps the most important finding was that:

The respondents from Illinois were characterized by an acceptance of technology and authority - they use the expertise of professionals in forecasting and communications when confronting the possibility of a tornado. Alabamians do not. They ignore these functions of the social system; for them, the encounter is between man and Nature (Sims and Baumann, 1972, p. 1391).

"Attitudes can promote or reduce disruption" (Rooney, 1967, p. 557) and can, therefore, affect one's perception of a hazard. In a study of the urban snow hazard in

¹This difference may be due to the fact that most of the tornadoes occurring in the South occurred at night, while those in the North occurred during the day, so the victims were more apt to take action.

seven cities located in Western and Midwestern United States, Rooney found that "most of the persons queried ...tended to underestimate the hazard potential of snow, considering it to be more of a nuisance than a serious problem" (Rooney, 1967, p. 557). These perceptions differed, however, between the West and the Midwest. "There is reason to believe that people hold the hazard in higher esteem in the Midwest, as evidenced by the existence of more sophisticated snow-control programs in that area" (Rooney, 1967, p. 557). Rooney also found that community adjustment to the snow hazard "...is explained largely by community decision-making and perception" (Rooney in Chorley, 1969, p. 400).

In the case of floods, Jacquelyn Beyer observes that

The greater the frequency the more accurate is the perception of the flood hazard by flood plain occupants and the greater is the willingness to consider a wider range of adjustments, including alternative sites for their activities (Beyer in White, 1974, p. 267).

However, it is questionable as to exactly how great an effect one's experience with flooding has on his perception of the hazard and, consequently, on his responses to the flood. For instance, "once occupance is well established, a change to land uses less vulnerable to flood losses rarely seems to occur chiefly as a result of floods" (White, 1964, p. 11). In addition, a study of Blairstown, New Jersey revealed that there was little

relationship between knowledge and/or experience and the expectancy of a future flood. A modest relationship was found between the expectancy of floods and an individual's interpretation of the nature of flood events (Beyer, 1967, p. 16).

The Adjustments to Floods

It is only after understanding how people perceive and respond to hazards, in particular flood hazards, that one can evaluate the adjustments that are available in order to minimize future flood losses. Each of the following adjustments may be appropriate for some situations, but not for all. At times, a combination of several may prove to be most effective. Some of the adjustments may be adopted by individuals while others call for a group effort.

The two most popular adjustments are that of individuals bearing the loss and flood control projects (i.e. bank stabilization, channel improvements, flood retarding structures, etc.). Bearing the loss is, perhaps, the most poorly conceived of all the adjustments. If floods have been experienced in the past, this adjustment will rarely be undertaken. Instead an attempt will be made to prevent future flood losses. Flood control projects, on the other hand, encourage occupancy of the flood plain.

Flood plain occupants may take the construction

of a dike or dam to mean that there will never be any more flooding. Consequently more and more people move in, and activity in the flood plain intensifies (Sewell in Chorley, 1969, p. 130).

Other possible adjustments include public relief, emergency action (sandbagging), structural change, flood insurance, and land use regulations.

Public relief is usually set up by voluntary organizations, by the government, and/or by friends and relatives. The disadvantages of this adjustment stem from the fact that this is not permanent relief and that it hinders the adoption of any measures to reduce future flood losses. Emergency action, on the other hand, does not discourage flood plain occupance, but it forces the potential victims to take positive measures toward minimizing losses.

Structural change, or flood-proofing, involves the modification of structures to repel flood waters as a means of reducing losses. These measures, such as the construction of walls with impervious materials and the closure of low-level windows, can be very effective, but they are quite costly. Therefore, structural change tends to encourage flood plain development, but it makes the resident aware of the great costs associated with such a location.

Flood insurance was not available until December of 1973 when Congress passed the Flood Disaster Protection Act. Prior to this, such insurance was virtually

non-existent because it was unprofitable for the private insurance industry to offer such policies. Insurance alone would not be likely to discourage flood plain occupance or reduce losses. However, the Flood Disaster Protection Act not only makes it mandatory for flood prone communities to apply for flood insurance and for the property owners to purchase flood insurance if available, but it also requires that state and local governments institute and enforce zoning of flood hazard lands (HUD News, 1974).

Most planners and researchers believe that land use regulation is an important adjustment in that it forces the consideration of the relative advantages of being in the flood plain versus location elsewhere. The argument follows that since flood plain land has a variety of potential uses, an attempt should be made to determine those uses that can afford to locate in the hazard area without being susceptible to serious flood damage. Such land use changes can be achieved through zoning ordinances, subdivision regulations, etc. (Sewell in Chorley, 1969; Beyer, 1967).

Relocation, or removing oneself from the hazardous area permanently, is an extreme measure and is rarely undertaken, as shown in the previous section (White, 1964; Beyer, 1967). However, next to bearing the loss, it is perhaps the easiest adjustment for an individual to undertake. Whereas it may prove to be quite costly

at the outset, relocation insures that one will not be flooded in the future - therefore preventing any future flood losses (and related costs).

The Research

Planners need to know as much as possible about how decisions concerning the flood hazard are made (Beyer, 1967, p. 1). These decisions are based primarily on the perceptions of the hazard. That is, if one believes that a flood was a "once-in-a-lifetime" occurrence, he will decide to do little to protect himself against future flood losses. If, on the other hand, he understands the nature of occurrence of such extreme events and views the occurrence of a future flood as a very real possibility, he may attempt to minimize his potential future flood losses. Thus, not only must planners be aware of the differing perceptions of floods, but they must also be aware of how these perceptions affect the decision-making processes of the victims.

According to James,

Individuals respond to flood hazards through four key decision processes... . These are 1) the process of selecting a location for occupancy, 2) the process of perceiving the flood hazard, 3) the process of formulating a personal response to the perceived hazard, and 4) the process of formulating a position on what the government should do about hazards (James, 1974, p. 5).

Considerable research has been undertaken concerning the first, second, and fourth factors (White, 1964;

Beyer, 1967; Sewell in Chorley, 1969; James, 1974). But little work has been done concerning the process of formulating a personal response to the perceived hazard. Previous research has concerned itself with those who have continued to reside on the flood plain. But what about those people who responded to a flood by seeking a higher, safer location for residency? How do their perceptions differ from those who decided to stay? What implications does this have for planners concerning the dissemination of information concerning the hazard? How can such knowledge affect the choice of adjustments that will be made?

Problem Specification

It is the intention of this study to assess the flood victims' perceptions of the flood hazard in relation to their relocation decisions, the depth of water in their residences, and their past experience with floods. To be more specific, it is believed that those who moved off the flood plain following a major flood have a significantly different perception of the hazard than those who stayed. That is, the "movers" accept the possibility of another flood and are willing to take positive measures (i.e. moving away from the hazardous area) to minimize future flood losses. On the other hand, those who remained and rebuilt (the "stayers") believe, on the whole, that the flood was

the result of fate and they can do little to avoid future flood losses. The perceptions of a third group, those who relocated in another part of the flood plain (the "shifters"), will also be evaluated. At the outset, it is difficult to imagine what prompted their decisions to relocate since many moved to areas which experienced more flooding than their former residences. It seems likely that such persons do not have a realistic view of their present hazard. In any event, it is argued that their decisions to relocate were poorly conceived in that they did not regard the differences in magnitude of the hazard when making their relocation decisions. It is believed, though, that the shifters perceive the hazard much as the stayers do and that their perceptions differ significantly from those who moved away from the hazardous area.

CHAPTER II

THE STUDY AREA

The Wyoming Valley is located entirely within Luzerne County of Northeastern Pennsylvania. It "...extends from Duryea, Pennsylvania on the Lackawanna River southwestward to Nanticoke, Pennsylvania, three miles downstream of Plymouth on the Susquehanna River" (U.S. Army Corps of Engineers, 1972, p. 5). The Valley encompasses a land area of approximately 300 square miles and contains 45 of the county's 74 municipalities (Figure 1). The city of Wilkes-Barre is located in the center of the Valley. In addition to being the largest municipality in the area, Wilkes-Barre is also the principal trade center and the county seat (Smith, 1974, p. 5).

The Valley is located in the Ridge and Valley Province of the Appalachian Mountains. A series of high mountain ridges extending in a southwest to northeast direction delineate the Valley. The North Branch of the Susquehanna River bisects it and has produced "...flood plains of varying breadth" (Smith, 1974, p. 6). Most of the developed area within the Valley is located along this natural flood plain.

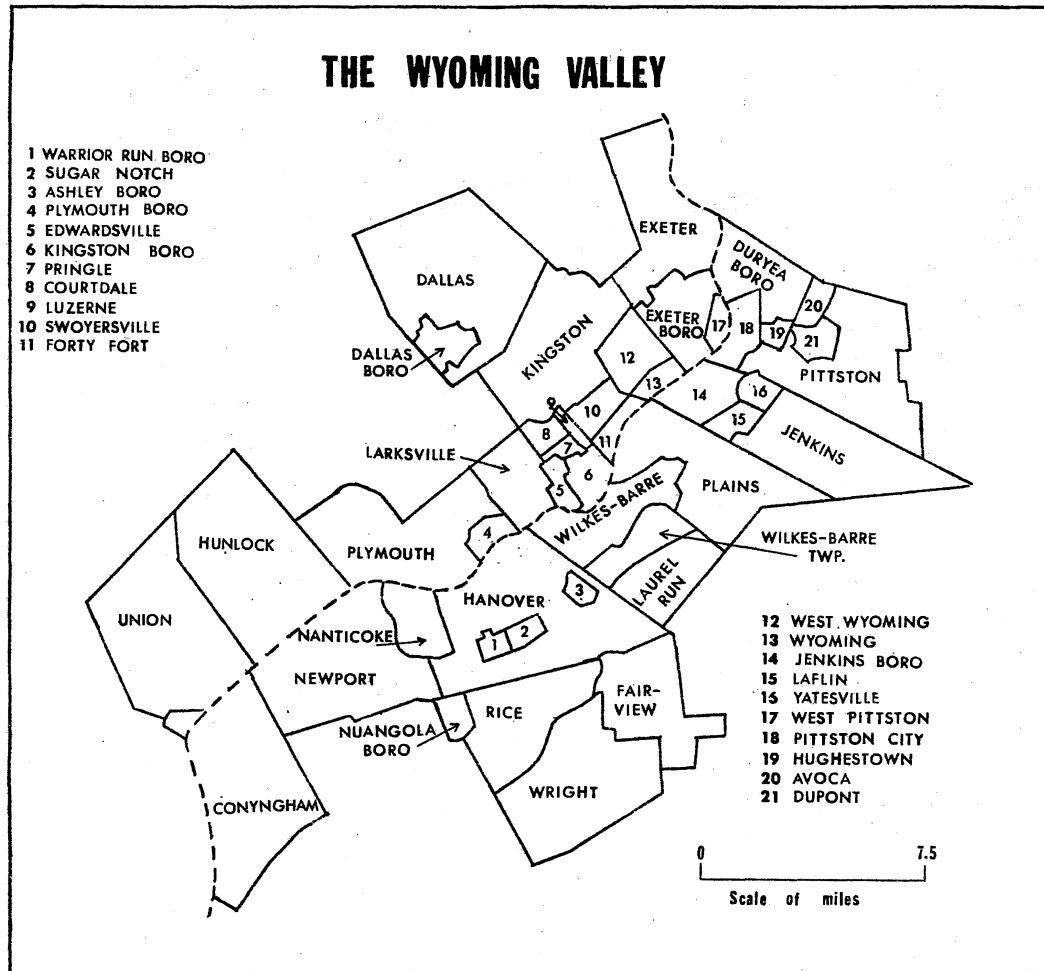


Figure 1. The Wyoming Valley

Economic Considerations

The presence of great quantities of coal in the Wyoming Valley caused it to become known as the "Anthracite Capital of the World." As the coal industry was developed as the primary economic base for the area, a significant population increase resulted.

The peak of anthracite mining in Luzerne County was reached in 1918. With the substitution of other fuels for coal, anthracite production declined from over 17 million tons in 1950 to 3.4 million tons in 1969, seriously affecting the economy of the Wyoming Valley (U.S. Army Corps of Engineers, 1972, p. 7).

The textile and garment industries moved into the Valley because of the low wage structure and the surplus of female labor. But the depression of the 1930's brought about the declining prosperity of these industries. "Between 1930 and 1960, nearly one-third of its population had fled the Valley" (Smith, 1974, p. 8). This population decrease stabilized by 1970, and between 1970 and 1972, the population began to increase at a rate of .46 per cent per year (Economic Development Council of Northeastern Pennsylvania, 1973).

The Susquehanna River Basin

"The Susquehanna River Basin includes three major physiographic provinces: the Appalachian Plateau, the Valley and Ridge, and the Piedmont" (Susquehanna River Basin Commission, 1973, p. 83). The river rises at

Lake Otsego, New York, and flows through intensively developed areas, rural areas, and forest lands (Susquehanna River Basin Study Coordinating Committee, 1970, p. 2). The Basin extends through three states - New York, Pennsylvania, and Maryland. Pennsylvania, the center of focus for this study, has 76.6% of the Basin's land area and 80.2% of the people residing in the Basin (SRBSCC, 1970, p. 46).

The average flow of the river is approximately 25 bgpd (billion gallons per day), although this is far from constant. The river has been known to vary from 1 bgpd to 536 bgpd (SRBSCC, 1970, pp. 2-3). The average rainfall in the Basin is about 39 inches per year (SRBSCC, 1970, p. 33). Virtually all of the major streams in the Susquehanna River Basin experience their highest flows in March, April, and May "...when melting snows combine with the spring rains. These three months account for about one-half of the yearly runoff" (SRBSCC, 1970, pp. 34-35). But major floods can occur in all seasons of the year. High intensity summer storms have often been aggravated by saturated ground conditions and have resulted in flooding.

The North Branch of the Susquehanna River

The North Branch of the Susquehanna River consists of 11,000 square miles. Of this total, 6,300 square

miles are located in northeastern Pennsylvania and 5,300 square miles are in south-central New York (U.S. Army Corps of Engineers, 1971, p. 35). The concern of this study, however, is not with the entire North Branch, but rather with that part of it which extends from Sayre, Pennsylvania to Sunbury, Pennsylvania - Sub-Basin III according to the U.S. Army Corps of Engineers (Figure 2).

The hydrologic characteristics of Sub-Basin III can be found in Table II.

TABLE II
HYDROLOGY OF SUB-BASIN III

Average Annual Precipitation	Average Annual Runoff	Average Annual Evapotranspiration
36.9 in.	18.2 in. (49%)	18.7 in. (51%)

Source: Susquehanna River Basin Study
Coordinating Committee, 1970,
p. 34

Whereas the Sub-Basin is the second most populous in the entire river basin, it is the most heavily urbanized. "Of the Basin's population, 22.4% live here, and nearly three-quarters of these people live in towns and cities over 2500" (SRBSCC, 1970, p. 48). Wilkes-Barre is the second

NORTH BRANCH OF THE SUSQUEHANNA RIVER

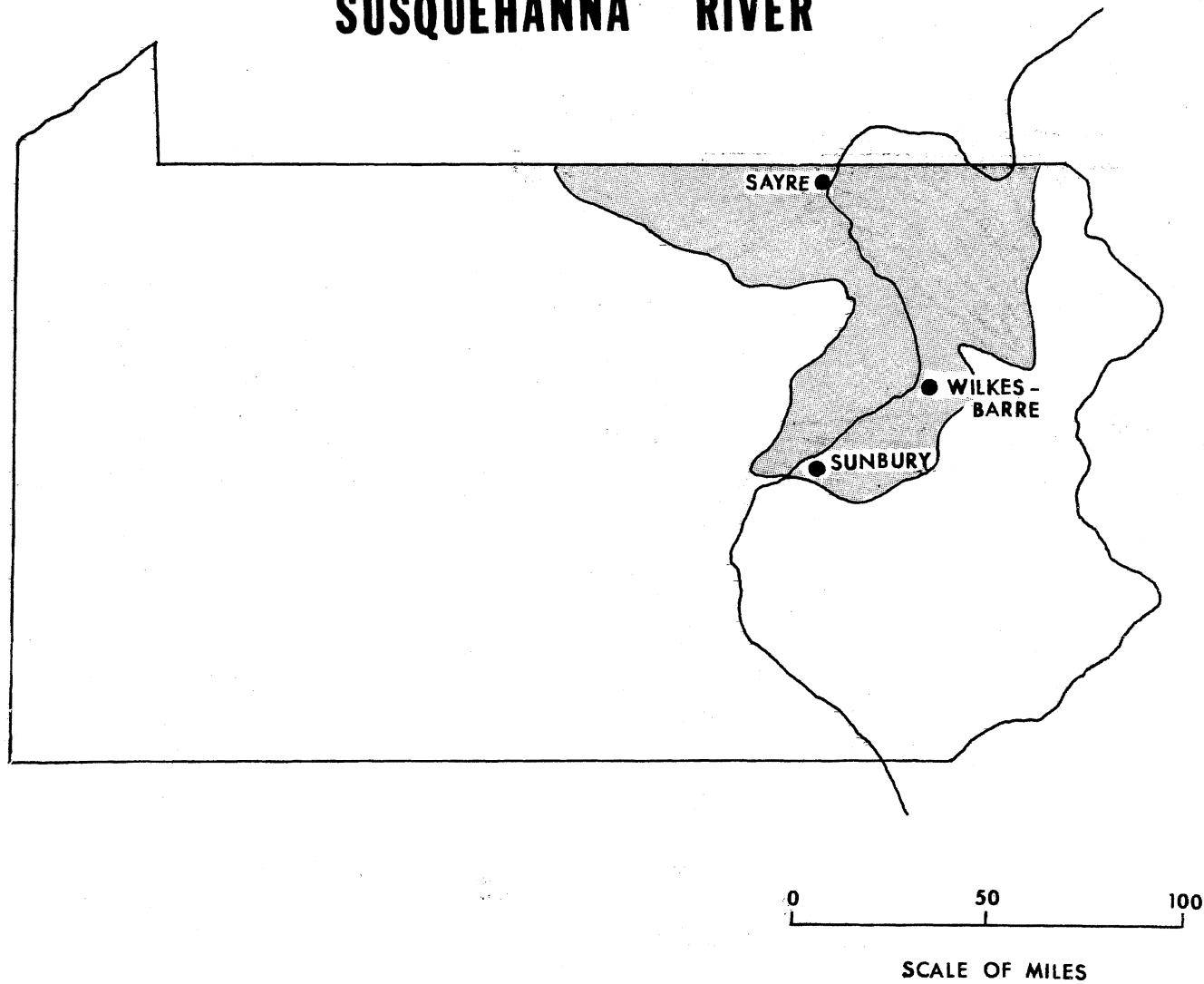


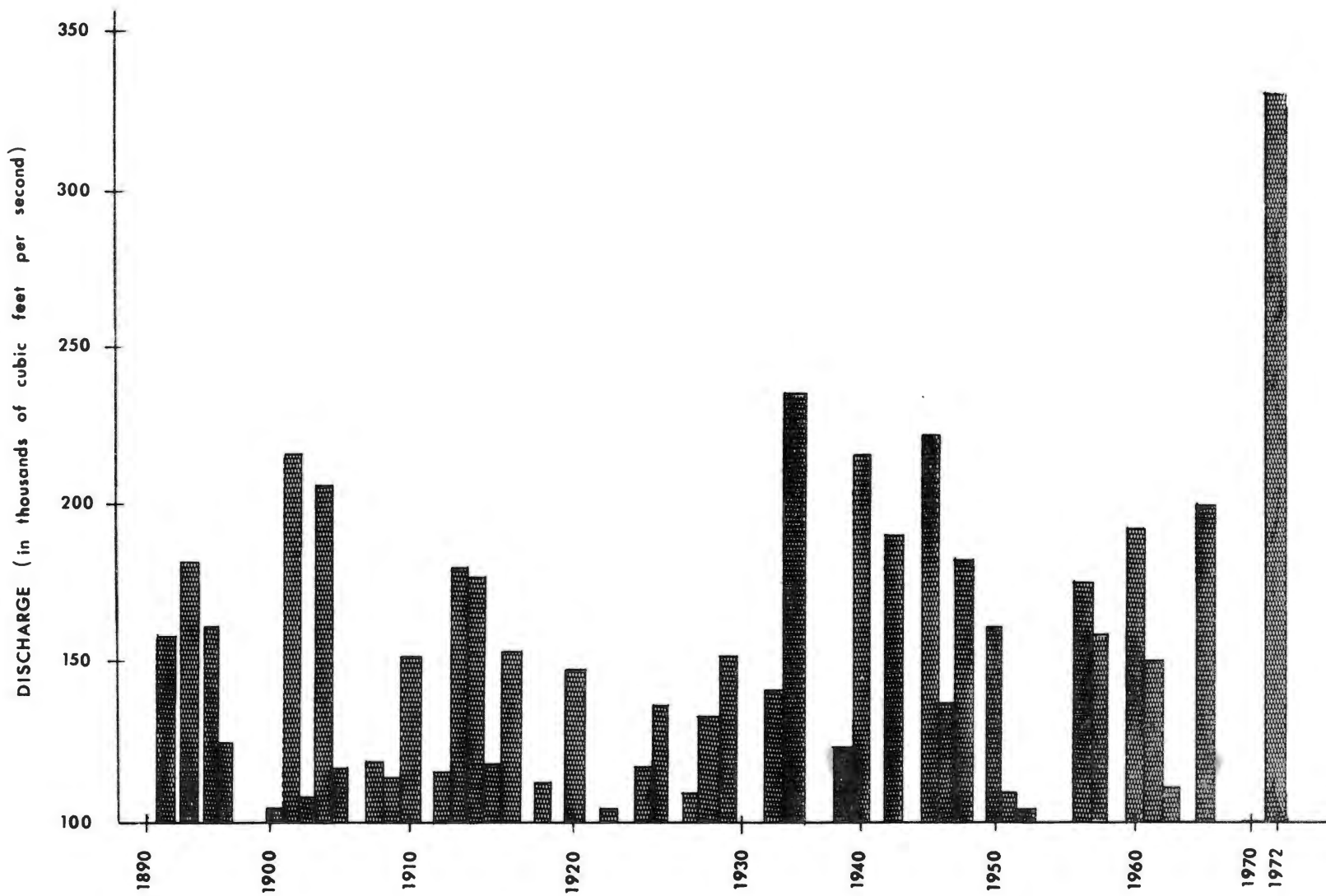
Figure 2. North Branch of the Susquehanna River

largest city in the Sub-Basin, with Scranton being the largest.

The area is very similar to the entire Susquehanna River Basin with regard to flooding in that peak occurrence is between the months of February and April. However, the greatest flood of record occurred in June of 1972 and was caused by tropical storm Agnes. Prior to this,

The floods of March 1865 and March 1936, both of which reached a stage of 33.1 feet, were the greatest floods in the period from 1784 to 1971. These floods were of major significance and, consequently, flood-protection works were installed in the 1940's and 1950's to protect Wilkes-Barre and nearby communities from floods of similar magnitude (Flippo and Lenfest, 1973, p. 1).

Local flood protection works have been completed in Swoyersville-Forty Fort, Wilkes-Barre-Hanover, Kingston-Edwardsville, Plymouth, and Sunbury (U.S. Army Corps of Engineers, 1971, p. 35). The levees constructed after the 1936 flood were designed to protect against a peak river flow of 232,000 cubic feet per second (cfs) - the discharge of both the 1865 flood and the 1936 flood. But the flood of 1972 reached a peak river flow of 345,000 cfs (U.S. Army Corps of Engineers, 1972, p. C-4). (Figure 3). In 1972 the Susquehanna River crested at 40.6 feet in the Wyoming Valley. This is 18.6 feet above flood stage and 7.5 feet above the previous record of 1936 (EDGNP, May, 1973, p. 2). Obviously, the existing flood protection structures were ineffective against a flood of this magnitude. Improvements have been

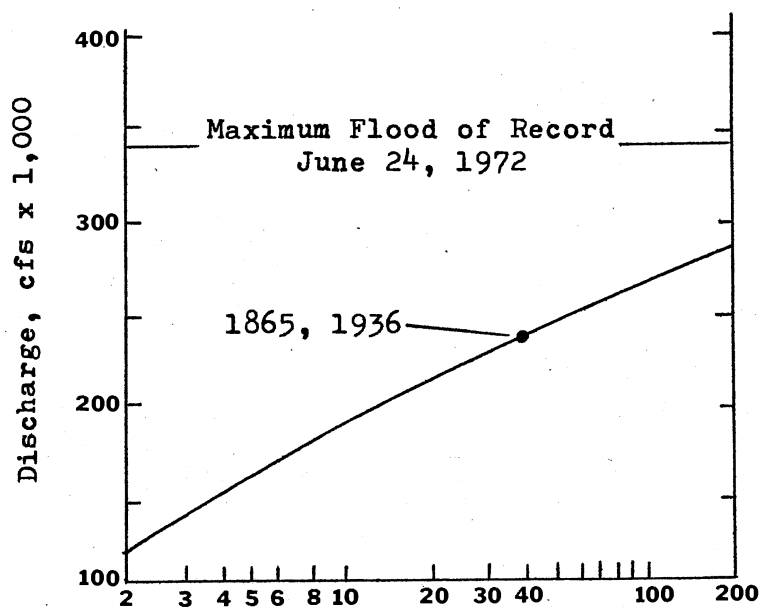


Source: Adapted from Flippo and Lenfest, 1973.

Figure 3. Annual Floods on the Susquehanna River at Wilkes-Barre, 1891-1972

made to the levee systems since June of 1972 to protect against floods of similar magnitude.

The recurrence interval, "the average interval of time within which a given flood will be equalled or exceeded once" (Flippe and Lenfest, 1973, p. 1), is an important consideration. The recurrence interval of the 1865 and 1936 floods is approximately 40 years. But the recurrence interval of the 1972 flood is difficult to predict. It is estimated, however, that this flood has a recurrence interval of greater than 200 years, so it follows that the probability of a flood of similar magnitude occurring in any year is less than 0.5% (Figure 4).



Source: Adapted from Flippe and Lenfest, 1973.

Figure 4. Recurrence Interval
(Based on flood record
in Figure 3)

Extrapolation of the flood frequency curve beyond a recurrence interval of 200 years is not recommended, owing to the questionable validity of estimated relations. Thus, the recurrence interval for annual floods of the magnitude of the 1972 flood cannot be reliably predicted through analysis of the flood records available (Flippo and Lenfest, 1973, p. 1).

Effects of the June, 1972 Flood

The effects of this flood were disastrous. In particular, approximately 150 manufacturing firms were flooded. In 1970, employment in these firms totalled 11,335. In addition, 73% (2,728 out of 3,726) of the commercial establishments in the Valley were directly affected (EDCNP, April, 1972, p. 1).

As this study is concerned with housing relocation decisions, primary emphasis must be placed on the number of dwelling units that were affected. According to the Economic Development Council of Northeastern Pennsylvania, approximately 25,000 housing units experienced flood-related damages. Of these, 13,500 were single-family units and 11,900 were multi-family units. In addition, 14,400 were owner-occupied while 10,300 were renter occupied (EDCNP, April, 1973, p. 2).

The residential areas which suffered the most extensive water damages were those located near the levees. "The damage was particularly severe in those areas located near the breaks in the levees since rapid on-rushes of water dislodged many homes from their

foundations" (U.S. Army Corps of Engineers, 1972, p. D-11).

Of all the flooded communities, Kingston had the most severely affected housing. Only 20 units out of some 6,000 experienced no problems with flooding. The slow residential restoration that occurred in Kingston is characteristic of a phenomenon that took place throughout the Valley. Because the affected sites in Kingston were scattered and the lot sizes were difficult to work with, it was not financially feasible to bring in developers. In order to restore these residences properly, rebuilding provisions were needed along with an extension of tax subsidies (Ramsauer, 1974).

It would appear that the aforementioned difficulties with rebuilding would cause the flood victims to consider a relocation. In addition, the areas nearest the river, and therefore the most severely damaged by flooding, are predominantly high rent areas (Ramsauer, 1974). Thus, the residents would not suffer greatly from the financial strain associated with a relocation under these particular circumstances. In spite of the conditions deemed conducive to relocation, preliminary research and investigation revealed that residential patterns in the built-up areas affected by the flood did not change much. In fact, according to Joseph D. Vinso of the Wharton School, University of Pennsylvania,

...less than 10%...were not living in the household chosen for sampling at the time of the June flood period. That means that greater than 90%

of the people have returned to the houses in which they were living at the time of the June flood (Vinso, 1974).

Post-1972 Adjustments to the Flood Hazard

Several adjustments were undertaken by both the affected communities and the flood victims themselves in order to minimize future flood damage potential. Structural works have been constructed both upstream and downstream from the study area. The U.S. Army Corps of Engineers has constructed ten flood control dams while the Soil Conservation Service has completed thirty-three dams. Both of these agencies have constructed local flood protection projects which consist, mainly, of levees. In addition, the Commonwealth of Pennsylvania has constructed five dams and thirty-six local flood protection projects (Susquehanna River Basin Commission, 1973, p. 16). All of these projects are designed to protect against a flood of the same magnitude as the one caused by Hurricane Agnes.

In addition to these structural methods of adjustment, flood insurance has been made available to the victims. Prior to the flood, this insurance was available but there were very few policies sold. After the flood, the flood hazard areas had to be remapped in order that the specifications of the National Flood Disaster Protection Act be met so that the communities would be eligible for flood insurance.

Perhaps the most extensive type of adjustment to the flood came in the form of flood recovery programs. These programs ranged from property tax rebates, disaster urban renewal programs, and Office of Emergency Preparedness reimbursements to low interest loans with a \$5,000 forgiveness clause (EDCNP, 1973).

CHAPTER III

METHODOLOGY

Determining the Sample

In order to investigate relocation decisions, a sample of 180 households was examined in great detail. This sample was drawn from the estimated 25,000 households in the Wyoming Valley which were flooded in 1972. The sample was stratified according to the extent of flooding experienced and whether or not the household moved after the flood. More specifically, the sample was developed in the following manner:

1. Each household was classified according to its experience with flooding in 1972. That is, a range of water levels was determined from the United States Geological Survey's Hydrologic Investigations Atlas showing the flooded areas of the Wyoming Valley. The highest water level was 22.4 feet and the lowest was 1.8 feet. The total range of 20.6 feet was then divided into three water level categories having the following ranges:

Low water = 1.8 ft. to 8.6 ft.
Medium water = 8.7 ft. to 15.5 ft.
High water = 15.6 ft. to 22.4 ft.

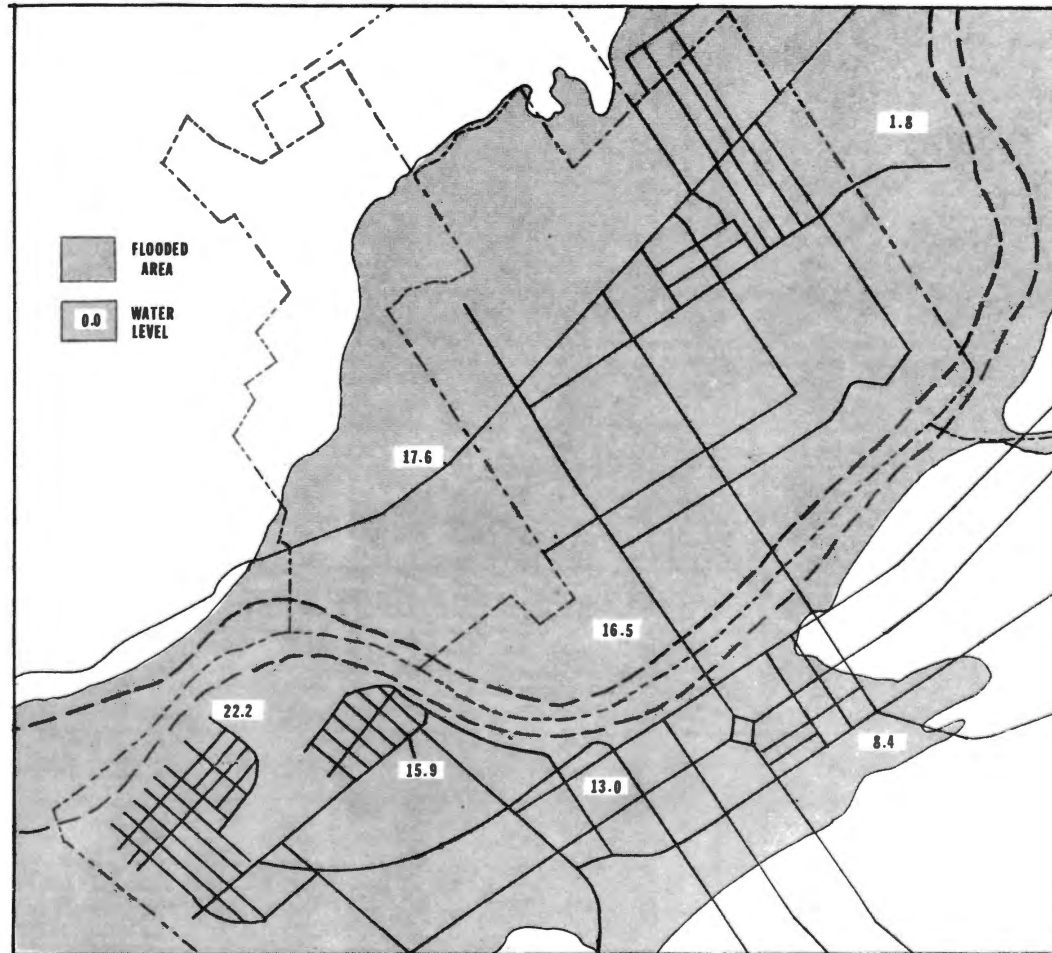
For purposes of this analysis, only households in

the low water and high water regions were used. The middle category was omitted in order to obtain better separation of the effects resulting in the high and low hazard zones.

2. Residential areas (i.e. areas which are predominantly residential with little, if any, commercial development) were selected in both the high and low hazard zones. As many sample blocks from these residential areas were used as were needed in order to obtain the specified totals of different types of households with respect to relocation behavior (Figures 5 and 6).

3. A 1971 City Directory for Greater Wilkes-Barre and a 1974 Telephone Directory of the Wyoming Valley were used in order to determine which of the households were stayers (those who remained at their former residences after the flood), movers (those who moved away from the flood plain), and shifters (those who moved to another area of the flood plain). The names of those people who resided on the chosen blocks in 1971 (prior to the flood) were obtained from the City Directory Street Guide. These names were then located in the Telephone Directory to determine where the people resided in November of 1974 (more than two years after the flood).

A total of 29 sample blocks were used in the study. Table III shows the number of households, broken down by relocation decisions, that were extracted from these



Source: Adapted from Flippo and Lenfest, 1973.

Figure 5. Flooded Area and Water Levels

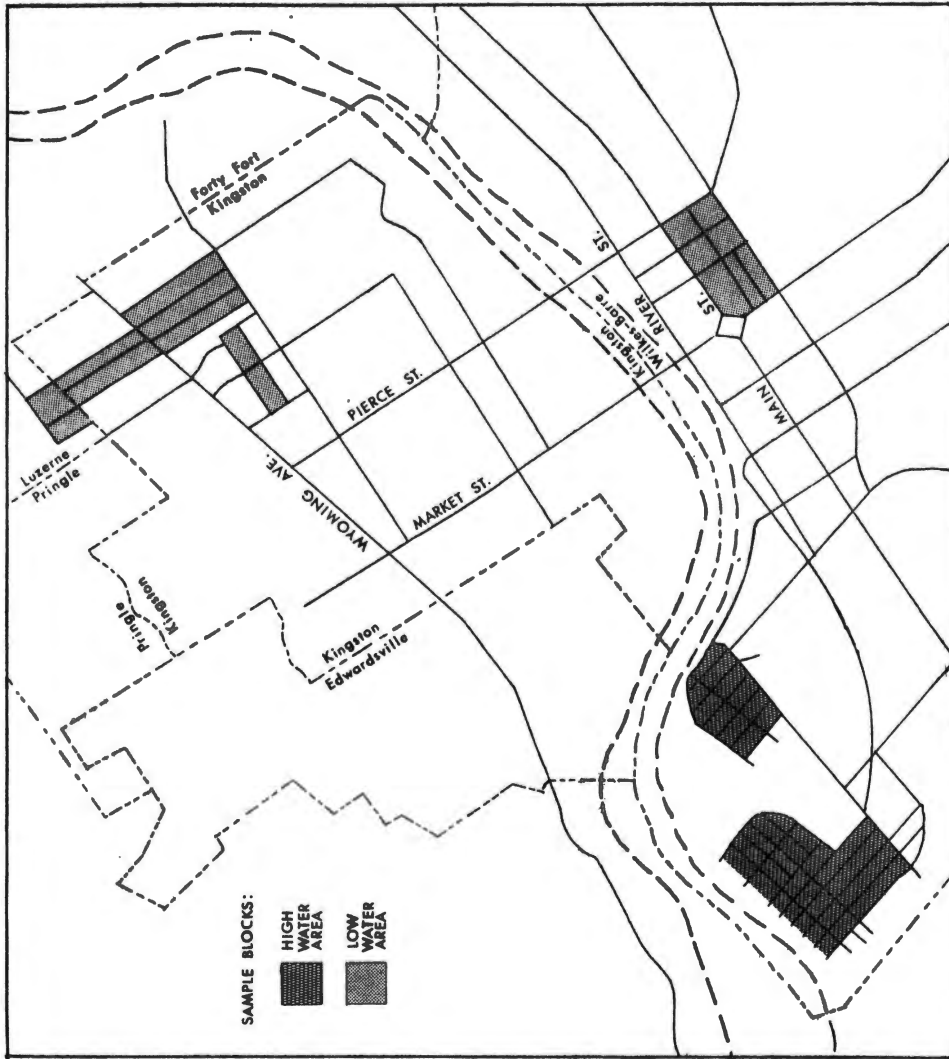


Figure 6. Sample Blocks

29 sample blocks.

TABLE III
 SAMPLE POPULATION: HOUSEHOLDS
 AND RELOCATION DECISIONS

Relocation Decision	Number of Households	Percentage of Households
Stayers	616	61%
Movers	61	6%
Shifters	66	7%
Unaccounted For*	266	26%

*It is believed that the 26% who are "missing" (i.e. who appeared in the 1971 City Directory but not in the 1974 Telephone Directory may be accounted for as follows:
 --Some have moved from the area - perhaps as many as 6.7% per year (the annual national average rate of people moving out of county or out of state); for a three year period, it is expectable that as many as 20.1% would have moved.
 --Some do not list phones, or they do not have them. The City Directory-telephone book cross check showed that 9.3% of those in the Directory did not appear in the phone book.

The sample population shows that approximately 61% of the people who were flooded are stayers. For this reason, and because this is a study of responses with regard to perceptions of the hazard rather than of relocations in absolute numbers, a disproportional stratified sample was chosen. That is, the interest centers "... primarily on the separate subpopulations represented by the strate (High and low water; stayers,

movers, and shifters) rather than on the entire population" (Blalock, 1972, p. 518). Therefore, equal numbers from each group (60) were selected. Because the movers and shifters make up only a small percentage of the entire sample population, it follows that these two groups have a higher probability of selection than the stayers.

Questionnaires were sent to a total of 180 flood victims with an equal number going to members of each category. Table IV shows the sample distributions.

TABLE IV
DISTRIBUTION OF SAMPLE POPULATION
RECEIVING QUESTIONNAIRES

	Experienced High Water	Experienced Low Water	Total
Stayers	30	30	60
Movers	30	30	60
Shifters	30	30	60
Totals	90	90	180

The Questionnaire: Use of Rotter's
Internal-External Locus of Control

The purpose of the questionnaire is to determine the way in which people react to certain events - in

this case, flooding - and, thus, to determine their perceptions of the hazard. For this reason, Julian Rotter's Internal-External Locus of Control test was used. The underlying premise of Rotter's locus of control is that some people are internally-oriented (a person perceives an event as being contingent upon his own behavior), while others are externally-oriented (the event is perceived as the result of luck, chance, or fate, or as being under the control of others). An internally-oriented person is more likely to:

(a) be more alert to those aspects of the environment which provide useful information for his future behavior; (b) take steps to improve his environmental condition; (c) place greater value on skill or achievement reinforcements and be generally more concerned with his ability, particularly his failures; and (d) be sensitive to subtle attempts to influence him (Rotter, 1966, p. 25).

Thus, it is believed that the more internally-oriented person would attempt to take positive measures in order to minimize future flood losses (i.e. move out of the hazardous area). The more externally-oriented person, on the other hand, perceives the event as being totally out of his control and therefore believes that he can do little to change the situation or to alter similar situations that may occur in the future (and is therefore a stayer or shifter) (Rotter, 1966).

While it is recognized that Rotter's test is more of a measure of personality than a perception technique,

it is argued here that factors of individual personality may account for variations in the perception of a hazard (Kates, 1970; White, 1974). Therefore, the Internal-External Locus of Control aids in measuring an individual's perception of the flood hazard in that it determines the extent to which one believes in fate and risk-taking.

In addition to the Internal-External test, each subject was asked what his income is and whether or not he had experienced a flood prior to the one of June, 1972. It is believed that each of these factors could have an effect on the subject's perception of the hazard and on his decision to stay or relocate. For instance, one who has more financial resources might be more likely to undertake a relocation. And, an individual who had experienced a previous flood may realize the problems associated with living in a hazardous area and may decide to try to avoid similar problems in the future.

Sample Response

The questionnaires were completed and returned anonymously. That is, the researcher did not know who returned the questionnaire, but the category of the respondent with respect to the location/relocation decision was known. By means of a coding procedure on the return envelopes, the category (high or low stayer, high or low mover, or high or low shifter) of the res-

pondent was determined.

Seventy-six (42%) of the 180 questionnaires were returned. This compares quite favorably to the one-fifth to one-third return that is customarily expected from mail-out, mail-back surveys.

Since seventy-six of the questionnaires were returned, it follows that 104 (58%) were not returned. The 58% of the households that did not reply may have refused because of a lack of interest. In addition, the questionnaire is somewhat lengthy, and this may have caused some people to ignore it.

A relatively lower response rate was exhibited by the residents of the low water areas than by residents experiencing high water levels. These flood victims may not feel that the flood was particularly disastrous (from an egocentric viewpoint), and, therefore, may have been unwilling to respond to a questionnaire concerning the hazard.

It is also speculated that those who did not respond to the questionnaire may view the hazard as significant, but may not have taken positive measures to protect themselves in the future. Thus, they do not want to exhibit the inconsistency between their actions and their beliefs (even through an anonymous questionnaire).

The Final Sample

Only sixty of the returned questionnaires were used in the analysis. To have a disproportional stratified sample, it is necessary that an equal number from each category be evaluated. Since only ten questionnaires from low shifters were returned, this determined the number from each of the other categories that could be used (the other categories exhibited higher response rates). Each return was numbered in order as it was received. A random numbers table was employed to determine which ten responses would be analyzed. The use of the table insured that each of the responses had an equal chance of being selected, and it helped eliminate any biases that may have entered into the analysis.

The returned questionnaires were analyzed using conventional statistical methods in order to measure the significance of the factors involved.

CHAPTER IV

RESULTS

Scoring the Tests

Each questionnaire was scored on the basis of the number of external choices the respondent made (See Appendix). Thus, the higher the score, the more externally-oriented is the respondent. The mean score for each category was used as the break-off point between internal- and external-orientation. Since the Internal-External Locus of Control determines a person's orientation relative to the other members of his sample population, the mean score was used as the break-off point for each category. A common break-off point among all of the categories would provide misleading statistics, since the internal-external orientation is not absolute. Thus, those with a score greater than the mean are considered to be more externally-oriented, and those scoring less than the mean are more internally oriented. It is necessary that one realize the need for the word "more" in this situation. Since Rotter's Locus of Control is based upon a continuous scale (as opposed to a dichotomous scale), it would be erroneous to state that those scoring higher than the mean are external and those

lower than the mean are internal. Instead, one is more externally-oriented or more internally-oriented, as the score indicates.

Relocation Behavior vs. Perception

Table V shows the score frequencies as related to relocation behavior.

TABLE V
RELOCATION AND INTERNAL-EXTERNAL
ORIENTATION

Score	Stayers	Movers	Shifters
20			XX
19			
18			
17		X	
16			
15			X
14			XX
13	X	X	X
12	X	XXX	X
11	XX	XXX	
10	XXX	XXXX	X
9	XX	XXXX	X
8	X	X	XX
7	XXXX		XX
6		X	
5	X		XX
4	X		X
3	XXX	X	XXX
2		X	
1	X		X
0			
	$\bar{X}=7.5$ SD=3.41	$\bar{X}=9.7$ SD=3.31	$\bar{X}=9.05$ SD=5.59

The mean scores indicate that the movers are the most externally-oriented (i.e. on the average, they scored highest) while the stayers are the most internally-oriented. It must be noted that this is the opposite of what was originally expected. The scores of the shifters cover the greatest range, indicating that this is a group whose perceptions of the hazard vary the most. The movers exhibit the most homogeneity with regard to internal-external orientation as demonstrated by the fact that three-fourths of the movers scored between 9 and 13. The stayers, on the other hand, tended to score the lowest and had the smallest range. In addition, as many (10) scored above the mean as scored below.

In order to determine if the relationship between one's perception of the hazard and one's response to it is statistically significant, the chi-square test was used. The frequency distribution is:

	More Internal	More External	Total
Stayers	10	10	20
Movers	8	12	20
Shifters	12	8	20
Totals	30	30	60

This yielded a χ^2 value of 1.60 which is not statistically significant. Thus, from these results, it cannot be concluded that one's relocation decision was related to one's perception of the hazard.

Hazard Region vs. Perception

Table VI shows how the households in each hazard region scored. Such a table and the resulting χ^2 tests provide a means of determining the relationship between perception and severity of the hazard, as indicated by water levels experienced.

TABLE VI
HAZARD REGION AND INTERNAL-
EXTERNAL ORIENTATION

Score	Experienced High Water	Experienced Low Water
20	X	X
19		
18		
17		X
16		
15	X	
14		XX
13	X	XX
12	XXX	XX
11	XX	XXX
10	XXX	XXXXX
9	XXXX	XXX
8	XXX	X
7	XXX	XXX
6		X
5		XXX
4	X	X
3	XXXXX	XX
2	X	
1	XX	
0		
	$\bar{X}=8$ SD= $\sqrt{4.38}$	$\bar{X}=9.5$ SD= $\sqrt{3.99}$

The mean scores indicate that those who experienced low water levels are, on the whole, more externally-oriented than those who experienced high water levels. Yet, the ranges and distributions shown by this table do not point out any significant differences between the scores of those experiencing high water and of those experiencing low water levels.

The frequency distribution for this X^2 test is:

	More Internal	More External	Total
High Water Region	15	15	30
Low Water Region	14	16	30
Totals	29	31	60

A X^2 value of .066 indicates that there is no statistical significance among these factors. Thus, perception and severity of the hazard are not related in this case.

Relocation and Hazard Region vs. Perception

In order to obtain a more in-depth analysis of the factors under consideration, chi-square tests were run for each of the relocation decisions. That is, the previous frequency distribution concerning hazard regions and internal-external scores was broken down on the basis of relocation decisions.

The frequency distributions and X^2 values are:

Stayers:

	More Internal	More External	Total
High Water Region	4	6	10
Low Water Region	6	4	10
Totals	10	10	20

$$X^2 = .200$$

Movers:

	More Internal	More External	Total
High Water Region	3	7	10
Low Water Region	5	5	10
Totals	8	12	20

$$X^2 = .2083$$

Shifters:

	More Internal	More External	Total
High Water Region	6	4	10
Low Water Region	6	4	10
Totals	12	8	20

$$X^2 = .000$$

None of these X^2 values is significant. In conclusion, it cannot be stated that the respondents'

reactions to the flood are related to their perceptions of it. It was expected that breaking down the internal-external scores on the basis of relocation decisions would provide greater insight into the reasons behind such decisions. However, this was not the case.

Relocation vs. Hazard Region

In order to better visualize the relocation decisions that were made with regard to the hazard regions, each of these decisions was mapped. Figure 7 shows the locations of those flood victims who remained at their former residences. It must be emphasized that only the sample population is mapped. Many more residents of these blocks are stayers.

Figure 8, Relocations Made by Those Flood Victims Who Experienced High Water Levels, shows that most of these movers did not go any appreciable distance. More specifically, ten out of thirty movers (33%) from the high water region moved to another area of Wilkes-Barre - but an area that is off the flood plain. It might be logically concluded that these households wanted to get away from the flood hazard, but they did not want to move out of the area that is familiar to them. In contrast, eight households (27%) moved to Dallas, a nearby high status suburb. This can be explained by the fact that Dallas is a developing area - new housing subdivisions and developments arose following the flood.

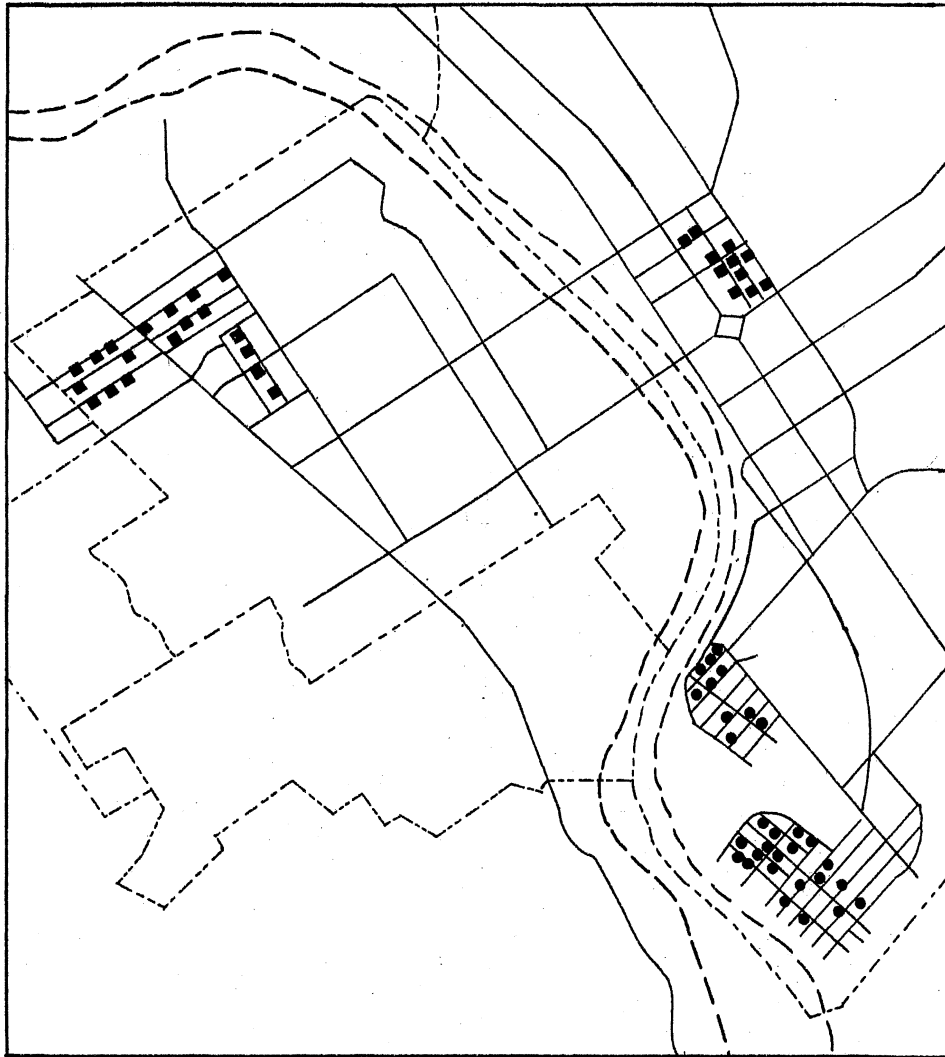


Figure 7. Locations of the Stayers

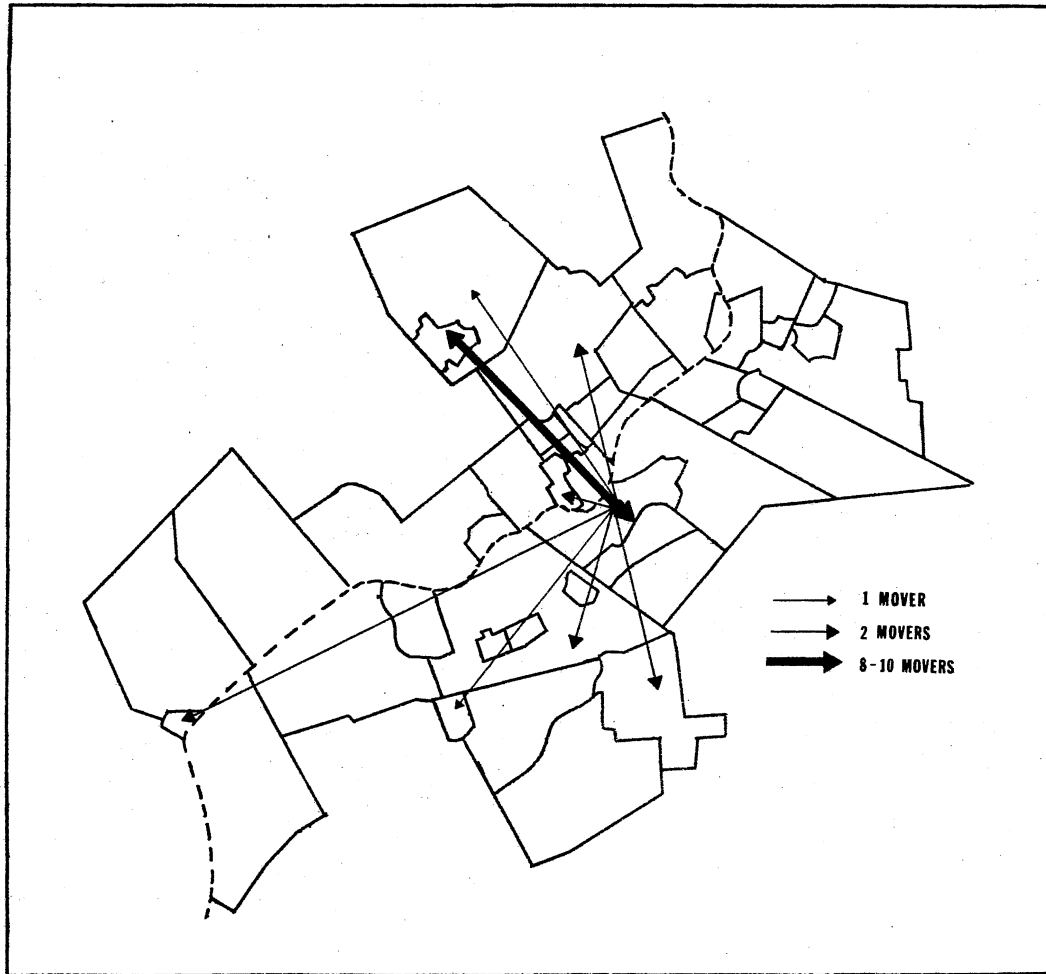


Figure 8. Relocations Made by Those Flood Victims Who Experienced High Water Levels

Thus, housing was available in the Dallas area (while Wilkes-Barre was experiencing a housing shortage).

Figure 9, Relocations Made by Those Flood Victims Who Experienced Low Water Levels, illustrates essentially the same trends. Most of the moves were within the same area, but out of the flood hazard area, as illustrated by the 27% who moved from one part of Wilkes-Barre to another and the 20% who moved from Kingston to Luzerne. The six moves from Kingston to Luzerne are actually moves of only a few blocks - just enough to get away from the flood hazard. Once again, a good proportion of the movers went to Dallas, most likely for the same reasons as before.

Figure 10 shows the moves to another area of the flood plain made by those flood victims who experienced high water levels. No particular trends are obvious, except for the six (20%) households that shifted from Wilkes-Barre to an area in Kingston which experienced similar water levels. This illustrates the point made in Chapter I concerning the fact that these relocation decisions were poorly conceived. Few, if any, of the households who moved from one area of the flood plain to another relocated in an area less susceptible to flooding, as shown by the map.

Figure 11 is also concerned with the shifts that were made, but with regard to low water levels. This map shows the same phenomenon. In this case, most of those

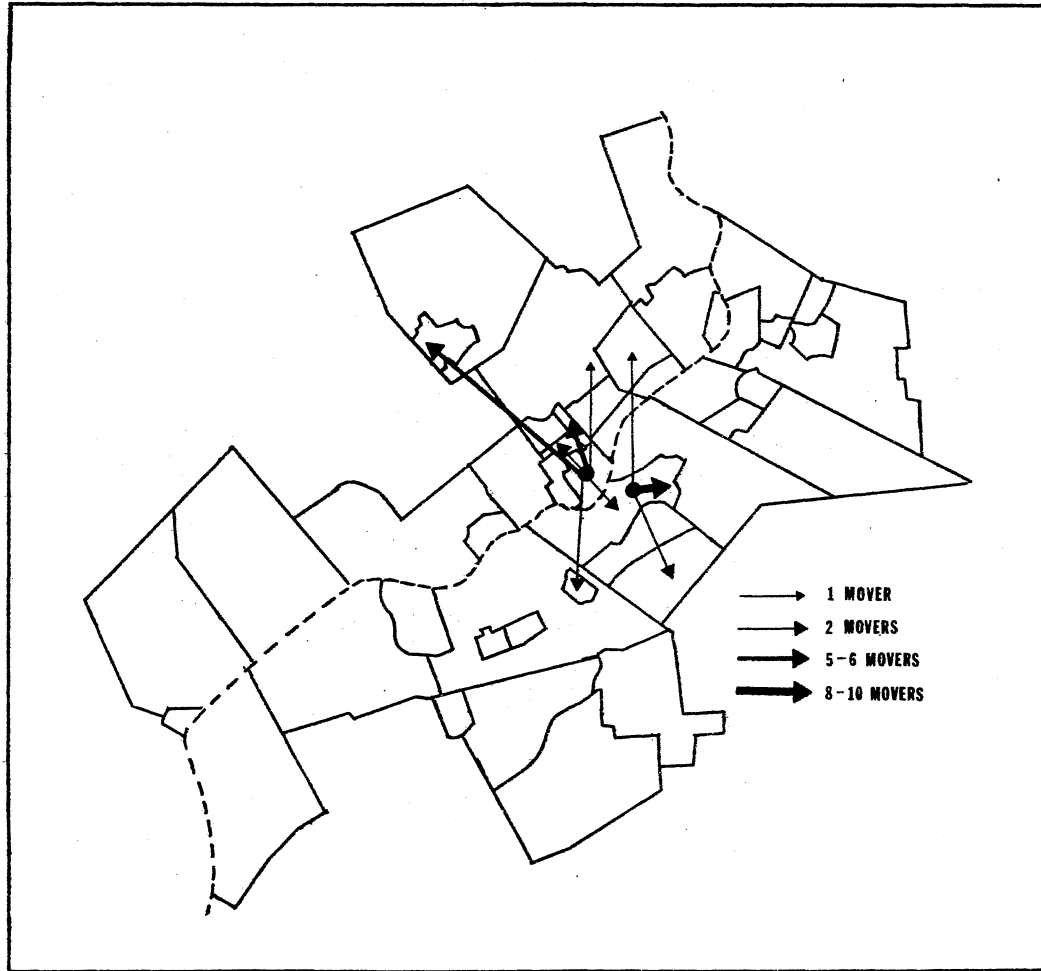


Figure 9. Relocations Made by Those Flood Victims Who Experienced Low Water Levels

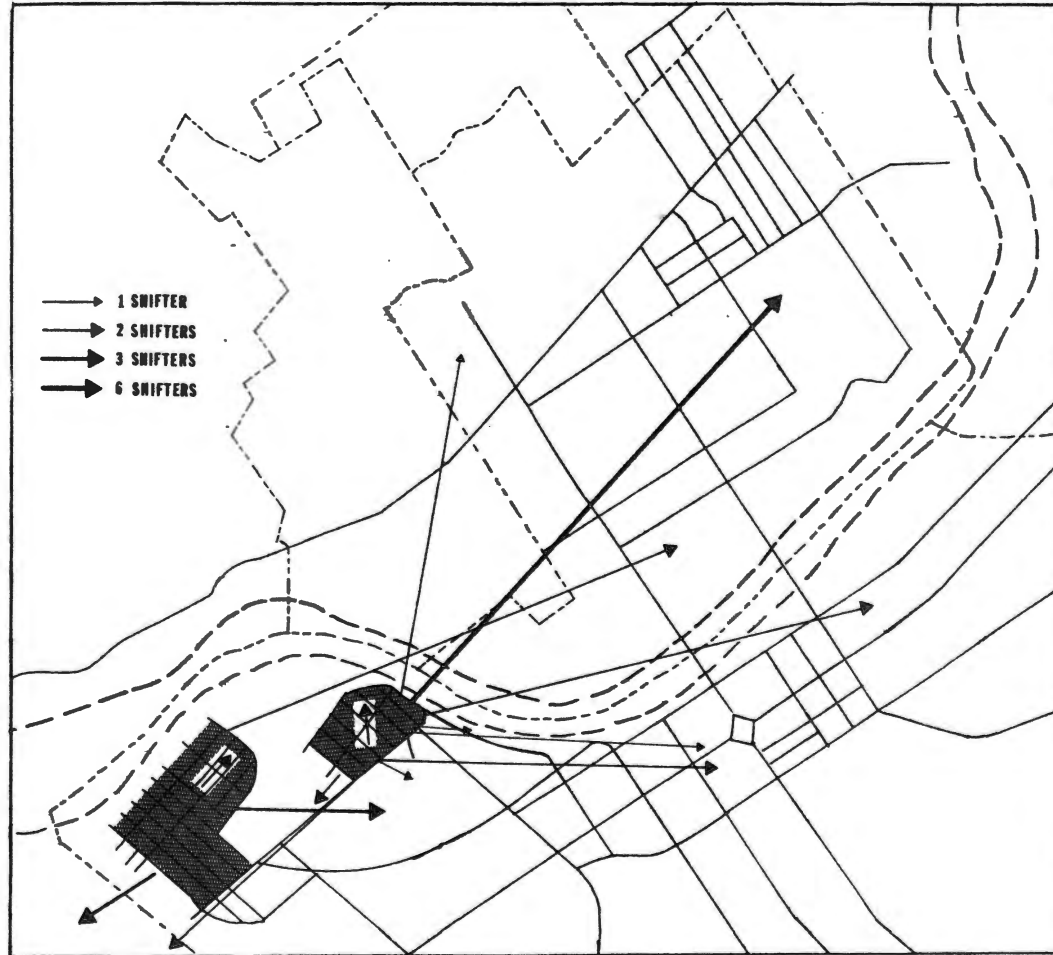
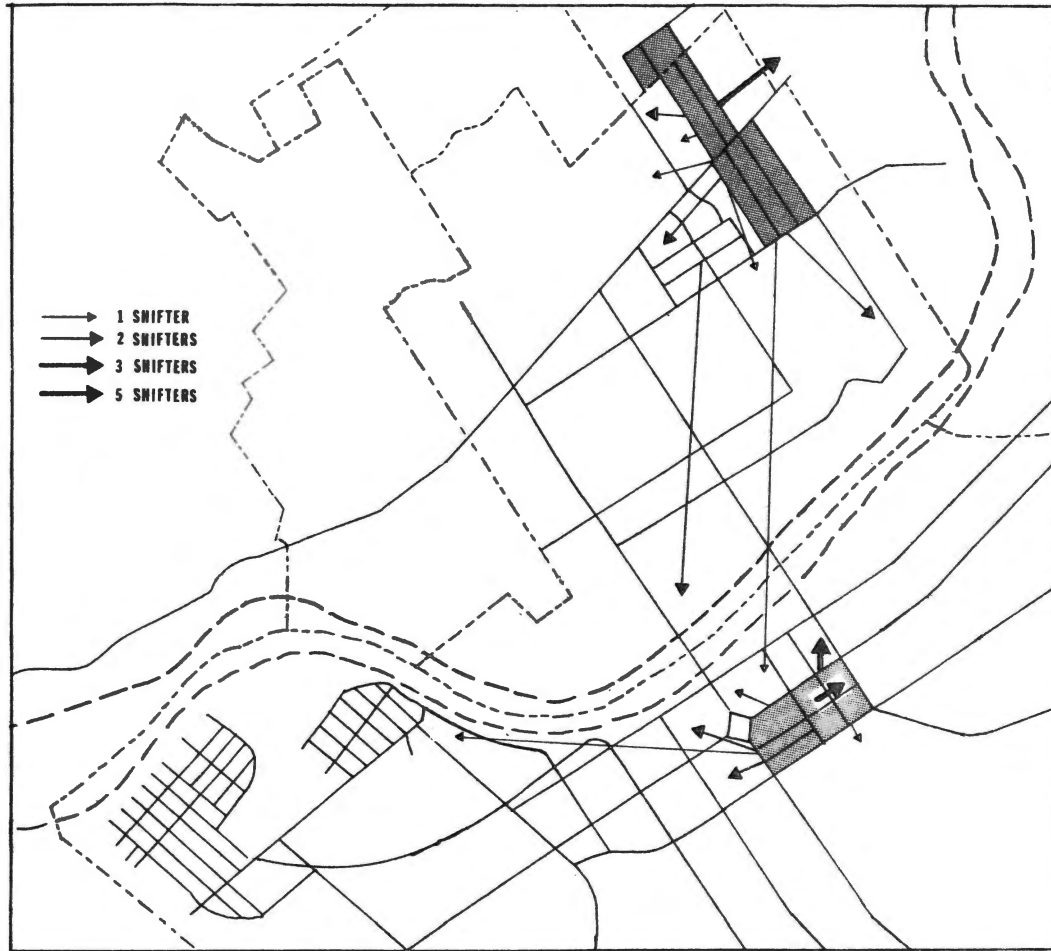


Figure 10. Relocations to Another Area of the Flood Plain
Made by Those Who Experienced High Water Levels



**Figure 11. Relocations to Another Area of the Flood Plain
 Made by Those Who Experienced Low Water Levels**

who shifted ended up in an area that experienced higher water levels than their former residences.

In conclusion, the maps depicting the movers, Figures 8 and 9, indicate that the general trends were 1) to move away from the flood prone areas but to remain close to areas with which the mover is familiar, and 2) to move to a developing area which has an ample supply of housing. The maps depicting the shifters, Figures, 10 and 11, emphasize the belief that these were not well thought-out moves. Only in very few instances did the shifter relocate in an area less susceptible to flooding.

Relocation vs. Flood Experience

Past experience with flooding could be a contributing factor to one's decision to relocate. Table VII shows previous experience with flooding as related to relocation decisions.

TABLE VII
RELOCATION AND PAST EXPERIENCE
WITH FLOODING

Relocation Decision	No Experience	Previous Experience
Stayers	13	7
Movers	12	8
Shifters	16	4

It becomes immediately obvious that most of the flood victims had never experienced a flood prior to the one of June, 1972. Whereas more movers had experienced previous floods, this does not appear to be a significant factor since almost as many stayers have also been flood victims previously. The group with the least experience with floods is the shifters. This may help in explaining why this group undertook the relocations that they did. Since most of them had never experienced flooding previously, it follows that they do not understand the nature of such events. Their actions with regard to relocation within the flood plain resulted in uninformed and possibly unwise decisions.

Once again, X^2 was used to test the statistical significance of these relationships. Table VII (previous page) shows the frequency distribution. The X^2 value of 2.0026 which resulted from this distribution is not significant and, therefore, no conclusions can be made on the basis of these results.

Income vs. Relocation

A final factor that was considered as likely to have an effect on the relocation decisions was that of income. It is believed that those with sufficient financial resources would be more likely to undertake a move than those on whom such a relocation would prove to be a financial burden.

Table VIII is a compilation of the income distributions as determined from the questionnaires.

TABLE VIII
RELOCATION AND INCOME

Income Category	Stayers	Movers	Shifters
Under \$3000			X
\$3000-4999	X	X	XX
\$5000-7999	X	XXX	
\$8000-9999	X	XX	XXXX
\$10000-11999	XXXX	XX	XX
\$12000-14999	XXX	XXXXXX	XXXX
\$15000-20000	XXXX	X	XX
Above \$20000	XXXXXX	XXXXX	XXXXX

For the purpose of statistical analysis, these categories were divided into two: Lower income (Under \$3000 - \$14999) and Higher income (Greater than \$15000). With this division, it can be seen that the stayers are the wealthiest group - 50% of the households fall into the higher income category. The movers and shifters are comparable in that 30% of the movers and 35% of the shifters are in the higher income group. This shows that those most financially able to undertake a relocation were, on the whole, the ones who remained at their former residences.

Once again, the statistical tests did not indicate any significance. The frequency distribution is:

	Stayers	Movers	Shifters	Total
Lower Income	10	14	13	37
Higher Income	10	6	7	23
Totals	20	20	20	60

In this case X^2 equals 2.02 which is not significant. An attempt was made to break these figures down on the basis of hazard regions, but, due to the small sample, the results of these statistical tests are questionable. That is, the observed frequencies were smaller than the expected frequencies (one cell had a value of 0), and, therefore, statistical testing was not appropriate.

Summary of Results

The initial hypotheses of this study (pages 13 and 14) proved to be unacceptable. The statistical tests that were run did not indicate any significance among the variables. But examination and evaluation of the tables and maps point up several interesting trends that deserve further mention.

With regard to the internal-external scores, the movers proved to be the most homogeneous group. This indicates that these people have essentially the same perceptions of the hazard. In addition, the movers proved to be the most externally-oriented. This is not what was expected since those who are more externally-

oriented are least likely to take positive measures to improve their situation with regard to the flood hazard (and moving away from the flood prone areas is believed to be a positive measure). In addition, the stayers proved, on the whole, to be the most internally-oriented, and therefore the most likely to take positive measures concerning one's susceptibility to flooding. They may also have made other arrangements, such as flood insurance, floodproofing, etc. Yet, this trend is also the opposite of what was expected. The shifters, on the other hand, had the greatest range of internal-external scores. Thus, their poorly conceived relocations may be the result of their unrealistic perceptions of the hazard (as determined by the vast differences in scores).

The maps of relocations (Figures 8, 9, 10, and 11) exhibit definite patterns. On the whole, both the high and the low movers generally relocated in areas relatively close to their pre-flood residences, or they moved to the Dallas area which, immediately after the flood, had an ample supply of housing. These appear to be well-informed, intelligent moves. The shifters, however, tended to move haphazardly. That is, their relocations were undertaken without regard to the flood prone areas.

Thus, despite the fact that the original hypotheses concerning the nature of, and the reasons for, the relocations could not be upheld, the results do indicate trends that provide the basis for conclusions concerning

possible individual adjustments to the flood hazard.

CHAPTER V

CONCLUSIONS

The findings of this study indicate that Gilbert White's statement "a change in land use less vulnerable to flood losses rarely occurs chiefly as a result of floods" (White, 1964, p. 11) is true in this case. In fact, as noted previously, land use patterns did not change much since the flood. This is further supported by the fact that over 60% of the residents of the sample blocks are stayers and another 7% are shifters - they moved from one residential area to another. This study can also be related to Jacquelyn Beyer's findings that there is little relationship between knowledge and/or experience and the expectancy of a future flood. In the study at hand, the fact that there is no statistical significance among perception, relocation, and experience suggests that her findings may be applicable to this research.

While the statistical tests do not confirm the existence of a relationship between perception (as measured by internal-external scores) and response and adjustment (or relocation decisions), inspection of the maps and tables implies that there is some consistency

among the factors affecting relocation decisions. The flood victims that moved did not do so for reasons associated with their perceptions of the hazard. The fact that the movers were the most externally-oriented seems to indicate that relocation was a last resort as a response to the flood hazard. More specifically, externally-oriented individuals tend to believe that they have little or no control over such events. Therefore, rather than attempting to control the effects of the event, the movers may have decided to rid themselves of the possibility of future flood losses. In essence, it may be that the notion that moving is the ultimate adjustment and therefore most significantly related to perception is ill-conceived. Rather other responses are more likely to be taken by internally "controlled" types.

The stayers were more internally-oriented, and therefore believe that they can control future events. Thus, they are unwilling to relocate. In addition, it may be that these flood victims are quite resourceful. That is, not only did they have the financial ability to repair, but they were able to tolerate these repairs of damage. It appears that the economic incentives to stay were far greater than they were to move. That is, the availability of loans, the new outlay of money that moving requires, and the fact that it is easier to repair than to relocate tend to promote staying. It follows that

those who could compensate these points relocated - those who could not stay and repaired.

Several other factors may have influenced the relocation decisions. For example, the households may have been contemplating a move anyway and the flood merely served to make this decision an easier one. Another factor (which was not examined in depth due to the scope of this study) is that of the redevelopment process. Since the flood many homes have been bought up by the Redevelopment Authority of the City of Wilkes-Barre so that the land could be put to a use that is more economically sound. Some of the residences under study may have been in these areas.

It appears (from the number of stayers as opposed to movers) that the flood under study was not enough to encourage residents to relocate away from the flood prone areas. This seems to be a logical response given that the flood of 1972 has a recurrence interval that is greater than 200 years. The last major flood was in 1936. If the Wyoming Valley had experienced floods between 1936 and 1972, the responses may have been significantly different.

In summary, the findings of this study show the need to provide economic incentives and zoning controls for potential victims and/or developers to build or relocate away from the flood plain. Flood insurance is one way of providing such incentives. But other government

controls are needed in addition to this. Thus, the reasons concerning the relocation problem appear to be due to more than mere perceptions of the hazard. Instead, economics, personal resourcefulness, and adjustment alternatives enter into the range of choices open to potential flood victims.

Shortcomings of the Research

At this point, it appears that the sample size that was chosen may have been too small. Even though a larger sample may not have yielded any statistically significant results, it would have provided a more representative sample population and, possibly, more reliable statistics. As mentioned previously, the frequency distributions that resulted may have been too small to provide meaningful results. A larger sample would also aid in making conclusions concerning the trends that resulted. It would also have allowed for the division of the internal-external scores into three groups (i.e. more externally-oriented, more internally-oriented, and a middle group). This division could have been more meaningful and more helpful.

Several shortcomings concerning Rotter's Internal-External Locus of Control became apparent. This test deals, primarily, with factors of individual personality rather than with the hazard itself. It is too easy for the respondent to choose the statement he would like to

believe rather than the one he truly believes. This, obviously, could have affected the results. The questionnaire deals with two of the three factors that Kates mentioned as affecting perceptions of natural hazards. That is, the questionnaire is concerned with "...the nature of personal encounters with the hazard and factors of individual personality" (Kates, 1970, p. 441). It does not, however, deal with "the way in which characteristics of the natural event are perceived" (Kates, 1970, p. 441). Since these characteristics concern one's perception of the magnitude, frequency, and duration of the event in addition to its temporal spacing, the results from this questionnaire may very well be incomplete. If one does not believe that another flood will occur during his lifetime, there is little chance that he will take any positive measures to protect himself from future flooding, although he believes that he is capable of undertaking such measures. In addition, the Locus of Control does not take into account the assumption that perception may be overridden by one's financial situation.

Another problem encountered in this study concerns the theory of cognitive dissonance. (It should be noted that this problem was realized prior to the research, but ways in which to avoid it could not be formulated). The theory of cognitive dissonance is based upon the notion that man does not want to appear irrational to himself or to others (Adams, 1973, p. 288). In the case of

flooding, Ericksen found that

if a respondent feared floods, but for socio-economic reasons was not able to relocate, he might well conceal his true expectations of future flooding so that his behavior, occupation on the flood plain, appears consistent (Ericksen in White, 1974, p. 68).

Thus, the stayers and shifters may have hidden their true beliefs concerning the flood hazard so that their actions (or lack of action) would appear to be rational.

Policy Implications

The policy implications of studies such as this one are numerous. Planners and policy-makers need to know which adjustment to choose in order to minimize future flood losses. In order to choose such adjustments wisely, they need to be cognizant of the responses that individual hazard victims make to the hazard as well as being aware of the victims' perceptions of the hazard. This is true at all governmental levels - from the local to the national level. For instance, communities need to be aware of these perceptions in order to choose those adjustments that are acceptable to and responsive to the needs of the residents of the community. But, agencies at the national level also need to be aware of the differing perceptions and responses that occur with regard to natural hazards. For instance, the Corps of Engineers and the Soil Conservation Service need to know how their flood control measures affect the individual's perception of the flood.

The encouragement of development of flood plains is contrary to the government's view on the use of flood plains. But flood retarding structures do, in fact, encourage the use of flood prone areas. Only through an understanding of the flood victims' perceptions of the flood hazard can wise decisions be made. However, previous perception studies have invariably been concerned with those who remained in the hazardous area. What about those hazard victims who choose to seek higher, safer locations? How do their perceptions differ from the perceptions of the stayers? How can this affect the range of adjustments that should be considered? All of these questions must be answered before proper adjustments to the flood hazard (such as a land use policy planning act) can be instituted.

Suggestions for Further Research

It is believed that assessing the victims' responses to a flood hazard is a worthwhile approach. As stated previously, most of the past hazard studies have been concerned with just those victims who remained in the hazardous area. The primary emphasis of these works has been on the victims' perceptions of the hazard. But one must know more than the way in which a hazard is perceived. It is also important to be aware of the responses and adjustments that are available and undertaken by individuals. There is a need for further research concerning

perceptions of a hazard in relation to the responses (and resulting adjustments) that the victims may undertake. There is a need to know how perception, economic incentives, and economic situations are related. It is also important to be aware of how different land use policy controls and/or incentives may affect this relationship.

With particular regard to the flood hazard, future research should include assessments of the victims' perceptions of the hazard in relation to each adjustment that is available.¹ Only through the results of studies of this nature can all of the factors affecting personal adjustment decisions be incorporated into intelligent community policy-making with the end result of minimizing future flood losses.

¹Dr. Duane D. Baumann of Southern Illinois University is presently undertaking a study concerning hazard perception and the purchase of flood insurance in New Braunfels and Seguin, Texas.

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APPENDIX

THE QUESTIONNAIRE ¹

This is a questionnaire to find out the way in which certain important events in our society affect different people. Each item consists of a pair of alternatives lettered a or b. Please circle the letter corresponding to the one statement of each pair which you more strongly believe to be the case as far as you're concerned. Be sure to select the one you actually believe to be more true rather than the one you think you should choose or the one you would like to be true. This is a measure of personal belief; obviously there are no right or wrong answers.

In some instances you may discover that you believe both statements or neither one. In such cases, be sure to select the one you more strongly believe to be the case. Also try to respond to each item independently when making your choice; do not be influenced by your previous choices. [The alternative in each item that is underlined indicates external orientation. Those items in which neither alternative is underlined are "fillers"

¹ Source: Rotter, 1966, pp. 11-12.

and are included to make the purpose more ambiguous.]

1. a. Children get into trouble because their parents punish them too much.
b. The trouble with most children nowadays is that their parents are too easy with them.
2. a. Most of the unhappy things in people's lives are partly due to bad luck.
b. People's misfortunes result from the mistakes they make.
3. a. One of the major reasons why we have wars is because people don't take enough interest in politics.
b. There will always be wars, no matter how hard people try to prevent them.
4. a. In the long run people get the respect they deserve in this world.
b. Unfortunately, an individual's worth often passes unnoticed no matter how hard he tries.
5. a. The idea that teachers are unfair to students is nonsense.
b. Most students don't realize the extent to which their grades are influenced by accidental happenings.
6. a. Without the right breaks one cannot be an effective leader.
b. Capable people who fail to become leaders have not taken advantage of their opportunities.
7. a. No matter how hard you try some people just don't like you.
b. People who can't get others to like them don't understand how to get along with others.
8. a. Heredity plays the major role in determining one's personality.
b. It is one's experiences in life which determine what they're like.
9. a. I have often found that what is going to happen will happen.
b. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.

10.
 - a. In the case of the well prepared student there is rarely if ever such a thing as an unfair test.
 - b. Many times exam questions tend to be so unrelated to course work that studying is really useless.
11.
 - a. Becoming a success is a matter of hard work, luck has little or nothing to do with it.
 - b. Getting a good job depends mainly on being in the right place at the right time.
12.
 - a. The average citizen can have an influence in government decisions.
 - b. The world is run by the few people in power, and there is not much the little guy can do about it.
13.
 - a. When I make plans, I am almost certain that I can make them work.
 - b. It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyhow.
14.
 - a. There are certain people who are just no good.
 - b. There is some good in everybody.
15.
 - a. In my case getting what I want has little or nothing to do with luck.
 - b. Many times we might just as well decide what to do by flipping a coin.
16.
 - a. Who gets to be the boss often depends on who was lucky enough to be in the right place first.
 - b. Getting people to do the right thing depends upon ability, luck has little or nothing to do with it.
17.
 - a. As far as world affairs are concerned, most of us are the victims of forces we can neither understand nor control.
 - b. By taking an active part in political and social affairs the people can control world events.
18.
 - a. Most people don't realize the extent to which their lives are controlled by accidental happenings.
 - b. There is really no such thing as luck.
19.
 - a. One should always be willing to admit mistakes.
 - b. It is usually best to cover up one's mistakes.
20.
 - a. It is hard to know whether or not a person really likes you.
 - b. How many friends you have depends upon how nice a person you are.

21. a. With enough effort we can wipe out political corruption.
b. It is difficult for the people to have much control over the things politicians do in office.
22. a. In the long run the bad things that happen to us are balanced by the good ones.
b. Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.
23. a. Sometimes I can't understand how teachers arrive at the grades they give.
b. There is a direct connection between how hard I study and the grades I get.
24. a. A good leader expects people to decide for themselves what they should do.
b. A good leader makes it clear to everybody what their jobs are.
25. a. Many times I feel that I have little influence over the things that happen to me.
b. It is impossible for me to believe that chance or luck plays an important role in my life.
26. a. People are lonely because they don't try to be friendly.
b. There's not much use in trying too hard to please people, if they like you, they like you.
27. a. There is too much emphasis on athletics in high school.
b. Team sports are an excellent way to build character.
28. a. What happens to me is my own doing.
b. Sometimes I feel that I don't have enough control over the direction my life is taking.
29. a. Most of the time I can't understand why politicians behave the way they do.
b. In the long run the people are responsible for bad government on a national as well as on a local level.

Into which of the following categories would you place your annual income? (Circle the appropriate letter).

- a. Under \$3,000
- b. \$3,000 to 4,999
- c. \$5,000 to 7,999
- d. \$8,000 to 9,999
- e. \$10,000 to 11,999
- f. \$12,000 to 14,999
- g. \$15,000 to 20,000
- h. Above \$20,000

Had you ever experienced a flood prior to the one of June, 1972? _____.

If so, how many times? _____.

VITA[~]

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