

Farmers Perception of and Adjustment to Typhoon Hazards on Cheju Island, KOREA.

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«Contents»	
1. Introduction	4. Research Design
2. Study site : Cheju Island	5. Research Results and Discussion
3. Theoretical Framework	6. Conclusion and Recommendations

1. INTRODUCTION

Cheju Island (or Chejudo), situated off the south coast of the Korean peninsula, has long been subjected to the natural hazard of frequent damage due to the tropical cyclones that originate in the western North Pacific Ocean. Typhoons passed through the Korean peninsular area near Cheju Island 35 times in the summer season of June to October, during the period 1976 to 1985. In twenty-two of the visits, there was loss of lives and severe damage to property on the island.¹⁾

The typhoons in the region are documented to have the highest frequency of occurrence among the world's major tropical cyclone regions, as shown in Figure 1.

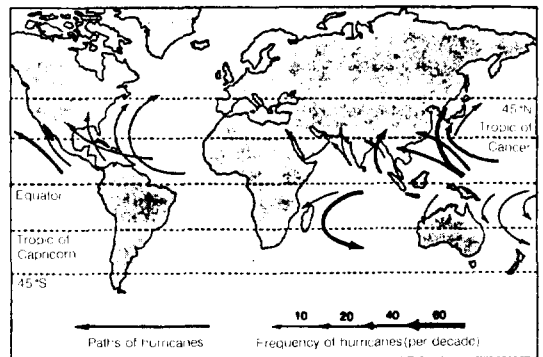


Figure 1. Typhoon and Hurricane Tracks on a Global Scale to Source: Whittow 1979.

The total losses on the island due to typhoon damage during this 10-year period represent approximately 14.2 billion won. The losses in 1986 alone represent 3.8 billion won (approximately one million dollars as the current exchange rate of August 1986), which is equivalent

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- (1) Cheju Doch'ong (The Office of Cheju Province). 1987a. *Che Ju Statistical Yearbook*. Cheju-shi, Korea: Cheju Doch'ong. P. 402.
- (2) KIST (Korean Institute of Science and Technology). 1986. *White Papers on Typhoons*. Seoul, Korea: Korean Institute of Science and Technology and Korean Central Meteorological Station. P. 24, pp. 182-217.

to 40 percent of the Chejudo local government budget during the same year.²⁾ The variance of losses (as percentages of the total losses) in 1986 was: 69 percent for agriculture; 20 percent for fishing ports and harbors including fishing boats; six percent for public facilities and structures such as roads, channel systems, and schools; and five percent for others. Of these losses, 33 percent were covered by national and local government funds and individual expenditures. The total amount of these funds was approximately 12.9 billion won: close to 69 percent from the national and local governments and 31 percent from private expenditures. Out of these funds, 60 percent were allocated to public facilities and structures and 40 percent to agriculture.³⁾ In spite of the claim that agriculture sustained the highest percentage (69 percent) of the total losses in 1986, the losses to this sector during the year were not satisfactorily recovered.

Agriculture has traditionally been the most important economic activity on Cheju Island, employing a large proportion (about 40 percent) of the total work force over the last several decades. However, agricultural development on the island has continued to be threatened by frequent typhoons in addition to pressure from the present government policy of tourism development.⁴⁾

The purpose of this study is threefold: (1) to survey the perceptions of and adjustments to typhoon hazards by Cheju farmers; (2) to identify traditional practices that attempt to mitigate the damage from typhoon hazards; and (3) to examine the perception by farmers of the role of the national and local governments in recovering typhoon losses and preparing for future typhoon hazards.

2. STUDY SITE: CHEJU ISLAND

1) Natural Environment

Cheju Island is located some 90 miles to south of the Korean peninsula, and off the northeast coast of the continent of Asia. It is a volcanic island isolated in the northern Pacific, facing the islands of Tsushima and Kyushu in Japan across the Korea Strait to the southeast, and China to the west (Figure 2).

The island, with a total land area of 1,824.9 square kilometers, is topographically divided into four zones: (1) the high mountainous zone above 1,000 meters, which has been designated a National Park conservation area (81.5 square kilometers, or 4 percent of the total area); (2) the middle mountainous zone at between 600 and 1,000 meters above sea level, which includes forest, range-land for horse raising, and look-out points for tourists (230.4 square kilometers, or 13 percent); (3) the lower mountainous zone between 200 and 600 meters, which comprises pasture and idle lands (508 square kilometers, or 28 percent); and (4) the coastal zone below 200 meters, which comprises most of the residential and agricultural areas (1,005 square kilometers, or 55 percent).

The region in which Cheju Island is situated — at mid-latitude between the east coast of the Asian continent and the Pacific Ocean—is characterized by climatic variety: the temperate type at mid-latitude; the continental type on the east coast of the continent; and the marine type such as found on an island. The climate of Cheju is generally humid, with warm summers and moderately cold winters. Since Mount Halla rises high in the center of the island, it figures in the regional differences in climate on

2) Cheju Doch'ong. 1987a. Data drawn from *Chart of Typhoon Damages on Chejudo*. Cheju-shi, Korea: The Department of Construction, Cheju Doch'ong.

3) Ibid.

4) Cheju Doch'ong. 1985. *The Master Plan of Development of a Special Region, Chejudo: the Outline of Plans*. Cheju-shi, Korea: Cheju Doch'ong. PP. 32-33.

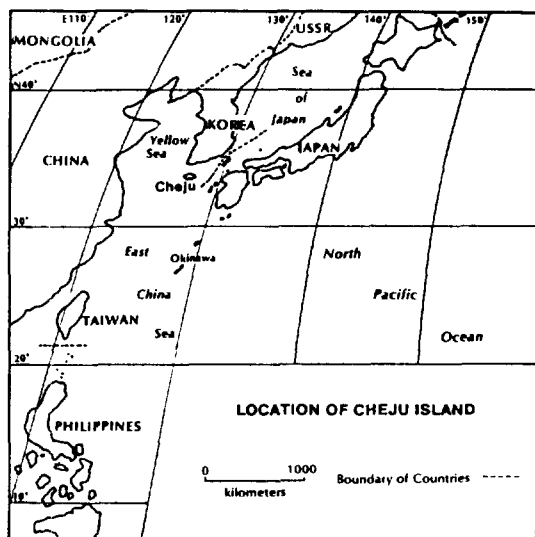


Figure 2. Location of Cheju Island

the island, and because of its elevation to the height of 1,950 meters, it is representative of a mountain climate. In addition, the island is affected by the continental climate: there is heavy rainfall in the summer and a noticeable difference in temperature from season to season. On the other hand, the situation of the island in the midst of the warm Japan Current (Kuroshio) profoundly modifies the local climate. Cyclonic storms that originate in the Yangtze Valley also cause variations in the local weather.

The summer temperatures are not as warm as would normally be expected at this latitude: the highest temperature in the summer seldom exceeds 30 degrees Celsius, and the average temperature remains at around 24 degrees Celsius (75 degrees Fahrenheit). The winters are fairly cool, with an average temperature of 6 degrees Celsius. The mean annual rainfall on the island is about 1,500 millimeters. The distribution of rainfall varies: 1,380 millimeters in Cheju-shi (Cheju City, north of Mount Halla); 1,720 millimeters in Sogwip'o-shi (in the south); 1,690 millimeters in the Songsan area (east); and 1,240 millimeters in the Taejong area (west). The difference in rainfall among the regions is about 300 millimeters between north and south,

and about 450 millimeters between east and west. And over 70 percent of the annual rainfall occurs during the summer half of the year.

Prevailing winds also play a role in the climate of Cheju Island. The movement of the air mass is typically from the northeast in winter and from the southwest in summer. Being influenced by the ocean, the climate of the island is generally mild, but it experiences the strongest winds in all of Korea. Unlike most parts of peninsular Korea, the island experiences cloudy and rainy weather in the winter because the wind from the north picks up moisture as it passes over the channel between the Korean peninsula and Cheju Island. On the other hand, during the summer, Cheju is often hit by typhoons from the South and East China seas.

The natural vegetation of Cheju Island is characterized by variety in kinds and distribution. Many Korean biologists divide the island into three zones: the area up to 500 meters above sea level from the coastline is called the "subtropical plant zone"; the middle area between 500 meters to 1,000 meters is the "temperate forest zone"; and the upper area from elevation 1,000 meters to the top of Mount Halla is the "frigid plant zone," which includes scrub forests. However, due to the presence of human settlements on the island over the centuries, the natural vegetation distribution on the island has necessarily been changed so that it is now characterized by plant succession. The following features may therefore be observed: (1) The agricultural zone extends up to around 200 meters above sea level from the coastline, and mostly upland farming is practiced there; stands of pine trees can be seen in the arable rocky places here and there, but wild plants are rarely seen. (2) The grassland zone extends between 200 meters and 700 meters above sea level, spreading out in a broad steppe. During the Yi dynasty this zone was used as ranch land after it had been opened up for horse raising by invaders from Yuan China at the time of the

Koryo dynasty in Korea.⁵⁾ Today this zone is still utilized for ranching—as a kind of “communal grazing-place” —but this practice has gradually decreased due to the expansion of orchard cultivation and tree planting for future forests. (3) This zone extends from 700 meters to the top of Mount Halla and consists mostly of tall trees, but at the higher elevations, scrub trees are more prevalent.

2) Typhoons on Cheju Island

The term typhoon as used in this paper is defined as an extreme climatic event consisting of strong winds accompanied by heavy rain, originating in the western North Pacific Ocean and occurring within the zone that lies between 32 and 40 degrees north latitude and 120 and 138 degrees east longitude—within which limits lie Cheju Island and the Korean peninsula, which are susceptible to this type of event during the summer season (See also Figure 2).

There were 35 typhoons that were recorded to have visited the Korean peninsula and its nearby seas during the period 1976 to 1985. Twenty-two typhoons were documented to have caused damage on Cheju Island during the same period; on the average, typhoons visit the island 2.2 times per year, and the highest frequency of typhoon occurrence is during the month of August.⁶⁾

The total losses due to typhoons over the last twenty-five years, from 1961 to 1985, are shown to be approximately 14,286 million won.⁷⁾

A great proportion of the losses has been sustained by the agricultural sector. In 1986 alone, agricultural losses from typhoon Bera represent 69 percent of the total losses, as

shown in Table 1.

Table 1. Typhoon Losses in 1986

Classification	Amount of Loss (1,000 Won)	%
Crops and crop fields	2,672,053	69.0
Harbors and fishing ports	780,570	20.0
Roads, stream banks, and channel systems	132,309	3.4
Schools and cultural assets	42,099	1.0
Public facilities (buildings, bridges, installation, etc.)	62,277	1.6
Others	188,198	5.0
Total:	3,877,506	100.0
(Approximately U.S.\$	1,000,000.00)	

Source: Cheju Doch'ong 1987b. Data drawn from Chart of Typhoon Damages on Cheju-do, Cheju-shi, Korea: The Department of Construction, Cheju Dochong.

3) Cultural Context

Cheju Island has had a turbulent history, involving popular rebellions, invasion, political upheavals spilling over from peninsular Korea, and the impact of contact with the outside world through trade, accidental visits by foreign ships and sailors, and military occupations.

The influence of historical events on the society and culture of Cheju can be seen in the personal traits of the people in their language, their family system, their religion, and in their attitude toward education. With regard to personality, the people of Cheju have been known among peninsular Koreans for their attitude of independence from and exclusivity toward those who are from outside the island. Within the island, however, there is cooperation

5) Kuk-lip Jiri-Won (Korean National Geographic Institute). 1986. *Han'guk Jiji (Geography of Korea)*. Vol. IV. Seoul, Korea: Kuk-lip Jiri-Won. P. 458.

6) (1) Cheju Doch'ong, 1987a, Op. Cit., P. 402.

(2) KIST, 1986, Op. Cit., PP. 168-177.

7) (1) Cheju Doch'ong, 1987a, Op. Cit., P. 402.

(2) Cheju Doch'ong, 1987b, Op. Cit.

(3) KIST, 1986, Op. Cit. PP. 182-217.

among local residents, who speak a Cheju dialect that is considerably different from the dialects of the various provinces of peninsular Korea.

The family system and the attitude toward education have been profoundly influenced by religion—and in particular by Confucian beliefs and practices. Family groups, either by blood relation or by surname, can be found in many parts of the island. Villages will often have groups of families bearing the same surname. Members of the same family group will appear to be very cooperative when other persons of the same group need to resolve certain problems in the village.

This tendency toward family “clustering” can be interpreted as a kind of inevitable “group dynamic” that is essential for the protection of immediate family members and relatives from the oppressive external forces—both natural and human—which have been associated with disasters throughout the history of the island.

Education has always been a major concern among the people of Cheju, since it has been their belief that education can lead to a successful life for their children. This belief originates in the Confucian principle that education is invaluable in one’s search for a better life; thus the teachings of the original Confucian scholars have influenced their descendants down through the generations. The strong desire by Cheju parents to secure an education for their children is reflected in the large number of schools in the island’s educational system and the enrollment in them—a total of 302 schools, including four colleges and two universities, with 140,342 students in 1987.⁸⁾

Modern economic development on Cheju Island was initiated in the early 1960s by the Third Republic, when the government of Korea began to take an interest in development according to regional characteristics. Thus, tourism came to Cheju Island, because of its “exotic”

subtropical climate and unique culture. Since that time, the island has passed into a transitional stage, from “poverty” to “developing.” Transport and communications facilities have been greatly expanded. Water resources have been satisfactorily improved. Modern buildings, including tourist hotels and resorts, have been constructed. Because of the progress in transportation, the economy of the island has accelerated to the level where it is now exporting agricultural and marine products to both domestic and foreign markets. The tourism industry has also progressed, the number of domestic and foreign visitors to the island increasing every year.

Agriculture on Cheju Island occupies about 28 percent (519.7 square kilometers) of the entire island (1,824.9 square kilometers) and is distributed into three zones as follows: the coastal area below 100 meters above sea level, which includes about 70 percent of the total farmlands; the lower mountainous area between 100 to 200 meters (about 20 percent); and the mountainous area over 200 meters (10 percent).

The prevailing agricultural products on Cheju Island have been food grains, which the farmers raise for their own use. However, production of this type of crop has recently declined at the same time that there has been an increase in the cultivation of commercial crops, including special vegetables and fruits, which bring in more income to farming families as they respond to the increased demand for these new crops in the market.

Agricultural development on Cheju during the period 1966 to 1981 has a recorded average annual growth rate of 3.0 percent.⁹⁾ Development in this sector has largely been achieved the result of an increase in the production of commercial crops and the rational utilization of cultivated land, and not necessarily by the expansion of agricultural land. Evidence of this

8) Cheju Doch’ong, 1987a, Op. Cit., P. 232.

9) Cheju Doch’ong, 1985, Op. Cit., P. 260.

Table 2. Change in Cultivated Land Utilization by Crop

Unit: percent					
Year	1966	1971	1976	1981	1986
Crops					
Food Crops					
Rice	100 (3,898)	48	63	45	30
Barley and wheat	100 (32,387)	68	52	48	34
Miscellaneous grains	100	65	34	14	15
Pulses	100 (6,584)				
Potatoes and sweet potatoes	100 (17,589)	56	65	62	33
Special Crops ^a	100 (6,291)	204	330	207	189
Vegetables	100 (1,780)	155	98	319	350
Orchards	100 (659)	886	1,756	2,240	2,574

Source; Cheju Doch'ong 1985. The Master Plan of Development of a Special Region, Chejudo: the Outline of Plans. Cheju-shi, Korea: Cheju Doch'ong. P. 260.

Cheju Doch'ong 1987a. Che Ju Statistical Yearbook. Cheju-shi, Korea: Cheju Doch'ong PP. 78-90.

Note: Figures in parentheses represent the area of cultivated land in hectares.

^aSpecial crops include cotton, sesame seed, perilla seed, peanuts, and rape.

fact may be seen in the figures in Table 2: special crops and vegetables in general and orchards in particular help to account for the higher percentage of utilization of the land. The figures for the area under cultivation for orchards in 1986 indicate an expansion of no less than 25 times the figure for 1966, while the area under cultivation for special crops and vegetables is about two times by comparison. On the other hand, the production of food crops has decreased about 30 percent in the utilization of cultivated area. In relation to the change in agricultural land utilization, the special staples, vegetables, and orchards have greatly contributed to an

increase in not only the agricultural gross receipts per farm household but also in the income of the island as a whole.

3. THEORETICAL FRAMEWORK

1) Origin of the Research

The relationship between man and his environment has been a concern of natural and social scientists over the past century, and it has been depicted according to various paradigms. The paradigm of the man-environment relationship in geography has evolved from environmental determinism to environmental possibilism, and recently to cognitive behaviorism. Environmental determinism is based on the idea that there are environmental factors powerful enough to determine a man-environment relationship in which man has no choice regardless of his thoughts and beliefs. Environmental possibilism is concerned with the possibilities and limitations that are set by the environment, without considering either man's motivations or his choices. Cognitive behaviorism places emphasis on man's reaction to his environment as he perceives and interprets it according to the consequences of his past experiences. Cognitive behaviorism has been involved in most of the natural-hazard-perception studies in geography during the past two decades. The present study follows this line.

At the beginning of the twentieth century, American geographers proclaimed their functional role as the bridge between the natural and the social sciences, and began to display their interest in the relationship between man and environment. Davis stated the importance of the man-environment relationship for geographical studies. He then conceptualized the nature of geography as manifesting some relation between "an element of inorganic control and one of organic response."¹⁰) This concept appealed to those

10) Davis, William M. 1906. "An Inductive Study of the Content of Geographical Society (1906), Vol. 38. pp. 67-84. In Douglas W. Johnson (ed.). *Geographical Essays*. Dover Publications. 1954. PP. 7-8.

geographers who were trained in the discipline of geology. Some geologists, then, shifted their specialization from geology to physical geography and then to human geography. Human geography, during this early period, was still close to physical geography, favoring the side of determinism.

During the 1920s and 1930s, there was a rising criticism against environmental determinism among many geographers. Barrows, as he retreated from environmental determinism, attempted to define geography as the science of human ecology. He criticized environmental determinists for focusing on the cause of the distribution of surface phenomena, and proposed that an understanding of the implications of human ecology should be the objective of geographic inquiry in attempts to make clear the man-environment relationship. His standpoint was to examine the relationship as man's adjustment to his environment, not from the adjustment to environmental influence. Barrows also suggested an explanatory description method for this examination, through field work involving observations on man's activities within his environment.¹¹⁾

Sauer pointed out the methodological limitations of an environmental determinism that depended heavily on a particular causal relationship to explain the man-environment relationship. Sauer therefore introduced the concept of natural and cultural landscape as: "an area made up of a distinct association of forms, both physical and cultural"¹²⁾ he posited that geographical inquiries based on the concept of

natural and cultural landscape should be directed toward cultural experiences, behaviors, and drives. The inquiries could be answered by using the method of physical observation¹³⁾. In addition to these criticisms, there was also criticism against the philosophical weakness of environmental determinism in the constructing of a framework acceptable to academic discipline and research¹⁴⁾.

Human and physical geography began to separate in the 1940s and 1950s, although geography was still regarded as a bridge between the natural and social sciences. However, these two major streams could not be integrated for the purpose of geographical studies—physical geography disregarded human activities, while human geography was generally indifferent to nature. Many geographers during this transitional period, who followed Sauer's approach, did studies on deforestation, erosion, reclamation, and the processes of environmental modification. They focused primarily on man's role as an ecological dominant.

The field of environmental perception arose as a new perspective in human geography, but it was not systematic in its approach to research until the 1960s.¹⁵⁾ The field of perception is not an entirely new idea within geography, since cultural geographers had long been concerned with it in their cultural approach. However, the idea of cultural appraisal or environmental perception had been used only in a broad and subjective way to describe whole cultures.

By the early 1960s, there was active metho-

11) Barrows, Harlan H. 1923. "Geography as Human Ecology." *Annals of the Association of American Geographers (AAAG)*. Vol. 13, No. 1, PP. 3-4.

12) Sauer, Carl O. 1925. "The Morphology of Landscape." Reprinted in J. Leighly (ed.), *Land and Life: A Selection from the Writing of Carl Ortwin Sauer*. Berkeley: University of California Press. 1963. P. 321.

13) Sauer, Carl O. 1941. "Foreword to Historical Geography." *AAAG*. Vol. 31, No. 1, PP. 5-7.

14) Mikesell, M.W. 1974. "Geography as the Study of Environment: An Assessment of Some Old and New Commitments." In *Perspectives on Environment*, I.R. Manners and M.W. Mikesell (eds.). Association of American Geographers, Publication No. 13. P. 3.

15) (1) Bunting, Trudi E. and Leonard Guelke. 1979. "Behavioral and Perception Geography: A Critical Appraisal." *AAAG*. Vol. 69, No. 3, PP. 453-454.

(2) Grossman, Larry. 1977. "Man-Environment Relationships in Anthropology and Geography." *AAAG*. Vol. 67, No. 1, P. 139.

dological discussion along the lines of perception studies among geographers. Kirk criticized the methodological limitations of a possibilistic approach, that could not fully explain man-environment relationships in which human are importantly engaged. He then suggested the development of a cognitive behaviorism approach whose observations could be measured and then applied to an explanation of the man-environment relation.¹⁶⁾ Human perception and behavior eventually became widely recognized as new approaches in human geography. These new approaches were based on the ideas of Sauer¹⁷⁾ and Kirk¹⁸⁾ among others, who emphasized the role of human behavior in the real world. Thus, considerable research has been conducted in the field of environmental perception and behavior. All of this research has been shaped by natural hazard studies that attempted to integrate the natural and social science perspectives in an effort to come up with a scientific rationale for the man-environment

relationship in geography. The representative studies on natural hazards during this period were carried out by White¹⁹⁾, Kates²⁰⁾, Burton²¹⁾, Saarinen²²⁾, and Sonnenfeld²³⁾.

2) Natural Hazard Research

A pioneering research on natural hazards was conducted by Gilbert F. White, whose general ideas on human adjustments to flood hazards focused on the physical factors that affected the adjustments.²⁴⁾ A more elaborate investigation was conducted into urban settlements on flood plains in the United States, especially with regard to the high cost of government investments in flood-control projects together with the cost of increasing annual resource losses due to floods.²⁵⁾ This investigation in turn led to a series of investigations at the University of Chicago, with a greater focus on social factors such as human perception and behavior in flood hazard area and public policies covering resource loss

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- 16) Kirk, William. 1963. "Problems of Geography." *Geography*, Vol. 48, PP. 364-5.
- 17) (1) Sauer, Carl O. 1925, Op. Cit.
 (2) Sauer, Carl O. 1941, Op. Cit.
- 18) (1) Kirk, William. 1952. "Historical Geography and the Concept of the Behavioral Environment." In *The Indian Geographical Society, Silver Jubilee Souvenir, N. Subrahmanyam Memorial Volume*, G. Kuriyan (ed.), Madras, India: University of Madras. PP. 152-159.
 (2) Kirk, William, 1963, Op. Cit.
- 19) White, Gilbert. F. 1964. "Choice of Adjustment to Floods." University of Chicago, Department of Geography Research Paper No. 93.
- 20) (1) Kates, Robert W. 1962. "Hazard and Choice Perception in Flood Plain Management." Chicago: University of Chicago, Department of Geography Research Paper No. 78.
 (2) Kates, Robert W. 1967. "The Perception of Storm Hazard on the Shores of Megalopolis." University of Chicago, Department of Geography Research Paper No. 109, PP. 60-74.
- 21) (1) Burton, Ian. 1962. "Types of Agricultural Occupance of Flood Plains in the United States." Chicago: University of Chicago, Department of Geography Research Paper No. 75.
 (2) Burton, Ian. 1964. "The Floodplain and the Seashore (A Comparative Analysis of Hazard-Zone Occupance)." *Geographical Review*, Vol. 54, No. 3 pp. 366-385.
- 22) Saarinen, T.F. 1966. "Perception of the Drought Hazard on the Great Plains." Chicago: University of Chicago, Department of Geography, Research Paper No. 106.
- 23) Sonnenfeld, Joseph. 1967. "Environmental Perception and Adaptation Level in the Arctic." University of Chicago, Department of Geography Research Paper No. 109, pp. 42-59.
- 24) White, Gilbert F. 1945. "Human Adjustment to Floods." University of Chicago, Department of Geography Research Paper No. 29.
- 25) White, Gilbert F., W. C. Calef, J.W. Hudson, H.M. Mayer, J.R. Sheaffer, and D. J. Volk. 1958. "Changes in Urban Occupance of Flood Plains in the United States." University of Chicago, Department of Geography Research Paper No. 57.

reduction.²⁶⁾

The research group worked on natural hazard studies using a cultural framework reflected by cognitive behaviorism which included research inquiries into such questions as: (1) why people occupy hazard-prone areas; (2) how people perceive extreme events and the resulting hazards; (3) what is the range of possible adjustments by a given group of people in response to extreme vents; (4) what is the process by which a choice of adjustment is made in order to minimize losses due to an extreme event; and (5) what would be the effect of public policy upon the responses of a particular group.

Within this central framework, investigations were expanded to different regions in the United States, taking into consideration not only floods but also other types of natural hazards such as drought, tornadoes, coastal erosion, windstorms, frost, hurricanes, earthquakes, and volcanoes.²⁷⁾

Extensive investigations then were elaborated to include responses in different cultures to

various kinds of hazards. New hazard research institutions were established, and specialized hazard research results were published. These hazard research institutions were included the University of Chicago, Clark University, and the University of Toronto, and they extended to other universities both in the United States and in other countries. They attempted to apply the earlier findings from flood-plain research to other geographical hazards by employing broader conceptualizations and new methodologies from various fields in the natural and social sciences. The new efforts also resulted in the initiation of a program of collaboration in cross-cultural research.

Cross-cultural studies into particular hazards were conducted in a wide range of countries, from the developing to the developed, taking into consideration a variety of social, economic, and psychological factors.²⁸⁾ These studies permitted the international comparison of empirical findings for a variety of hazards, physical

26) (1) Burton, Ian, 1962, Op. Cit.

(2) Burton, Ian and R. W. Kates, 1964. "The Perception of Natural Hazards in Resource Managemet." *Natural Resources Journal*, Vol. 3, No. 3, pp. 412-441.

(3) Holmes, R.C. 1961. "Composition and Size of Flood Losses." *Papers on Flood Problems*. Edited by G.F. White, Chicago: University of Chicago, Department of Geography, Research Paper No. 70. PP. 7-20.

(4) Kates, Robert W. 1962. Op. Cit.

(5) White, Gilbert F. 1964. Op. Cit.

27) (1) Davenport, S.S. 1978. "Human Response to Hurricanes in Texas--Two Studies." University of Colorado, Institute of Behavioral Sciences, Natural Hazards Working Paper No. 34.

(2) Jackson, Richard H. 1974. "Frost Hazard to Tree Crops in the Wasatch Front: Perception and Adjustment." In *Natural Hazards: Local, National, Global*, PP. 146-151.

(3) Jackson, E.L. and T. Mukerjee. 1974. "Human Adjustment to the Earthquake Hazard of San Francisco, California." In *Natural Hazards: Local, National, Global*, pp. 160-166.

(4) Miller, D.J., W.A.R. Brinkmann, and R.G. Barry. 1974. "Windstorms: a case study of wind hazards for Boulder, Colorado." In *Hazards: Local, National, Global*, pp. 80-86.

(5) Murton, B.J. and S. Shimabukuro. 1974. "Human Adjustment to Volcanic Hazard in Puna District, Hawaii." In *Natural Hazards: Local, National, Global*, pp. 151-159.

(6) Rowntree, Rowan. 1974. "al hazard in the Cultural and Ecological context." In *Natural Hazards: Local, National, Global*, pp. 70-79.

(7) Saarinen, T.F. 1966. Op. Cit.

(8) Sims, J.H and D. D. Baumann. 1972. "The Tornado Threat: Coping Styles of the North and South." *Science*. Vol. 176, pp. 1386-1392.

28) (1) Heathcote, R.L. 1969. "Drought in Australia: A Problem of Perception." *Geographical Review*, Vol. 59, pp. 175-194.

(2) Heathcote, R.L. 1974. "Drought in South Australia." In *Natural Hazards: Local, National, Global*. Edited by G.F. White. New York: Oxford University Press, pp. 128-136.

(3) Heijnen, J. and R.W. Kates, 1974. "Northeast Tanzania: comparative observations along a moisture gradient." In *Natural Hazards: Local, National, Global*, pp. 105-114.

environments, and cultures. The International Geographical Union's Commission on Man and Environment played a leading role in stimulating and coordinating such research activities in many countries.²⁹⁾ As a result, geographers were able to see a more complete picture of the dynamic interaction between humans and their varied environments. The progress in theory and methodology in natural hazard studies became evident. The new, advanced methodologies included the techniques of standard interviews and field observation and the instruments of behavioral research.

Further investigations of policy at regional, national, and international levels contributed to integrated reviews of hazard situations and human responses to particular extreme events. Recent hazard perception studies are part of a trend, with policy implications for improving warning systems, for evaluating hazard information, and for instituting educational programs.³⁰⁾

It is believed that the contribution of natural hazard studies has been to test general theories related to man-environment relationships through the analysis of empirical data, and through the integration of knowledge in the natural and social sciences. More importantly, natural-hazard studies have provided human society with specific information concerning natural hazards and human responses to these hazards—information which crosses regions, nations, and cultures, thereby helping to resolve practical problems in the “real world.”

3) LITERATURE REVIEW AND HYPOTHESES

A natural hazard has been defined as “an interaction of people and nature governed by the co-existent state of adjustment in the human use system and the state of nature in the natural events system.”³¹⁾ Natural extreme events have power well beyond the human capacity to manage them, and they are ever uncertain and unpredictable. Extreme events, however, would not constitute hazards if there were no human occupancy; hence the need for adjustment in a hazardous area.³²⁾ Human occupancy in a hazardous area, therefore, creates damage potential, the possibility of change, and the potential for problems of adjustment.

The study of natural hazards according to a behavioral approach begins by examining how people interact with their extreme environment, focusing on human perception and behavior. More specifically, the examination involves such questions as (1) how people perceive natural hazards; (2) how people interpret their previous experiences of these hazards; (3) why people inhabit natural hazard areas; (4) how they make decisions relating to adjustment to hazards, and (5) how they utilize their resources in the process of adjustment to natural hazards. The present study intends to involve such an examination, and it deals specifically with typhoon hazards on Cheju Island, Korea.

An understanding of human perception is the starting point for an analysis of the relation-

(4) Islam, M.A. 197-. “Human Adjustment to Cyclone Hazards: A Case Study of Char Jabbar.” Boulder: University of Colorado, Institute of Behavioral Science, Natural Hazards Working Paper No. 18.

(5) Kirkby, Anne V. 1974. “Individual and Community Response to Rainfall Variability in Oaxaca, Mexico.” In *Natural Hazards: Local, National, Global*, pp. 119-128.

29) Mitchell, J.K. 1974. “Natural Hazard Research.” In *Perspectives on Environment*, Edited by I.R. Manners and M.W. Mikesell. Washington, D.C.: Association of American Geographers. P. 313.

30) Whyte, A.V.T. 1986. “From Hazards Perception to Human Ecology.” In *Geography, Resources, and Environment*, Vol. II. R.W. Kates and I. Burton (eds.). Chicago: University of Chicago Press. P. 245.

31) White, Gilbert F. 1974. “Natural hazards research: concept, methods, and policy implications.” In *Natural Hazards: Local, National, Global*, P. 4.

32) Ibid, P. 3.

ship between man and his environment, since human behavior is seen to be a reflection of human perception in behavioristic terms.³³⁾ Perception of a hazard is crucial to the process of adjustment to the hazard, and the quality of perception helps to explain why the human response to a hazard is sometimes not on a level with the probability and distribution that have been scientifically assessed. Hazard perception is associated with the variables in magnitude and frequency of a particular hazard, how recent and how frequent the personal experience has been, and the personality of those who go through the experience.³⁴⁾

Hazard perception studies have consistently shown that people tend to underestimate a hazard and to perceive the hazard as less risky than it is.³⁵⁾ There is documentation for a positive correlation between the amount of personal experience and the accuracy of hazard perception: people who have had more previous experience with hazards tend to show greater accuracy in hazard perception.³⁶⁾ People who have had recent and intense experience with hazards also seem to show more accuracy in hazard perception.³⁷⁾ One researcher has concluded that the variables related to the accuracy

of hazard perception are: the objective certainty of future impact; greater and more recent experience with hazards; and direct experience with economic loss due to hazards. On the other hand, the variables not related to the accuracy of hazard perception are; educational level, sex, income level, age, and risk-taking propensity.³⁸⁾ It has been hypothesized in this research that Cheju farmers in typhoon hazard areas would perceive a typhoon as a hazard, and their awareness of the typhoon hazard would be associated with the frequency of occurrence of typhoons (Hypothesis I). It has also been hypothesized that the more intense and more recent are the experiences with typhoon hazards, the more accurate would be the Cheju farmers' perception of a hazard (Hypothesis II).

Human occupancy refers to the habitation that persists in areas of recurrent hazard, a persistence that may lead to potential resource losses. Human occupancy is influenced by social, economic, and cultural factors. Researches into coastal flood hazards have provided evidence that hazardous areas are more attractive to human occupancy than safe areas because of the perceived economic and aesthetic advantages.³⁹⁾ It was reported that increasing

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- 33) Whyte, A.V.T. 1977. *Guidelines for Field Studies in Environmental Perception*. Paris: United Nations Educational, Scientific and Cultural Organization (UNESCO), Man and Biosphere (MAB). P. 11.
- 34) Parker, D.J. and D.M. Harding. 1979. "Natural Hazard Evaluation, Perception and Adjustment." *Geography*. Vol. 64(3). No. 285. P. 311.
- 35) (1) Burton, Ian and R.W. Kates. 1964. Op. Cit. P. 385.
 (2) Heathcote, R.L. 1969. Op. Cit. PP. 183-184.
 (3) Kates, Robert W. 1967. Op. Cit. P. 68.
- 36) (1) Burton, Ian and R.W. Kates. 1964. Op. Cit.
 (2) Kates, Robert W. 1967. Op. Cit.
 (3) Roder, W. 1961. "Attitudes and Knowledge on Topeka Flood Problems." In *Papers on Flood Problems*. Edited by G.F. White. Chicag: University of Chicago, Department of Geography Research Paper No. 70.
 (4) Saarinen, T.F. 1966. Op. Cit.
- 37) Kates, Robert W. 1971. "Natural Hazard in Human Ecological Perspective: Hypotheses and Models." Natural Hazard Research Working Paper No. 4. Clark University, Department of Geography. Reprinted in *Economic Geography*, Vol. 47. 1971. P. 441.
- 38) Mileti, Dennis S. T.E. Drabek and J.E. Haas. 1975. "Human Systems in Extreme Environments: A Sociological Perspective." University of Colorado, Institute of Behavioral Science, Program on Technology, Environment and Man, Monograph 21. P. 24.
- 39) (1) Burton, Ian. R.W. Kates and R.E. Snead. 1969. "The Human Ecology of Coastal Flood Hazard in Megalopolis." Chicago: University of Chicago, Department of Geography, Research Paper No. 115.
 (2) Islam, M.A. 1974. "Tropical Cyclones: Coastal Bangladesh." In *Natural Hazards: Local, National, Global*. PP. 19-24.

demands for scenic amenity and outdoor recreation are causes of human occupancy in hazard-prone areas.⁴⁰⁾ Economic factors have been widely documented as dominant factors behind human occupancy in most hazard-prone areas. Flood-hazard areas have frequently appeared to offer advantages such as fertile alluvial and volcanic soils beneficial to agriculture. Moreover, flood plains have provided cheap sites for housing.⁴¹⁾ A cyclone-hazard study in Bangladesh suggested the importance of social preferences and strong family and community bonds—in addition to the economic factors—for human occupancy in hazard-prone areas.⁴²⁾ It has been hypothesized in this research that occupancy in typhoon-hazard areas on Cheju Island would involve socio-cultural factors such as family and community ties, rather than economic factors (hypothesis III).

Human adjustments occur as the result of the interaction between human-use systems and natural extreme events. The adjustments to natural hazards involve human activities which attempt to minimize natural resource losses due to extreme natural events, while simultaneously trying to maintain natural resources.⁴³⁾ Human adjustment may consist of two types: purposeful and preventive. The purposeful adjustment refers to the bearing or sharing of the full burden of loss due to natural extreme events, while the preventive adjustment involves changes or modifications in the basic pattern of production or else migration to other pla-

ces.⁴⁴⁾ It has been hypothesized in this research that the adjustment of Cheju farmers to the typhoon hazard would be a combination of purposeful and preventive adjustments (Hypothesis IV).

Awareness of human adjustments to natural hazards is “a function in the main of the causal access to communication networks and of motivation to seek new modes of adjustment.”⁴⁵⁾ Awareness of adjustments is importantly related to choice of adjustment, and this is reflected in decision-making. Decision-making in the process of adjustment involves certain influential factors: personal experience with natural hazards, the material wealth of individuals, personality traits, and the perceived role of individuals.⁴⁶⁾ One hazard-perception study suggested that personal experience might result in an increase in adjustment knowledge when positive views of fate are encouraged.⁴⁷⁾ A study of volcano hazards in Hawaii noted the importance of personal experience as a critical factor in the awareness of adjustment.⁴⁸⁾ It has been hypothesized in this research that the awareness and choice of adjustment by Cheju farmers would be positively related to their extensive past experiences with typhoon events (Hypothesis V).

Government, at both the national and local levels, has been subjected to analysis of policy implications for its role in coordinating or assisting in hazard-damage reduction, hazard-adjustment choice, and preparedness for future hazards. More importantly, cooperation at the levels of

40) Mitchell, J.K. 1974. Op. Cit. P. 310.

41) (1) Burton, Ian. 1972. “Cultural and Personality Variables in the Perception of Natural Hazards.” In *Environment and the Social Science: Perspectives and Applications*. Edited by J.F. Wihlwill & D.H. Carson. Washington, D.C.: American Psychological Association, P. 185.

(2) Mitchell, J.K. 1974. Op. Cit., P. 323.

42) Islam, M.A. 1974. Op. Cit. P. 24.

43) Mileti, Dennis S. 1980. “Human Adjustment to the Risk of Environmental Extremes.” *Sociology and Social Research*. Vol. 64, No. 3, pp. 330-333.

44) Burton, Ian, R.W. Kates and G. F. White. 1978. *The Environment as Hazard*. New York: Oxford University Press, PP. 44-49.

45) Kates, Robert W. 1971. Op. Cit. P. 441.

46) Burton, Ian, R.W. Kates and G.F. White. 1978. Op. Cit. PP. 106-111.

47) Kates, Robert W. 1971. Op. Cit. P. 441.

48) Murton, B.J. and S. Shimabukuro, 1974, Op. Cit. P. 159.

government, community, and individuals in coping with the problems associated with hazards has been emphasized.⁴⁹⁾ Many natural-hazard studies have stated a lack of awareness by inhabitants in natural-hazard areas of the extent to one way or another with their hazard-related problems. The perceived poor communications and the lack of information sharing by government agencies with local inhabitants are widely recognized. This seems to suggest the need for more concerted efforts in education and communication.⁵⁰⁾ It has been hypothesized in this research that the level of communication and education is poor between Cheju farmers and the national and local government agencies, with regard to typhoon hazards (Hypothesis VI).

4. RESEARCH DESIGN

The methods adopted for the present research included a questionnaire, personal interviews, and field observation. The combination of these approaches has been highly recommended for environmental perception studies in geography, in an attempt to achieve scientific objectivity through the collection of empirical data for the studying of subjective materials. In addition, a library search and a review of the relevant maps and government documents comprise substantial portions of this research effort.

1) Locale of Study

The study area consists of the three counties of Han'gyong-myon, Taejong-up, and Songsan-up, which are located on the coastal plains of Cheju Island. Han'gyong and Taejong counties are located adjacement to each other on the west coast of the island. Songsan county is located on the southeastern coast (Figure 3).

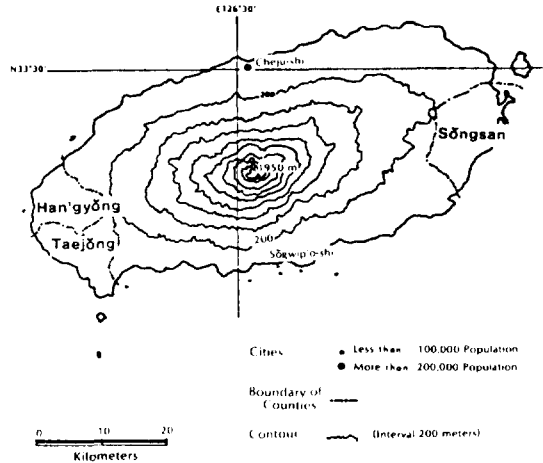


Figure 3. Study Areas

The total area of these counties is 258.4 square kilometers, which constitutes about 14 percent of the 1,824.9 square kilometers that comprise the total land area of the entire island. The area of each county is as follows: 82.2 square kilometers for Han'gyong, 79.9 square kilometers for Taejong, and 96.3 square kilometers for Songsan. Of the total area, agricultural land comprises 111 square kilometers, equivalent to 43 percent of the total area: 37 square kilometers (45.0 percent) for Han'gyong, 42 square kilometers (52.6 percent) for Taejong, and 32 square kilometers (33.2 percent) for Songsan.

The total population of the three counties in 1987 amounted to about 12 percent of the island total of 495,968 persons, and most of the population was engaged in agriculture: 94 percent in Han'gyong, 85 percent in Taejong, and 80 percent in Songsan.

All three counties are vulnerable to changes in the weather since most portions of them are located on plains which are less than 200 meters

49) Davis, Ron. 1977. *Coping with Natural Disasters at the Local Level* (ICEP Special Report). Washington, D.C.: International Center for Emergency Preparedness, PP. 10-11.

50) Moline, M.T. 1974. "Perception Research and Local Planning: Floods on the Rock River, Illinois: In *Natural Hazards: Local, National, Global*, P. 59.

above sea level and which are relatively wider and flatter than the other parts of the island (also Figure 3). These areas are directly exposed to strong northwest winds from the Asian mainland during the winter season and to typhoons from the East China Sea in the summer. The areas have long been subjected to typhoon hazard problems.

Most of the land in the study sites is used for the production of food crops such as barley, wheat, millet, upland rice, and pulses such as soybeans, red beans, and mung beans, and potatoes including sweet potatoes. Sesame seeds, perilla seed, and rape are cultivated as special crops. Recently, there has been an increasing trend toward orchards in the upland areas, and vegetable cropping and greenhouse cultivation in the lowlands. It is just when some of the agricultural products are ready for harvest that they are damaged by the typhoons. Those crops which are mainly subject to typhoon damage during the summer season are millet, soybeans, sesame, upland rice, and vegetables. Millet and sesame especially are susceptible to winds.

Agricultural practices in the three countries are a combination of traditional methods such as plowing with horses and cows, and of modern techniques mainly involving the use of simple farm machines such as small tractors. Farmers also cooperate during planting and harvesting at both the family and the community levels.

Human settlement has been extended along the coastline and around the volcanic cones, where fresh water is available. The volcanic cones, with an average height of 150 meters, and which are scattered here and there on the plain, serve as protection for the people of the island against extreme weather events. Most houses are of similar design, with gently pitched flat roofs and simple construction. The traditional houses with their gently pitched, straw-thatched roofs tied with straw ropes have almost entirely disappeared, and the few remain are for the purpose of cultural conservation.

On the other hand, the improved modern houses with more colorful (but still gently pitched) roofs, and built of cement for protection against typhoons, are the type of houses where most of the people now live.

Breakwaters or seawall for protection against winds and high tides along the shoreline in the study areas are rarely seen except for piles of lava stones in a few fishing ports.

2) Sampling

The names of 113 farmers who are householders were selected by stratified and random sampling methods. Regarding the ratios of the populations of each of the three sites, 33 farmers for Han'gyong, 44 for Taejong, and 36 for Songsan were selected from the census list, obtained from the County Offices, by using a random-number table. The release of the census list was permitted by the Heads of the three County Offices.

3) Questionnaire

The questionnaire was designed, based on the Natural Hazard Research Questionnaire, to explore the proposed hypotheses concerning human perception of and adjustment to natural hazards. The questionnaire consists of four major sections: (1) General Background Information; (2) Perception; (3) Adjustment; and (4) The Role of Government. The first section includes general questions on such items as age, income, education, agricultural products, and duration of occupancy in the area. The second section involves questions about the perception of typhoon hazard experiences, and sentences for completion to measure the range of typhoon experience, the emotional impact of the experiences, and the locus of control to identify personality traits. The third section includes the aspects of occupancy together with the process of adjustment to typhoon hazards. The fourth and last section assesses the farmers' perception of the role of government in resolving typhoon hazard problems.

4) Procedure

A pilot study was held involving ten farmers in Chejudo a week prior to the actual survey, in order to assess the contents of the questionnaire. The questionnaire was acceptable to the farmers.

A total of 113 farmers were interviewed. Three interviewers including the author visited each head of the household in his or her home in the study sites, but most of the interviews were conducted on the farms, using the farmers' break periods.

Besides the survey interviews with the farmers, informal interviews consisting of three short questions were conducted with three government officials who were engaged in the resolving of typhoon hazard problems. The questions were designed so as to compare the responses of the farmers concerning the role of government to the responses of the government officials.

The data were collected and checked by the interviewers immediately after the completion of the interviews in order to confirm whether there was any missing information on the questionnaire and whether the respondents misunderstood any of the questions. The data collected were stored in a computer data file at the end of each day of interviews.

All the data collected were organized for computer analysis, by constructing a code manual based on the majority response for each of the items on the questionnaire. And SAS program was used for the analysis of the data, by performing both frequency distribution and chi-square analysis.

5. RESEARCH RESULTS AND DISCUSSION

The results of the present research, which were obtained from the interview survey using the questionnaire, and from field observation, include the responses to the research questions dealing with the three major categories of per-

ception, adjustment, and the role of government. The summary and discussion which follow the results relate to the hypotheses of the present study and compare them with the findings of previous natural-hazard studies. Responses drawn from informal interviews with the local Cheju government officials are also presented at the end of the discussion.

1) Perception

Cheju farmers in the three typhoon hazard areas are generally aware of the hazard presented by annual typhoons because of their considerable experience over a long period of occupation in the hazard areas (Table 3).

Table 3. Awareness of Typhoon Hazard

	Frequency	Percent
Is a typhoon hazardous?		
Yes	109	96.5
No	4	3.5

The farmers interviewed whose average age was 47 years, have lived in the hazard areas for almost their entire lives—on the average, 42 years. As a result of their many years of experience with typhoons, more than half of the farmers could remember with fair accuracy the frequency of past typhoons, responding that they occurred two or three times a year. The statistical record, as presented in the earlier section, shows an average frequency of 2.2 times per year. Moreover, farmers were able to predict closely when a typhoon would come again (Tables 4 and 5). A predicted typhoon in fact did visit on 31 August 1987, 15 days after the date on which the survey was held.

The way in which a typhoon hazard is perceived appears to be related to the level of

Table 4. Remembered Occurrence of Typhoons

	Frequency	Percent
1 or 2 times	45	40.5
2 or 3 times	55	49.5
More than 3 times	11	9.5

Table 5. Prediction of Future Typhoons

	Frequency	Percent
Will a typhoon come again?		
Yes	108	96.4
Don't know	4	3.6
Will it come soon?		
Soon	95	88.0
Next year	13	12.0

education—the farmers with more education tend to perceive the severity of a typhoon in terms of its power (i.e., its velocity and magnitude), while the less educated farmers tend to perceive the severity in terms of the amount of damage caused by the typhoon. Hazard perception is further extended to the degree to which the farmers who have adopted new orchard technology differ from those who have not. The adopters perceive typhoons to be less of a hazard, while the non-adopters perceive them to be more of a hazard ($X^2=9.03$; $DF=3$; $P < 0.05$).

However, Cheju farmers are fairly optimistic for their future lives in the hazard areas, although they have long been aware of the frequency of typhoons.

Personality traits became apparent in the responses—Cheju farmers in the typhoon-hazard areas mentioned hard work, money, and a sincere attitude as major factors that help people to better their lives or improve their chances of success.

2) Adjustment

The dominant reason for Cheju farmers to continue occupancy in typhoon-hazard areas is that they have family and relatives in these areas; therefore they do not want to leave. Uncertainty of income comes next as a reason for their continued occupancy. When asked about their preference among places to live, only 13 farmers out of the 113 responded. A majority of the farmers (82 percent) responded that they did not have any other place to live.

Almost half of the Cheju farmers in the hazard areas knew that a typhoon would come, by

observing the shapes of the clouds covering the top of Mount Halla or changes in the appearance of plants, or by calculating the date based on the lunar calendar. More than half of the respondents, however, did not know how to learn of the coming of a typhoon.

In preparation for typhoons, more than half of the farmers did secure their houses and farms and arranged drainage systems, while the rest stayed at home without engaging in any activities related to preparation (Table 6).

Table 6. Preparation against Typhoons

Do you prepare?	Frequency	Percent
Yes	59	53.2
No	33	29.7
Uncertain	19	17.1
If yes, how do you prepare?		
Secure the farm	10	16.7
Secure the house	19	31.7
Secure both farm and house	6	10.0
Arrange drainage system	15	25.0
Other	10	16.7

However, there was an apparent regional difference among the three hazard areas—Taejong farmers were better prepared for future typhoons than were the farmers in the other two areas, Songsan and Han'gyong. Typhoon preparation appears to be related to the length of time lived in the hazard areas. The farmers who have lived for less than twenty years in a given area were more concerned with preparing their farms ($X^2 = 10.8$; $DF = 4$; $P 0.05$).

Preparation also appears to be related to level of education—farmers with more education were more concerned about their farms, while those who were less educated worked on their houses or stayed at home without doing anything ($X^2 = 22.9$; $DF = 8$; $P 0.05$).

Changing the kinds of agricultural products or the patterns of farming has been one strategy of Cheju farmers in coping with typhoon hazards, but these types of change involve only 27 percent of the total respondents.

The agricultural products involved in these changes include soybeans and sweet potatoes as

dominant products; next come mainly the root vegetables such as garlic, carrots, onions, and cabbage; and finally there are the greenhouse products such as water melons, sweet melons, grapes, and pineapples. The farmers who have changed from one crop to another explained that the ones to which they changed are less likely to be damaged by strong winds. Changes in agricultural patterns include early or late seeding (21 percent), in order to avoid vulnerability during the predicted period of a typhoon, as well as greenhouse cultivation (15 percent).

Changes in agricultural products or patterns are related as well to the variables of religion, duration of stay in the hazard areas, and adoption of new orchard technology. Where religion is concerned, followers of Confucian practices in the hazard areas (56 percent of the total respondents) responded more by changing their crops and farming patterns than did the other two principal religious groups, the Buddhists (24 percent) and the shamanists, including non-adherents (19 percent). Those farmers who adopted the new orchard technology changed their agricultural pattern to greenhouse cultivation, while the rest who chose to make some kind of change preferred mulching and late planting or early harvesting. However, 73 of the total number of farmers who were respondents expressed no intention toward any kind of change in the future, while 27 percent of the respondents stated their intention to change to commercial crops—with an eye toward future family income—by resorting to traditional mulching and early harvesting or late planting.

3) The Role of Government

When questioned as to the best type of help in recovering from damage to their properties due to typhoons, Cheju farmers in the typhoon hazard areas responded: self, government, and neighbors in that order. Ways to recover losses included central government compensation through the local government, as well as cooperation within communities (Table 7). However,

farmers added to the response that the government's current help included only small amounts of funds as compensation.

Table 7. Those Who Helped Most in Recovery of Losses

	Frequency	Percent
Who helped the most ?		
Friends	2	1.8
Relatives	6	5.4
Neighbors	19	17.0
Self	59	52.7
Government	26	23.2
What did the help consists of?		
Working together	22	41.5
Compensation for damages	22	41.5
Loan	1	1.9
Guidance from the town office	3	5.7
Community funds	3	5.7
Other	2	3.8

In preparation against future typhoons, the farmers have done most of the work themselves. the government's assistance in this preparation was acknowledged by a small number of farmers, who made reference to some degree of guidance from the township office (Table 8). Ways of being helped vary; they included working together with neighbors, obtaining information from the local Weather Station by means of radio or television, and receiving guidance from the township office—mainly concerning the use of pesticides after typhoons.

Table 8. Those Who Helped Most in Typhoon Preparation

	Frequency	Percent
Who helped the most?		
Neighbors	8	7.1
Self	97	86.6
Government	5	4.5
Other	2	1.8

An existing government program or policy was recognized among the majority of the respondents. These programs or policies regarding typhoon hazards consisted primarily of govern-

ment financial aid including compensation for damage, agricultural loans, and tuition waivers for children.

Almost 60 percent of the respondents answered yes when asked if they needed government assistance in resolving typhoon-hazard problems (Table 9). Some of the specific types of government assistance included maximizing the compensation for typhoon damage and expanding agricultural loans. The farmers did not desire government assistance during the actual period of the typhoon, but they did request considerable government assistance in preparing against future typhoons. The requests included accurate weather forecasting at the local level, maintenance of drainage and irrigation systems, inspection of agricultural areas prior to the coming of a typhoon, and the building of breakwaters and the planting of trees along shorelines to protect against strong winds.

Table 9. Kinds of Assistance Desired from Government

	Frequency	Percent
Do you wish to receive government assistance?		
Yes	63	57.8
No	46	42.2
What kinds of assistance?		
<i>During the typhoon</i>		
Preparation for possible damage	6	8.0
No assistance	69	92.0
<i>After the typhoon</i>		
A government policy on agricultural product price	2	3.0
Maximization of compensation	40	60.6
Restoration of public facilities	2	3.0
Expansion of agricultural loan	13	19.7
Other	9	13.6
<i>Before the typhoon</i>		
Accurate weather reports at the local level	29	49.2
A warning system	6	10.2
Maintenance of drainage and irrigation systems	11	18.6
Inspection of hazard areas	5	8.5
Building breakwaters and planting trees	4	6.8
A more active compensation program	1	1.7
Other	3	5.1

The desire for government assistance in preparation for future typhoons is significantly related to the variable of religion ($X^2 = 14.7$; $DF = 4$; $P = 0.05$) and site ($X^2 = 11.6$; $DF = 2$; $P = 0.05$). Shamanists and non-adherents requested more government assistance than the other two groups, the Buddhists and the Confucians. Songsan farmers requested more government assistance than did the farmers in the other two locations, Taejong and Han'gyong. In addition, there also seemed to be a tendency for the better educated farmers to request more government assistance than those with less education.

4) Summary and Discussion

The perception of typhoon hazards on Cheju varies according to personal long-term experiences with typhoons among those who live in the same hazard areas. Personal experience is closely related to an awareness of a typhoon hazard and to the accuracy of prediction of future typhoons. Perception by Cheju farmers is also related to level of education, to personality traits, and finally to the adoption of certain types of adjustment.

Awareness causes stress among Cheju farmers, but paradoxically it has resulted in a tendency for them to underestimate their actual suffering from annual typhoon hazards. Instead, Cheju farmers have adopted certain adjustments in order to cope with these hazards. The results of the present study support not only the findings of the previous studies on hazard perception, but also the hypotheses I and II of the present study. However, the results are extended to support a relation between (1) the level of education and the degree to which new orchard technology has been adopted and (2) hazard perception, although the previous hazard perception studies did not support these relationships.

Adjustments by Cheju farmers to the annual typhoon hazards have been a result of their long-term occupation in the hazard areas. The occupation involves the dominant social factor

of the family bond, rather than the economic factors that have been found in most of the previous hazard studies. For Cheju farmers, evacuation and migration to other places are not options. They prefer to stay in hazardous areas and endure suffering as a result of damage to and loss of their properties. This finding sustains the hypothesis III of the present research and the finding of Islam⁵¹⁾, who investigated cyclone hazards in Bangladesh and suggested that social preferences and family and community bonds were important factors for human occupance in the hazard areas. The farmers' adjustment process involves both their accurate prediction of approaching typhoons, as a result of their long experience with these typhoons, and preparation through the use of both traditional and modern strategies. The traditional strategies include: modeling the roof of a house in a round, gentle pitched shape; building a low stone wall around the house or farm field; arranging a drainage system; changing to the cultivation of crops that are more tolerant of strong winds; adopting the agricultural pattern of late planting or early harvesting to avoid the typhoon period; and predicting future typhoons by observing natural phenomena such as the shape of clouds or the appearance of plants. The modern strategies include: building houses with cement; adopting greenhouse cultivation; constructing community warehouses to store harvested crops; and relying on the communications media such as radio, television, and newspapers for information regarding future typhoons. Preparedness also includes an attitude of independence among the farmers, who take responsibility for resolving typhoon-hazard problems by themselves. This independence was evident from the results of the locus-of-control measurements in this study. These results also support the hypotheses IV and V of the present research, and confirm the adjustment theory posed by Ian Burton, Robert

W. Kates, and Gilbert F. White which specifies the two types of adjustments, the purposeful and the preventive. However, in the case of Cheju farmers, of those who chose a combination of purposeful and preventive adjustments, for the purposeful adjustment the farmers took more responsibility for bearing the full burden of loss due to typhoon hazard by themselves, rather than sharing the burden with others. For the preventive adjustment, the farmers adopted modifications in the basic pattern of agricultural production, rather than drastic change in the agricultural pattern or migration to other places. Moreover, preparation was a major concern of the farmers in the process of making these adjustments, and this tendency was seen to be related to the level of education. This relationship has seldom been documented in the previous research on hazard perception.

The role of government in resolving typhoon hazard problems is fairly well recognized among Cheju farmers as a kind of "assistance"—but it is limited to providing small amounts of financial aid after severe typhoons have resulted in noticeable loss of property in the hazard areas. The limitations in this assistance might be a cause of the almost 50 percent "no" responses among the farmers to the question of whether they desired government help. On the other hand, "no" responses could possibly be interpreted as an indication of the attitude of independence among Cheju farmers, who may have had long experience with self-reliance rather than reliance on others. This independence seems to be a socio-cultural trait, which has been described in the section on Cultural Context.

Government assistance appeared to be concerned more with the recovery of typhoon losses than with the preparation for future typhoons. However, it is evident that Cheju farmers have wished to receive more government assistance in the area of preparation to minimize possible damage from future typhoons,

51) Islam, M.A. 1970, Op. Cit.

by suggesting specific useful strategies, mentioned in earlier section.

The topic of the government's role was discussed in informal interviews with three government officials in the Cheju local government, in order to compare the responses of the farmers with those of the government officials. The government officials were aware of the annual typhoon hazards in the three hazard areas, and of the need for the government to support those farmers who have been affected by typhoon hazards. The available funds, the government officials explained, were from the central government (about 80 percent) and the local government (about 20 percent). However, all of these funds were actually managed by the local preparedness such as erecting breakwaters, constructing drainage systems, and planting trees along shorelines in the hazard areas, while at the same time they emphasized the need for effort and responsibility on the part of farmers in preparation for minimizing possible damage from future typhoons. The preparation strategies suggested by the government in fact did not identify specific target areas. There was a clear statement concerning the annually increasing expenditures by the government due to typhoon hazards. However, among the three government officials, there was no precision as to how to minimize the high cost of government investment in the solution of typhoon problems on Cheju.

The results of the comparison of the responses drawn from the farmers and the government officials support hypothesis VI of this research and suggest the need for a government program that promotes a higher level of communication and education among the farmers in preparation for future typhoons, thereby minimizing resource losses.

6. CONCLUSION AND RECOMMENDATIONS

The annual typhoons of Cheju Island have

socio-cultural, economic, political, and psychological associations. The socio-cultural connections are the family and ancestor-worship systems, since they strongly influence human occupancy in the typhoon-hazard areas. The economic and political connections are the struggle for survival through agricultural activity and the Korean national regional development program. The psychological connection is the spirit of independence and self-reliance in the effect to resolve typhoon-hazard problems.

Cheju farmers perceive typhoon hazards as annual "unwelcome visitors," and there is a tendency to underestimate the impact of the typhoons because of the familiarity of the farmers with the nature and cause of these typhoons through long-term experience. On the other hand, the farmers adopt purposeful adjustments to enable them to continue their livelihood and prepare for future typhoons. The adjustments consist mostly of self-reliance and sometimes cooperation with neighbors by adopting traditional preventive methods. Self-reliance is a particularly common personality trait and may be the result of past experiences by the farmers with the government, whose efforts to assist them have not satisfied the farmers in their attempts to cope with typhoon hazards. The farmers quite understand the situation of the government, whose financial resources have been limited, although the farmers do not forget that they are taxpayers. Their desires are modest, and the suggestions that they present to the government are fairly reasonable strategies for preparing against future typhoon hazards, with the aim of minimizing potential losses due to typhoons. It should be noted that the farmers are literate and that they benefit from modern communications media such as newspapers, radio, television, and telephones.

Cheju local government is heavily dependent upon central government funds in the effort to resolve typhoon-hazard problems. The funds are limited, and are mostly directed

toward the recovery of losses; hardly any funds go to typhoon preparation. The local government has set up an agency for typhoon preparation and plans to build sea walls or breakwaters and to plant trees along the coastline. However, the role of this agency and its plans are little appreciated among the farmers who live in the typhoon-hazard areas.

The farmers are satisfied with neither the present level of compensation nor the efforts at preparation; the government, on the other hand, is provided with limited funds but recognizes the inadequacy of these funds to meet increasing expenditures for the recovery of losses. Under these circumstances, solutions to the problem of natural hazards were suggested by what was learned from interviews with the farmers and government officials, and considered together with observations of the real-world associated with typhoon hazards. The basic recommendation is for the development of preparation strategies in order to minimize potential typhoon damage, thereby reducing the high expenditures on the part of both the public and the government to cover resource loss.

The recommended preparation strategies are as follows:

1. Develop a warning system, utilizing the communications facilities in daily use by the farmers, or community facilities that permit the attachment of a warning siren. The warning system might possibly be connected by computer to the existing local weather-service station, which could direct weather forecasting to specific typhoon-hazard regions in Cheju, instead of attempting to cover the entire island. Education of the public at the community level should be conducted in conjunction with this action.
2. Build breakwaters and plant trees, coordinating the efforts of the entire Cheju system in a step-by-step, long-term plan.

3. Improve existing drainage and sewage systems, guiding the expansion of the system according to careful technical analysis.

4. Conduct educational programs, providing information, guidance, and safety kits related to typhoons. The information and guidance should be carefully thought out before being provided to the public, with special regard for practical application in a real-world situation. Government plans related to typhoon-hazard problems can be presented during public meetings, in order to foster public understanding.

5. Conduct quantitative as well as qualitative research on typhoon hazards in the region, under the leadership of educational institutions. In Chejudo, there are four institutions of higher learning including a national university with a graduate school. These educational institutions produce many graduates who are potential resource persons for the educational programs stated here. This proposed research may provide empirical data leading to useful suggestions for resolving typhoon-hazard problems. For example, data and suggestions on agricultural practices related to typhoons would be useful for farmers in preparing for typhoons. However, there is a need for resource persons to monitor the research findings as well as for the farmers to comprehend them. More importantly, this research should be encouraged through the contribution of funds and the stimulation of interest on the part of both the public and the government.

These recommendations are the outcome of the present research, which has benefited from the guidance of previous environmental perception studies and from the discipline of geography, in which the man-nature relationship is importantly regarded. There was evidence of the importance of this relationship in the analysis of the interaction of farmers and typhoons on Cheju Island.

— 태풍재해에 관한 제주도 농부들의 인식과 적응도 연구 —

김 욱 중*

「國文要約」

거의 해마다 내습하는 태풍위험을 제주지역 농부들이 어떻게 인식하고 그에 적응하고 있는지 아울러 이와같이 연례행사처럼 발생하는 태풍재해 문제 해결에 있어 정부관계기관의 역할에 대한 그들의 인식은 어떠한가를 살펴보는 것이 본 연구의 목적이다.

우선 위 연구과제를 살피기 위하여 다음과 같은 세가지 가설이 전제되었다.

첫째, 태풍과 같은 자연발생적 위협과 빈번한 접촉내지 오랜 경험은 인간에게 위협과 손실을 준다는 자각으로 이끌며 또한 장차 발생의 정확한 예측에 비교적 밀접한 관계를 갖는다. 그리고 이러한 경험들은 그와같은 자연발생적 위협으로부터 일시 피하거나 위협지역으로부터 아주 떠나기 쉽다기 보다 오히려 적응이라는 선택을 취한다.

둘째, 인간이 이와같은 위협지역 제주도와 같이 사회문화적인 특성이 뚜렷한 지역에 삶의 터전을 가지고 있는 것은 경제적 요인에서라기보다도 사회문화적 바탕에서 그 원인을 찾을 수 있다.

셋째로, 정부의 이와같은 자연발생적 재해문제 해결은 해당 지역 거주주민들과 보다 긴밀한 커뮤니케이션과 함께 정부나 커뮤니티를 통한 자연재해에 관한 계몽교육을 강화함으로써 그 역할이 효과적으로 수행될 수 있다.

총 113명의 농업을 주업으로하는 가구주들을 제주의 상습태풍재해지구에서 무작위 단계별군집(Random-cluster Stratified Sampling) 방법에 의하여 선별하고 태풍위험에 대한 개인별 재해인식과 인간적응을 알아보기 위하여 작성된 설문서를 통하여 각기 면담, 연구분석자료가 수집되었다.

제주농부들의 태풍에 대한 자각과 적응은 제주도나름의 풍토에서 오랜 삶의 경험을 토대로 얻어진 결과라는 것이 입증되었다. 한편, 장차 태풍내습에 대한 그들의 예측은 상당히 정확하였으며, 태풍재해에 대한 적응은 동기적이고 예방적 즉, 농부들은 재해의 근원적 소멸을 위해 재해지역을 떠난다기보다 오히려 피해를 감수하고 있었으며 또한 그들의 기본 영농방법이나 작물의 대체를 급격히 전환한다기 보다 부분적으로 수정, 변경시켜 나가고 있는 것으로 나타났다. 한편, 그들의 적응과정은 현대적 영농기술과 그들 특유의 전통적 방법을 혼합 병행하고 있었으며 가족이나 친척 이웃과의 유대관계가 재해지역에 거주하는 지배적 이유로 나타났다. 또 한편, 해당연구지역 농부들은 태풍피해에 대한 정부의 보조를 알고는 있으나 그것이 재해문제를 해결하는데 있어서 효율적이라고 생각치 않고 있다.

그들은 더욱 많은 재정적 보조를 희망하는 것만큼 연례적으로 내습, 피해를 주고 있는 태풍재해 문제에 대한 정부의 적극적이고 좀더 효과적 예방 대책을 요구하고 있다.

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