*Risk Analysis, Vol. 13, No. 5, 1993*

# Environmental Hazards in the Chinese Public's Eyes

**Zhang Jianguang**[1]

*Received May 11, 1992; revised October 22, 1992*

The People's Republic of China suffers each year from various environmental hazards. Although risk perception study has a 40-year history in Europe and North America, little is known about risk perception in China. Previous studies of risk perception have primarily focused on unnatural hazards, but China has experinced many natural environmental hazards. Therefore, the Chinese public's perceptions of environmental hazard risks must be considered in order to support the IDNDR program. The Chinese public's perceptions of environmental hazards are similar to those of Europeans and North Americans, but different characteristics are observed.

**KEY WORDS:** Risk perception; environmental hazards; China.

## INTRODUCTION

The People's Republic of China has suffered greatly from a variety of environmental hazards. These hazards have included the 1976 earthquake in Tangshan and the recent 1991 flood in East China that had devastating effects on property and lives. During the past 40 years, the resulting economic loss from natural disasters amounts to nearly one sixth of the gross state revenue. In recent years, scholars and government officials have joined efforts to study, reduce, and manage environmental hazards. This effort has focused on the physical, economic, and technological aspects of environmental hazards, but less attention has been given to the social and psychological aspects.[1,2]

In the West, risk analysis has a 40-year history. The resulting research provides helpful references for the study of Chinese risk perception. Although the principles of risk analysis apply to natural disasters such as earthquakes, most risk analysis work has focused on engineering and health risks resulting from unnatural environmental hazards, as first noted by White *et al.*, as early as the 1970s.[3,4]

The year 1991 was a disaster for East China. Millions of people suffered as a result of the rare flooding of the Huaihe River and the Yantze River. The resulting direct economic and property loss was unprecedented, reaching as high as 70 billion RMB Yuan. Most households and enterprises had no property insurance coverage, so insurance companies provided little compensation for the loss. Later, government administrators stressed the importance of increasing public awareness of natural hazard risks and participation in hazard management exercises. As a result, the psychological aspects of environmental hazards, particularly natural hazards, are discussed in this paper. As White pointed out, it is necessary to know what the public, who are the subjects upon which governmental disaster prevention and mitigation plans are focused, think of the hazards.[6] With the proceeding of the IDNDR project in China, pubic awareness of environmental hazards must be studied. This study is undertaken to support disaster prevention and reduction and to learn Chinese risk perception characteristics of hazards.

## 2. METHOD

The basic method of this study is a replication of Fischhoff *et al.*'s method, which was widely employed in Europe and North America.[7,8] Changes have been made, however, to adjust the questionnaire to the situ-

[1] Chongqing Foreign Affairs Office, China.



0272-4332/93/1000-0509$07.00/1 

ations in China. The survey was conducted from May to November 1991, and a total of 238 subjects were asked to complete a two-part questionnaire. The subjects of the study included university students, middle school students, teachers, and workers. With approximately 63% male, 29% female, and 8% missing data, the subjects were Chinese between the ages of 17 and 55.

The first part of the questionnaire collected information on the subjects' backgrounds, including sex, age, education, major, profession, and native province. This information is used to identify variations of risk perceptions by different background groups. The second part of the questionnaire listed a subset of 20 hazards that were carefully selected to represent environmental hazards, particularly natural hazard situations in China. For each hazard, subjects were asked to choose one of the five possible choices on each of the five qualitative risks characteristics (Table I). "Danger level" is a comprehensive indicator of risk, which includes "Chinese society as a whole." The other four characteristics describe different faces of hazards perceived by the public. They are regarded as factors that influence subjects' judgments on the "danger level" of each hazard, and subjects were told to express their choices according to their own points of view.

At the beginning of the survey, the second part was designed as a rating form. An experimental rating by colleagues and students suggested that it was difficult to make a choice among the scores on the scale used in Europe and North America. In addition, the subjects were not paid, and it was unwise to let them make difficult choices. Even if they completed the questionnaire, the judgments may not be dependable. Thus, the simpler questionnaire was preferred.

The quantification work was done by those conducting the study, For "danger level," scores given to the five choices were "not at all dangerous" (= 0), "not very dangerous" (= 30), "moderately dangerous" (= 50), "quite dangerous" (= 70), and "very dangerous" (= 90). For the other four characteristics, from left to right, scores of 1, 3, 5, 7, and 9 were given respectively.

## 3. RESULTS AND DISCUSSION

The mean "danger level" perceived by all subjects is 55.69 and is equivalent to "moderately dangerous" with only small variations among background groups. This result contradicts the widely-accepted serious environmental hazards reality in the scientific and technical circle. The average scores for knowledge, vulnerability and possibility of catastrophe, and controllability are 5.35, 3.51, 6.59, and 5.35, respectively. These results show that most of the Chinese public knows little about evivonrmental hazards and do not expect to be subjected to the threats of environmental hazards. Furthermore, the results show that the public recognizes that when a hazard occurs, catastrophic consequences are possible, but they are not sure in most cases whether the adverse influences are controllable.

In the questionnaire, 20 hazards were intentionally arranged in a disorderly manner so the subjects' would not mistake the order as a rank of importance. Surprisingly, the overal danger level rank in Table II is nearly identical to scientific assessments with only a few exceptions, which implies that although the public uses different criteria, their judgments on the relative danger levels among hazards are effective. Obvious exceptions are pollution and drought. Water pollution and air pollution were perceived as more dangerous than estimated, but drought was significantly underscored. The top and bottom five hazards based on four characteristics are listed in Table III.

**Table I.** Five Characteristics and Their Five Choices

| Characteristics | Five choices | | | | |
|---|---|---|---|---|---|
| Overall danger level | Not at all dangerous | Not very dangerous | Moderately dangerous | Quite dangerous | Very dangerous |
| Knowledge of hazard | Know nothing | Know a little | Know some | Know much | Familiar |
| Vulnerability to hazard | Not vulnerable | A little vulnerable | Moderately vulnerable | Quite vulnerable | Very vulnerable |
| Catastrophic possibility | Impossible | Not very possible | Uncertain | Quite possible | Very possible |
| Controllability of hazard | Completely controllable | Large part controllable | Uncertain | Small part controllable | Uncontrollable |

**Table II.** 20 Hazards Mean Danger Level and Rank

| Hazard | Overall danger level | RANK | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | All | Male | Female | >30 yr | <30 yr | Science | Liberal | Engin. |
| Earthquake | 70 | 1 | 1 | 5 | 3 | 4 | 4 | 1 | 3 |
| Flood | 70 | 2 | 2 | 3 | 8 | 2 | 3 | 2 | 5 |
| Water pollution | 69 | 3 | 3 | 2 | 10 | 1 | 1 | 5 | 1 |
| Air pollution | 69 | 4 | 4 | 1 | 7 | 3 | 2 | 4 | 2 |
| Soil erosion and water loss | 66 | 5 | 6 | 6 | 11 | 6 | 6 | 6 | 6 |
| Desertification | 63 | 6 | 5 | 10 | 16 | 5 | 5 | 11 | 4 |
| Fire Hazard | 63 | 7 | 9 | 4 | 2 | 7 | 10 | 3 | 7 |
| Typhoon | 61 | 8 | 8 | 9 | 6 | 9 | 8 | 7 | 12 |
| Debris flow and earth slide | 60 | 9 | 7 | 15 | 13 | 8 | 7 | 8 | 10 |
| Tornadoes | 57 | 10 | 12 | 7 | 5 | 12 | 11 | 10 | 14 |
| Drought | 57 | 11 | 10 | 13 | 15 | 10 | 9 | 12 | 9 |
| Pesticide | 57 | 12 | 11 | 8 | 4 | 13 | 13 | 9 | 11 |
| Bio-diseases and pests | 54 | 13 | 14 | 11 | 12 | 14 | 12 | 14 | 13 |
| Noises | 54 | 14 | 13 | 14 | 20 | 11 | 14 | 15 | 8 |
| Volcano | 52 | 15 | 15 | 12 | 1 | 15 | 15 | 13 | 15 |
| Hailstorm | 48 | 16 | 16 | 16 | 9 | 16 | 16 | 16 | 16 |
| Cold spell | 39 | 17 | 18 | 18 | 17 | 17 | 19 | 18 | 18 |
| Chemical fertilizer | 39 | 18 | 19 | 17 | 19 | 18 | 17 | 19 | 17 |
| Snow hazard | 38 | 19 | 17 | 19 | 18 | 19 | 18 | 17 | 19 |
| Sea wave | 30 | 20 | 20 | 20 | 14 | 20 | 20 | 20 | 20 |

**Table III.** Top and Bottom Five Hazards on Four Characteristics

| Knowledge | Vulnerability | Possibility of catastrophe | Controllability |
|---|---|---|---|
| Top 5 | | | |
| Fire hazard | Air pollution | Flood | Volcano |
| Drought | Water pollution | Water pollution | Earthquake |
| Water pollution | Noise | Air pollution | Tornadoes |
| Air pollution | Pesticide | Fire hazard | Typhoon |
| Noise | Soil erosion and water loss | Earthquake | Hailstorm |
| Bottom 5 | | | |
| Desertification | Tornadoes | Noise | Bio-diseases |
| Typhoon | Snow hazard | Cold spell | Pesticide |
| Tornadoes | Typhoon | Fertilizer | Fire hazard |
| Snow hazard | Volcano | Snow hazard | Water pollution |
| Sea wave | Sea wave | Sea wave | Fertilizer |

Correlation analysis reveals that the public pays most attention to knowledge and the possibilty of a catastrophe of a hazard to estimate its danger level, unlike specialists who use more objective data to estimate danger (Table IV). Similar findings were revealed by a danger level ($r = 0.57$). However, the correlation coefficients of danger level/vulnerability and danger/controllability were below 0.10 confidence significance. A possible explanation is that knowledge is highly correlated with vulnerability ($r = 0.88$) and controllability ($r = 0.63$,), and the information on vulnerability and controllability was embedded in knowledge.

Unlike the typical two-dimensional factor struc-

**Table IV.** Correlation Coefficients Between Risk Characteristics ($N=20$)

| | Danger level | Knowledge | Vulnerability | Possibility of catastrophe | Controllability |
|---|---|---|---|---|---|
| Danger level | 1.00 | 0.57* | 0.36 | 0.96 | −0.24 |
| Knowledge | | 1.00 | 0.88** | 0.67* | −0.63* |
| Vulnerability | | | 1.00 | 0.43 | −0.77** |
| Possibility of catastrophe | | | | 1.00 | −0.24 |
| Controllability | | | | | 1.00 |

*$P=0.01$; **$P=0.001$.

ture[11,12], a different structure is obtained through PCA analysis (Fig. 1). Cvetkovich et al. argued that the identified two-dimensional structure is not universal, and such is the case in China.[13] Regardless of the specific background group, the first principal factor accounts for at least 77% of the total variance. Controllability and vulnerability have heavy loading on factor 1; therefore, it is possible to classify the 20 hazards into two types: uncontrollable and/or a little vulnerable and controllable and/or highly vulnerable. Another distinct feature of Fig. 1 is that all hazards are located above factor (*i.e.*, the hazards are judged as potentially castastrophic).

Some differences in the perceived risks of different background groups have been observed. For example, the top five hazards on the danger level rank perceived by men are: (1) earthquakes, (2) floods, (3) water pollution, and (4) air pollution, and (5) desertification. The hazards perceived by women are: (1) air pollution, (2) water pollution, (3) floods, (4) fire hazards, and (5) earthquakes. On average, scores on the other four risk characteristics show that men perceive more knowledge, higher vulnerability, less catastrophe possibility, and a smaller controllability than women. The average danger level perceived by women is only slightly higher than that perceived by men.

For those subjects older than 30, the top six hazards are: (1) volcanoes, (2) fire hazards, (3)earthquakes, (4) pesticides, (5) tornadoes, and (6) typhoons. For those younger than 30, the top six-hazards are: (1) water pollution, (2) floods, (3) air pollution, (4) earthquakes, (5) desertification, and (6) soil erosion and water loss. These groups have only one hazard in common, earthquakes. These findings suggest that older people who have more work and life experience are concerned about hazards that threaten property and life. Young people, including mainly students who have less social experience, appear to be more concerned about hazards that endanger the general environment of human beings, whether the hazards are catastrophic or chronic. For university students of different majors, the top six hazards remain nearly the same with varied rank orders. Liberal Arts students perceive the order as (1) earthquakes, (2) floods, (3) fire hazards, (4) earthquakes (5) water pollution, and (6) soil erosion and water loss. Science students perceive the following order: (1) water pollution, (2) air pollution, (3) floods and (4) earthquakes, (5) desertification, and (6) soil erosion and water loss.

A comparative study of risk based on different cultural backgrounds is undoubtedly of interest. As no single set of hazards has been studied in other countries, systematic comparisons are not yet possible. Based on available literature, for example, the danger level of pesticides and chemical fertilizers perceived by the Chinese seems similar to those perceived by the Hong Kongese.[14,15] Does this imply a similarity in the risk of perceptions of people with similar cultural backgrounds? Or does it merely reflect the reality of pesticide and chemical fertilizer usage situations (Table V)? These questions remain unanswered; however, the fact is clear that Chinese perceive a higher danger level than Europeans over pesticides and chemical fertilizers. The higher Chinese perception is at least partly due to the reality of the present widespread usages of the two, especially pesticides that include some banned in western countries.

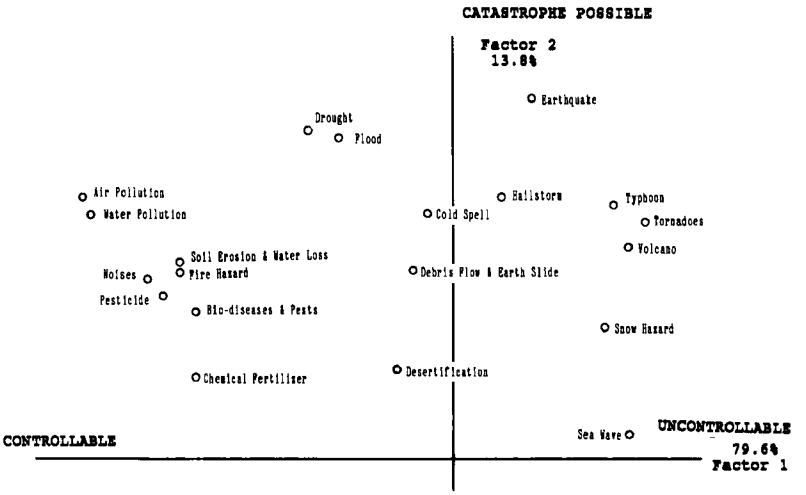


**Fig.** Location of 20 environmental hazards in the two-factor space.

**Table V.** Different Ratings over Two Hazards

| Hazard | China (1991) | Poland (1990) | USA (1987) | Hungary (1986) | Norway (1988) | HK (1985) |
|---|---|---|---|---|---|---|
| Pesticide | 57 | 40 | 53 | 23 | 36 | 59 |
| Chemical fertilizer | 39 | 40 | — | 18 | 16 | 46 |

## 4. CONCLUSIONS

On the whole, Chinese public risk perceptions of environmental hazards are lower than scientific estimates. Although the public employs different standards (*i.e.*, knowledge and possibility of catastrophe, particularly the latter) to judge hazards' danger levels, their conclusions on hazard rank are usually similar to those of scientific assessment.

On average, the Chinese perceive all 20 hazards as moderately dangerous. They have only some knowledge of environmental hazards and thus do not think and expect that they are subject to the threats of environmental hazards. Once the hazards materialize, catastrophic consequences are likely to take place, and they are not certain under most circumstances whether the adverse influences are controllable.

In the 20 hazards discussed, the typical two-dimensional structure often seen in European and North American studies is not found. However, a structure dominated by the first factor, which is identified as controllability and vulnerability, and a structure with all hazards are located over the horizontal axis (*i.e.*, factor 1).

Some differences on risk perceptions vary among background groups. In general, men perceive a slightly lower danger level, more knowledge, a slightly greater vulnerability, less catastrophic possibility, and less controllability of hazards than women. People older than 30 pay more attention to hazards that threaten their adjacent "small environment," while their younger counterparts are more concerned about those hazards endangering the "general environment." Differences in risk perceptions among major groups are also observed.

An overall cross-cultural risk perception comparison has not yet been made because a subset of comparable studied hazards is lacking. According to available literature, Chinese danger level perceptions of pesticides and chemical fertilizers are quite similar to those of the Hong Kongese, but remarkably different from those of Europeans.