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Living with floods: victims' perceptions in Beijiang, Guangdong, China

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This study revealed the collective values of the flood victims in the Beijiang area, Guangdong, China, as a result of a hazardous flood in 1994. The victims were sceptical of large flood-prevention engineering structures. They believed that flooding was unavoidable, but by extending support networks, applying hazard-resistant designs, and developing loss-sharing adjustments the disastrous effects of a flood could be mitigated. Seemingly, victims were prepared to live with floods and adopted functional adjustments to lessen flood impact.

Key words: *China, Beijiang, flood victims, flood prevention measures, functional adjustments, sustainable floodplain development*

Introduction

In the summer of 1994, the entire Beijiang basin in the north of Guangdong Province, China, was struck by the worst flood of the twentieth century. Torrential rains brought by a typhoon that attacked the Guangdong area in early June caused the flood. The flood affected an extensive area in the middle course of the Beijiang River, particularly in areas around Qingyuan City (Figure 1). According to data reported in *Yangcheng* Evening News and *Nanfang* Daily News, two local newspapers published in the Guangdong Province, the flood affected two million people with floodwater covering 92 per cent of the built-up area of Qingyuan City and inundating 9000 villages in the surrounding floodplain. The flood engulfed 1.5 million *mu* (100 000 ha) of farmland and destroyed the entire summer paddy crop. About 230 000 houses were damaged by the floodwater, of which 66 000 were mud-brick houses that collapsed. The total direct economic loss of Qingyuan City alone amounted to RMB3.2 billion. Many dikes failed to hold back floodwater and collapsed, fully exposing the flaws of the flood-prevention structures of the area. Fortunately, the casualties caused by the flood were relatively small: 102 people died and 2000 were injured.

In the literature of natural hazard studies, scientific endeavours have provided many systematic analyses of the physical mechanism of natural hazards (Frazier 1979; Foster 1980; Smith 1992). It has become patently clear that no-one can control every element of nature in order to eliminate risks. Indeed, human factors are just as much a cause of natural hazards as are extreme geophysical processes (Hewitt 1983; Tobin and Montz 1997). It is the recognition of human involvement that extended the scope of hazard research and led many, including politicians, economists and hazard managers, to advocate comprehensive development planning to mitigate the impact of natural hazards (White 1973; White and Haas 1975; Freudenburg 1988). Disasters caused by natural hazards are, therefore, imbedded in larger political, social, economic, and technological structures. It is often impossible to separate their influences and impact from the contexts of the event (Mitchell *et al*. 1989; Albala-Bertrand 1993; Cutter 1994). Moreover, the vulnerability approach argues that society, too, creates conditions in which people face disasters differently (O'Keefe *et al*. 1976;

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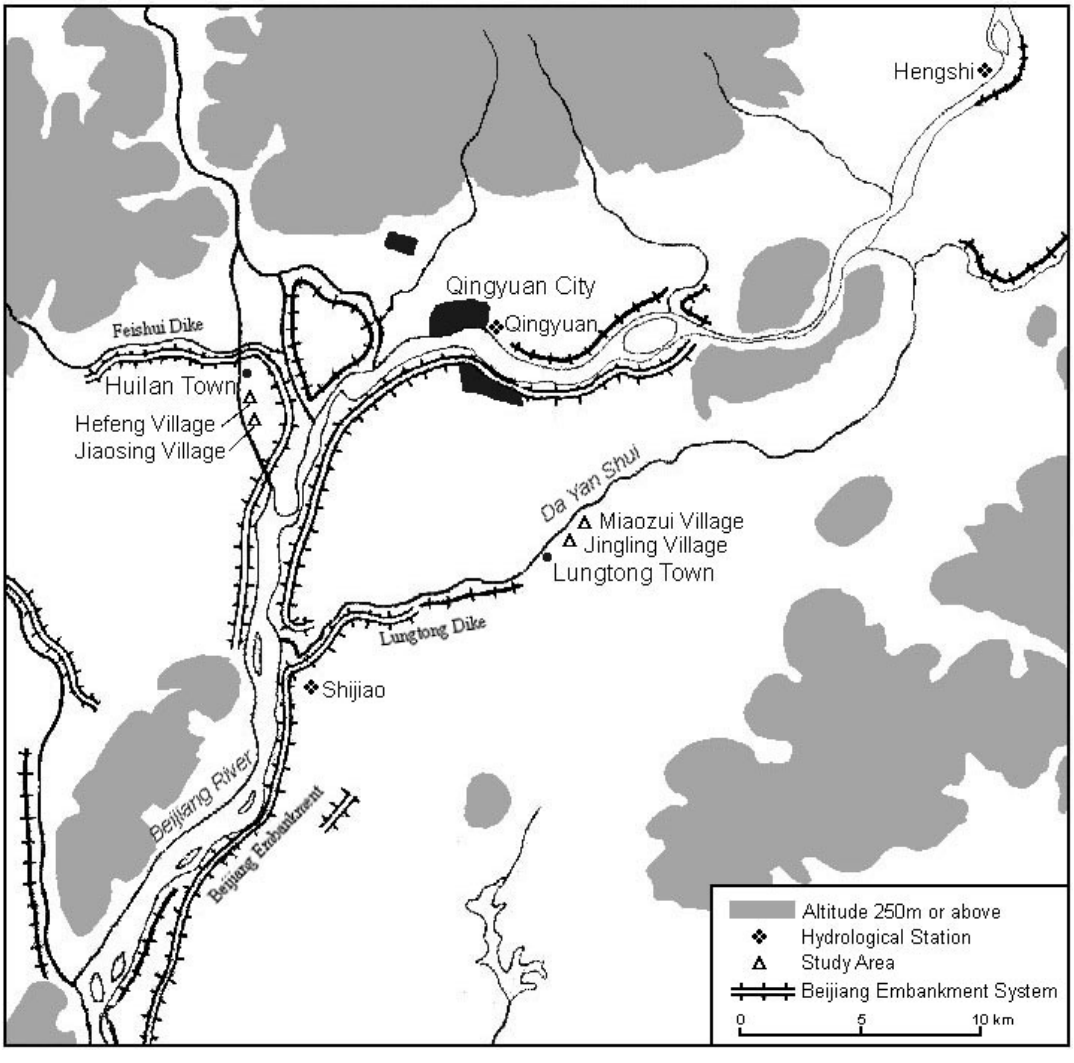

Figure 1 The location of the study area and the Beijiang Embankment System

Liverman 1994; Varley 1994; Blaikie *et al.* 1994). Many researchers focus their attention on the behaviour of individuals before, during and after hazardous events (Burton and Kates 1964; Kates 1971; Saarinen *et al.* 1984; Kasperson *et al.* 1988). In recent years, however, a new perspective has emerged that views hazards as basic elements of environments and as constructed features of human systems, rather than as the extreme and unpredictable events they are traditionally perceived as. When hazards and disasters are viewed as integral parts of environmental and human systems, they become a formidable test of individual and societal adaptation and sustainability (Oliver-Smith 1996; Mileti 1980; Mileti *et al.* 1995).

In China, flooding has been one of the most widespread hazards affecting a huge number of people. According to the China National Committee for the International Decade for Natural Disaster Reduction, more than ten million hectares of land are affected by floods annually, of which more than five million hectares could be categorized as severely affected (*CNCIDNDR* 1998). Natural hazard research in China focuses mainly on the analysis of the physical processes of the specific event, which has resulted in the publication of voluminous reports

to provide an overview of the major hazards of China (HWRIN 1997; SSB 1995; SSTC 1993; Shi *et al*. 1992). It is important to note that individual's perceptions are frequently ignored when analysing natural hazards in China.

This paper attempts to elucidate villagers' responses to an extreme flooding incident that occurred in Beijiang in 1994. It focuses on victims' perceptions, and considers how their views might affect their behaviour and responses. The findings shed light on the formulation of floodplain management policy in China.

The empirical survey

Sampling

Sampling is the process of selecting cases from a population. Owing to the unique characteristics of the study area and resource constraints, both the site and respondent samples were not selected by the random selection procedures prescribed by probability sampling. Knowing the inherent shortcoming of the non-probability nature of the sampling procedure the investigators were consciously cautious in the selection of the survey sites and respondents. Prior to the selection of survey villages, the investigators conducted a reconnaissance visit to some of the most seriously affected settlements in June 1996. These settlements were chosen from a list of 18 settlements (at township level) mentioned in the news in the *Yangcheng* Evening News and *Nanfang* Daily News. With the assistance of the People's Government of Qingyuan City, the investigators were guided by officials of the Three-Disaster (flood, drought, and typhoon) Prevention Headquarters (or *Sanfang zhihuibu*), visiting the six exemplary townships identified previously. During the visit, local officials informed the investigators about the magnitude and impact of the flood and the rehabilitation work carried out afterwards. After careful deliberation, two townships were selected as the survey sites—Lungtang Town of Qingyuan City and Huilan Town of Qingxin County. For each township two villages were selected from which a total of 52 households were drawn to constitute the respondent sample.

The first two villages, Miaozui and Jingling, administered by Lungtang Town, are located in the valley of Da Yan Shui—a tributary of the Beijiang River to the east of Qingyuan City (Figure 1). Miaozui village consists of 105 households and has a total population of 1280. Twenty households were included in the survey sample. Jingling is a smaller village with only 34 households and has a population of about 250. Sixteen households were interviewed. The other two villages, Hefeng and Jiaosing, are located on the west bank of Beijiang adjacent to the Feishui dike—a major flood-prevention structure built after a devastating flood occurred in the area in 1968. The Feishui dike collapsed during the 1994 flood causing floodwater to inundate large swathes of land behind the dike. Hefeng village and Jiaosing village together have 120 households and a population of about 500 people. Sixteen households were interviewed—four from Hefeng and twelve from Jiaosing.

Survey design and implementation

Composing good questions that elicit accurate responses from respondents is crucial to the achievement of survey success. The present study attempts to probe into flood victims' perceptions of, and responses to, an extreme flood event through face-to-face interviews. The questions asked by the interviewer related to:

- flood impact;
- emergency relief operations;
- post-flood rehabilitation and reconstruction works; and
- respondents' perceptions on diverse flood prevention and mitigation measures.

In order to standardize the responses given by respondents and to facilitate subsequent data analysis, most questions were closed-ended questions. The investigators also jotted down all relevant responses given by the respondents while interviewing them, and noted all cues that might reveal villagers' preparedness to combat flood losses.

The household interviews were conducted in August 1996. All respondents were paddy farmers except one who owned a grocery store in Miaozui village. The majority of the respondents were females (70%), since most male household members were engaged in outdoor work in the fields during the survey period. Most respondents were in the 30–50 years age groups (66%), with an overwhelming majority (83%) having received a maximum of primary education. The investigators also looked for cues, both physical and social, associated with flood disaster impact in the surveyed villages.

Table 1 The water regime of selected hydrological stations in Beijiang

Station	Critical stage level (m)	Pre-1994 record-high stage level*	Highest stage level recorded in 1994 (m)	Above pre-1994 record-high stage level (m)
Shijiao	10.3	13.9	14.72	0.82
Qingyuan	12.00	15.88	16.34	0.46
Hengshi	-	23.56	23.93	0.37

*The record was set in May 1982
Source: Remin Zhujiang August 1994

Results

Flood regime

The physical cause of the 1994 flood in Beijiang was the excessive rainfall brought by a typhoon that struck the area in early June. According to rainfall measurements in major hydrological stations along the Beijiang and its tributaries, the total average rainfall received over the ten-day period from 8 June to 17 June was about 400 mm, with the highest rainfall measurement of 574 mm recorded in the Lianjiang basin. The rainfall was characterized by high intensity, prolonged duration, and large areal extent, which resulted in augmentation of the river discharge. Flood magnitude is best expressed in terms of instantaneous peak river flow (or discharge), while the hazard potential will relate more to the maximum height (stage) that the water reached. Accordingly, the stage levels recorded in the Shijiao, Qingyuan, and Hengshi hydrological stations along the middle course of Beijiang all exceeded their historical stage records (Figure 1; Table 1). Clearly, the 1994 flood was the largest flood in the study area since the establishment of the People's Republic of China in 1949.

Disaster impact

The severity of a flood disaster depends primarily on the interaction between the magnitude of the flood and the vulnerability of the human settlements. The most serious direct effect of the 1994 flood was housing damage. The flood destroyed over 80 per cent of respondents' houses, and an additional 15 per cent reported that their houses were seriously damaged (Table 2). The destruction of houses resulted in many villagers being made homeless. The victims either took temporary shelter in tents erected on the embankment or stayed in the homes of unaffected relatives. Apart from the destruction of houses, the flood caused serious damage to property and infrastructure. Over 90 per cent of the respondents reported that their summer crops were completely destroyed. In addition, the flood killed most of their poultry and livestock. The flood also led to the suspension of many services and facilities such as water, power, food supply, transportation and communication, which adversely interrupted emergency relief operations and subsequent rehabilitation works. Fortunately, despite serious damage to houses and property, there was no direct loss of human life and only one interviewed household claimed that a member was injured by the flood. One reason for the low number of casualties was that water flooded the villages slowly and gradually, allowing villagers to escape to safer places.

Table 2 Damage and loss caused by the 1994 flood in Beijiang

Damages and losses	Yes (%)	No (%)
Death	0.0	100.0
Injury	1.9	98.1
House collapsed (homeless)	81.1	18.9
House damaged	15.1	84.9*
Property damaged	1.9	98.1
Crop losses	92.5	7.6
Poultry and livestock losses	92.5	7.6
Water and electricity supply suspended	98.1	1.9
Communication suspended	83.0	17.0
Inadequate food supply	98.1	1.9
Road damage and blockage	75.5	24.5
Income reduction	98.1	1.89

*The percentage included the 81.1% with houses collapsed, i.e. only 3.8% of the respondents' houses were unaffected by the flood.

Table 3 Victim's perceptions on flood-fighting and emergency relief operations

Flood-fighting and emergency relief operations	Very satisfactory (%)	Satisfactory (%)	Unsatisfactory (%)	Very unsatisfactory (%)	No comment (%)
Rescue work of local government (*number of people involved and facilities provided*)	0.0	17.0	81.1	0.0	1.9
Epidemic disease control	0.0	79.3	17.0	1.9	1.9
Medical and health service	0.0	75.5	17.0	0.0	7.6
Flood warning	0.0	58.5	20.8	0.0	20.8
Information dissemination	0.0	75.5	15.1	0.0	9.4
Emergency relief: material supply	0.0	9.5	84.9	0.0	5.7
Emergency relief: material apportioning	0.0	15.1	64.2	0.0	20.8
Maintaining public order	0.0	88.7	9.4	0.0	1.9
Controlling price of essential goods	0.0	43.4	43.4	0.0	13.2
Overall assessment	0.0	58.5	32.1	0.0	9.4

Furthermore, people living in the flood-prone areas were very accustomed to floods and they knew how to escape to safer places. This helped to reduce mortality.

Emergency relief

The prevailing emergency relief policy guidelines of the Chinese Government require that local authorities provide basic necessities such as food, shelter and medical care for victims. The survey revealed that slightly over half (58%) of the respondents endorsed the flood-fighting and emergency relief work of local authorities (Table 3). They were, nevertheless, discontent with the disposal of relief materials. Moreover, over 80 per cent of the respondents complained that not enough manpower was engaged in the rescue endeavour. Evidently, the administrative machinery dealing with flood emergency relief operations was very cumbersome and fragmentary. This might be the reason why villagers were dissatisfied with the disaster relief operations. Villagers were more satisfied, however, with the authorities' epidemic-disease control and medical and health care services. No outbreak of communicable diseases was reported in the survey area. In recent years, local health and sanitary departments have reacted promptly to natural disasters and made epidemic control a top priority in disaster relief work. Furthermore, villagers credited the authorities' effort to maintain public order and control the price of essential goods.

Rehabilitation and reconstruction

Disaster rehabilitation and reconstruction work started immediately after the flood receded. Rehabilitation was targeted at short-term activities to restore vital life support systems to their minimum operating standards. Reconstruction focused on long-term measures to mitigate flood effects and prevent future disasters. The four surveyed villages were among the areas most severely damaged by the 1994 flood. For example, the two villages in Huilan Town were completely destroyed when the Feishui dike collapsed. Floodwater inundated houses, farms and community facilities for more than three weeks. Similarly, most of the houses collapsed in the two villages in Luntang Town. The most pressing task, therefore, was to reconstruct the damaged dike and re-build the collapsed houses.

The Beijiang flood received widespread media coverage in Hong Kong, which gave impetus to many fund-raising activities. A total of RMB540 million was raised in Hong Kong, Macau and Taiwan through various channels. Part of the funds was allocated to immediate emergency relief and the rest were allotted to long-term restoration and reconstruction programmes. With these funds, the four surveyed villages were able to rebuild their houses soon after the flood receded. For instance, Miaozui village and Jingling village were considered by local authorities as the 'models' of post-flood housing reconstruction programmes in the area. New building design standards set by the local Planning

Table 4 Victim's perceptions on post-flood rehabilitation and reconstruction

Rehabilitation and reconstruction	Very difficult (%)	Difficult (%)	Not difficult (%)	Very easy (%)	No comment (%)
Housing reconstruction					
Fund arrangement by victims	34.0	52.8	7.6	0.0	5.7
Comply with new flood-prevention design standards	0.0	0.0	94.3	1.9	3.8
Site selection*	0.0	0.0	86.8	3.8	9.4
Availability of building materials#	0.0	0.0	88.7	3.8	7.6
Production restoration					
Fund arrangement by victims	13.2	83.0	0.0	0.0	3.8
Supply of materials	9.4	84.9	1.9	0.0	3.8
Technical supports	7.6	83.0	1.9	0.0	7.6
Human resource (labour)	3.8	79.2	13.2	0.0	3.8

*The building site was allocated by the local government rather than selected by victims
#Local officials used donations from Hong Kong to purchase building materials for flood victims

Committee were implemented in the re-building of houses. For instance, each household was permitted to build a house that occupied an area of not more than 80 square metres, and each house had to be built on an elevated platform about one metre above ground level (Plate 1). In addition, new houses had to be built with more water-resistant red bricks, instead of the traditional mud variety. According to local officials, these requirements could protect villagers from the impact of flooding of a 10–20 year flood return period. Of course, victims welcomed the new building standards. With donations from Hong Kong, each household was given 22 000 red bricks, 10 tons of cement, and 1.8 tons of steel to re-build their houses—enough materials to build a single-storey house as shown in Plate 1. However, each household still needed to raise about RMB5000, mainly from relatives and clan members, to hire construction workers to build their house. On the whole, the villagers were thankful for the aid from Hong Kong as they might not have been able to achieve the building standards set by the planning bureaux without the donations.

Another urgent task, aside from rebuilding houses, was to restore agricultural production. Many villagers claimed that they did not receive the necessary funds and technical support to restore their agricultural production. In addition, over 83 per cent of the respondents said that they suffered from labour shortages since some of their family members migrated to cities to seek employment, notably in Guangzhou and Shenzhen. The Chinese Government adopted a 'help yourself by restoring production' (or *shengce zhijiu*) policy, which practically means farmers should adhere to the principle of 'self-reliance'. Though dissatisfied with the meagre aid given by the government, the villagers knew that their only option was to replant their crops as soon as possible to sustain the village's economy (Table 3).

Flood prevention measures

Over the past few decades, there has been an important change in attitude and policy towards flood hazard mitigation. The emphasis has moved away from physical control and structural measures towards reducing human vulnerability through non-structural approaches, such as flood warning, land use planning, and insurance (Smith 1992). Therefore, the interview included questions to solicit villagers' perceptions of the major flood prevention structure along Beijiang—the Beijiang Embankment System (Figure 1). Interestingly, only about one-quarter of the respondents regarded the embankment system as a significant flood prevention structure that contributed to reducing flood hazards (Table 5). Another one-quarter of them said the embankment system could reduce economic losses caused by floods. It is interesting to note that some respondents (12.6%) believed the embankment system was built to protect Guangzhou City, the provincial city of Guangdong, rather than their own villages. The high proportion of 'no comment' responses reflected the fact that the majority of the respondents were unsure about the significance of the Beijiang Embankment

Plate 1 New houses built (in 1996) according to new planning standards set by local Planning Bureau on a site destroyed by the 1994 flood

System. In addition, they were generally unaware of other subsidiary functions of the embankment system, such as improving irrigation and facilitating regional development. Table 6 shows villagers' perceptions of flood prevention measures at the village level. It is noteworthy that respondents held a prevailing pessimistic attitude towards flood prevention structures. For instance, only two per cent of them agreed that 'people are capable of controlling the occurrence of floods'. They almost unanimously agreed that 'flooding is unavoidable and cannot be prevented' in their villages. Less than one-fifth of the respondents held that 'flood hazards could be reduced by *man-made* structures'. Only about 13 per cent of them believed that 'modern technology is the best way to evade flood hazards'. Respondents' sceptical attitudes explained the unusually low percentage of them (8%) who felt that 'flood prevention structures are more important than emergency relief'. As a whole, villagers were doubtful about the significance of engineering structures designed to control floods physically. Villagers recognized that huge financial resources were needed to construct effective flood prevention structures and they preferred the establishment of a special fund to give them instantaneous emergency relief and help in the event of a flood (Table 6).

Living with floods: implications

The preceding findings revealed flood victims' perceptions of a disastrous flood at the village level, particularly their attitudes to counteract, mitigate and prevent flood hazards. There are at least three perspectives that might have profound implications for designing appropriate flood management strategies in rural China.

1 Lack of confidence in large flood-prevention engineering structures

The dominant sentiment of respondents was that flooding is unavoidable. The Chinese have a long history of building flood-control dikes, dams and sluice gates to regulate flood water. For instance, the

Table 5 Victim's perceptions on the significance of the embankment system built on Beijiang

Significance of the Beijiang embankment system	Very significant (%)	Significant (%)	Insignificant (%)	Very insignificant (%)	No comment (%)
Reduce crop loss	13.2	11.3	0.0	1.9	73.6
Reduce property loss	13.2	11.3	0.0	1.9	73.6
Avoid road damages	13.2	9.4	0.0	1.9	75.5
Flood prevention	15.1	11.3	0.0	0.0	73.6
Reduce flood frequency	13.2	11.3	0.0	0.0	75.5
Improve irrigation	0.0	1.9	3.8	5.7	88.7
Facilitate regional development	0.0	1.9	3.8	5.7	88.7
Protect flooding in Guangzhou City	5.0	7.6	0.0	0.0	83.0

Table 6 Victim's perceptions on flooding and flood prevention measures

Flooding and flood prevention measures in the surveyed villages	Strongly agree (%)	Agree (%)	Disagree (%)	Strongly disagree (%)	No comment (%)
Flooding is inevitable and cannot be prevented	37.7	56.6	0.0	0.0	5.7
The flood hazards could be reduced by man-made structures	1.9	15.1	0.0	0.0	83.0
Huge investment is needed to reduce flood hazards	41.5	54.7	0.0	0.0	3.8
Flood preventive measures are more important than emergency relief and rehabilitation work	0.0	7.6	5.7	0.0	86.8
The State should establish financial reserves to help flood victims	39.6	45.3	0.0	0.0	15.1
People are capable of controlling the occurrence of floods	0.0	1.9	11.3	0.0	86.8
Modern technology is the best way to solve the flooding problems	1.9	11.3	3.8	0.0	73.0

present regime has built 247 000 kilometres of flood control dikes and 84 000 reservoirs all over the country since 1949 (CNCIDNDR 1998). Most of these dams and dikes were substandard and ineffective in resisting larger floods, such as the floods that struck Beijiang in 1994. To many villagers, those structures did not prove effective in reducing flood risks. Repeated incidences of dike collapse and dam failure weakened villagers' confidence in engineering structures. Thus, it is not surprising that only 17 per cent of the respondents believed that 'flood hazards could be reduced by engineering structures' (Table 6). Interestingly, but not surprisingly, less than one-quarter of the respondents conceived that the Beijiang Embankment System was capable of preventing floods and reducing property losses in their villages (Table 5). During the interview, some respondents even claimed that the dikes actually augment the flood impact by holding back floodwater. Many houses collapsed because of prolonged (more than three weeks) inundation that weakened their foundations. Population pressure led villagers to have limited locational choices. They were prepared to live with floods, and called for better emergency relief and rehabilitation programmes following particularly disastrous ones.

2 Functional adjustment approaches

Undoubtedly, living with floods is a reality for many people in rural China. Respondents in the surveyed villages conceived flood hazard as a perpetual phenomenon, in which they were caught in a 'disaster-damage-repair-disaster cycle' (Tobin and Montz 1997). Past experiences have resulted in floodplain inhabitants getting accustomed to the recurring impact of floods. They gradually developed various functional adjustment approaches to combat flood hazards. For instance, villagers in Miaozui village marked the water levels of major floods in white paint on the wall of the most visible house in the

village to constantly remind people about flooding risks (Plate 2). Moreover, to better survive repeated flooding effects, local planning agencies have introduced new hazard-resistant building design standards, as discussed earlier. These standards could reduce the chance of housing damage and the losses and stress experienced by people living in flood-prone locations (Plate 1). Of course, villagers welcome all hazard-resistant or hazard mitigation standards or programmes. However, not all victims were as fortunate as those in the surveyed villages, who received donations from Hong Kong to assist them in re-building their houses. Villagers elsewhere might encounter difficulties in getting adequate resources, both financial and material, to rebuild collapsed houses according to the standards stipulated by the planning agencies. Even the more fortunate victims in this survey would like the government to set up financial reserves (i.e. some sort of flood insurance) to help the needy in the post-flood restoration and reconstruction (Table 6). Furthermore, the prevailing post-flood production restoration policy in China is the principle of 'self-reliance', meaning that victims have to resolve their problems by themselves. Hence, victims will normally resume their production promptly after the flood has receded. Meanwhile, many take up 'sideline' work in local areas, and someone in the family may even migrate to cities to seek temporary employment to supplement the family income. In China, the role of communal systems and social networks based upon kinship relationships in disaster relief works should not be neglected. For instance, many respondents indicated that a mutual-help system based upon extended family and kinship relationship was a significant source of support during flood hazards. Aid provided included moral support, provision of food and shelters, and even cash loans given to buy seeds and other equipment to restore production. This aid not only helped victims to survive the most difficult period, but was also crucial during rehabilitation and reconstruction. The survey found that local authorities have begun to levy some sort of 'flood tax' on each household in recent years with the aim of building up a pool of emergency funds to assist the needy flood victims. This is indeed a very encouraging development indicating that the idea of loss-sharing is emerging as an important flood-hazard adjustment in rural China.

3 Sustainable floodplain development

Clearly, the above-mentioned functional adaptation strategies play an important role in mitigating the impact of floods on many villagers. The success of these strategies depends on the cohesiveness of the social network and the preparedness of its members. To be more effective, these strategies should become an integral part of the emergency relief programme in rural China, particularly in areas where government aid is minimal. Despite the apparent disaster—damage—repair-disaster cycle confronting the villagers in the flood-prone areas, the study revealed how individuals survived the disaster and how villages were rebuilt following the floods. However, many of the disaster responses tend to be *ad hoc* and piecemeal. To allow inhabitants to combat floods more effectively, comprehensive, unified approaches to flood-hazard mitigation and disaster reduction are necessary. The notion of sustainable floodplain development focuses on the use of an integrated approach to flood-hazard mitigation and prevention (Mileti *et al.* 1995; Haque and Zaman 1994). An evolving consensus amongst researchers is that sustainability with respect to floodplain management should focus on reducing the risk of catastrophic losses, while enhancing the people's capability and responsiveness to dramatic flood hazards (Burton *et al.* 1993). Evidently, a policy of sustainable floodplain development would promote 'living with floods', by establishing the social connections needed to accomplish emergency relief tasks and to strengthen people's preparedness to anomalous floods. Only with this recognition will the disaster—damage—repair-disaster cycle be broken.

At present, over half of China's 1.3 billion people, one-third of the total cultivated land and three-quarters of the gross value of industrial and agricultural output lie on the alluvial floodplains of major rivers (Liang 1998). Without underestimating the importance of the engineering structures designed to control floods physically, it is unlikely that those structures could provide the most cost-effective protection to the inhabitants of the huge floodplain in China. Rather, a sustainable floodplain development, which focuses on small-scale, self-help strategies that fit in with present land use practices and reduce the ecological impacts of engineering schemes, should be implemented. In other words, human adjustment modification should receive more attention in loss minimization efforts, particularly for the majority of people living in rural areas.

China formally promulgated its first *Flood Prevention Law* in August 1997. The Law is aimed at effectively harnessing floods and inundation, protecting life and property, and safeguarding the

Plate 2 Flood water levels of major flooding incidents were clearly marked (in June 1996) on the wall of a village house to remind or alert villagers about flood hazards

sustainable development of the nation (Liang 1997). The major flood management strategies proposed have shifted from almost exclusive reliance on engineering structures (such as dams, dikes, and channel improvements) designed to control floods, to include more non-structural approaches (such as floodplain zoning, flood forecasting, and insurance) designed to reduce vulnerability to floods. The present study reveals that there is a realization among the victims of the need to live with floods. Therefore, strategies to incorporate the functional flood adjustment approaches discussed in the preceding section will strengthen people's capability to cope with disastrous flood effects. This capability is essential if China is to achieve sustainable development in its floodplains.

Conclusions

Flooding is the most common of all environmental hazards in China. The preceding analysis has examined how victims perceived and responded to a catastrophic flood. The study revealed the collective values of flood victims at the village level. Contrary to expectations, victims were quite sceptical of large flood prevention engineering structures. Victims believed that flooding was unavoidable, but by extending support networks, applying hazard-resistant designs, and developing loss-sharing adjustments, flood hazards could be mitigated. The notion of sustainable floodplain development advocates a 'living with floods' mode of livelihood in which people empower themselves by increasing their ability to survive flood hazards.

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