

**The Chinese Academy of Social Sciences and  
The Academy of the Social Sciences in Australia  
Australia-China Joint-action Program  
Final Report**

Name of Chief Investigator and Australia team leader:	<b>Dr Alex Lo, Griffith University</b>
Chinese team leader:	<b>Dr Yan Zheng, Chinese Academy of Social Sciences</b>
School / Faculty	<b>School of Environment</b>
Project Title	<b>Climate Risk Governance in Vulnerable Cities: A Comparative Study of Brisbane and Shanghai</b>

Total Funding Received (from ASSA)	First Year of Funding	Number of Years' Funding Received
\$3,500	2013	1

**Details of international visits and objectives:**

This project aimed to investigate climate change governance and the risk perception of Shanghai residents. Research activities included site visits and interviews with stakeholders and local people.

With the funding support from the ASSA, I took visits Beijing, where my CASS colleague is based, on two occasions:

26 – 28 June 2013

I had a scoping meeting with my CASS colleagues. We discussed the methodology of our research and timeline for fieldwork. Also I completed a 40-minute presentation at the Institute of Urban and Environmental Studies in the CASS on a topic related to our project. My CASS colleagues visited Australia and conducted the fieldworks in China later in 2013.

3 – 5 April 2014

I visited Beijing again for finalizing the research publication based on the project findings and discussing future collaborations. I also took this opportunity to participate in an Australia-China Climate workshop hosted by the Ministry of Science and Technology and partly funded by Griffith University.

Mid-July 2014

I have scheduled another meeting at Beijing to discuss a new research project and grant application and conduct more fieldworks.

## Project outcomes and research findings

We conducted a series of stakeholder interviews and social surveys in Shanghai. Analysis of interview results is ongoing and expected to finish by June this year. The survey data collected have been analyzed and reported in an article published in a leading academic journal. An electronic version of this article is attached to this final report. Below is the abstract of the article:

*Shanghai is a megacity located at a hazard-prone region, but one in which local residents have not actively engaged in disaster risk management. This paper aims to identify factors of perception influencing their propensity to adopt risk-mitigating measures. It presents results of a structured questionnaire survey administrated to Shanghai residents. Results show that risk-mitigating measures are deemed to be important if they 1) have frequently experienced extreme weather; 2) believe that extreme weather events are severe in Shanghai, and; 3) are concerned about other public risks confronting the international society, such as energy security and terrorism. It is important to note that the third item has demonstrated greater impacts than the other two factors. A cultural explanation is offered by this paper. Public risk awareness emanates from a generic concern over the security of the human world. This generic concern acts as a socio-cultural backdrop that contextualises the ways in which individuals respond to natural hazards. The significance of this factor indicates the need for broadening the analytic scope of risk perception research in China. The findings are useful for local policy-makers, emergency managers, and community and aid organizations to devise creative strategies for risk education and communication.*

## Future international collaborations

Currently we are preparing a joint application for seed funding from the International Social Science Council (ISSC). Both my CASS colleague and I were elected as the ISSC's *World Social Science Fellows* (in 2013 and 2014 respectively) on topics relating to climate change adaptation (Details are available from the ISSC website: <http://www.worldsocialscience.org/activities/world-social-science-fellows-programme>). We attempt to benefit from our existing collaborations and seek more funding to extend the successful ASSA-CASS project.

Signature of Chief Investigator



Date

12 May 2014

# Generic security concern influencing individual response to natural hazards: evidence from Shanghai, China

Xin Lu Xie\*, Alex Y Lo\*\*, Yan Zheng\*, Jiahua Pan\* and Jing Luo\*\*\*

\*Institute of Urban & Environmental Studies, Chinese Academy of Social Sciences, China;

\*\*Griffith School of Environment, Griffith University, Gold Coast, Queensland 4222, Australia;

\*\*\*Research Centre for Chinese Borderland History and Geography, Chinese Academy of Social Sciences, China

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*Shanghai is a megacity located in a hazard-prone region, but one in which local residents have not actively engaged in disaster risk management. This paper aims to identify factors of perception that influence residents' propensity to adopt risk-mitigating measures. It presents results of a structured questionnaire survey administered to Shanghai residents. Results show that risk-mitigating measures are deemed to be important if people: (1) have frequently experienced extreme weather; (2) believe that extreme weather events are severe in Shanghai; and (3) are concerned about other public risks confronting international society, such as energy security and terrorism. It is important to note that the third point has resulted in greater impacts than the other two factors. A cultural explanation is offered in this paper. Public risk awareness emanates from a generic concern over the security of the human world. This generic concern acts as a socio-cultural backdrop that contextualises the ways in which individuals respond to natural hazards. The significance of this factor indicates the need for broadening the analytical scope of risk perception research in China. These findings are useful for local policymakers, emergency managers and community and aid organisations seeking to develop creative strategies for risk education and communication.*

**Key words:** risk perception, natural hazard, extreme weather, cultural theory of risk, social survey, China

## Introduction

Flooding, cyclones, landslides, storms, heatwaves and wildfires have resulted in considerable damage in human settlements (Ball *et al.* 2013; Fuller and Bulkeley 2013; King *et al.* 2006; Lo 2013a 2013b; Wong and Zhao 2001). Historically such natural hazards have caused 3.3 million deaths between 1970 and 2010 (World Bank 2010, 26). In large cities, concentrations of humans, their assets and activities can represent a significant proportion of national wealth and may result in additional forms of vulnerability (Nicholls 1995). Global climate change has put human settlements at even greater risk due to its adverse effects on the frequency, intensity, spatial extent, duration and timing of extreme weather events (Intergovernmental Panel on Climate Change 2012).

Asian megacities are particularly susceptible to the disruptive impacts of extreme weather. This is because of the

extraordinarily high concentration of urban populations with large proportions of vulnerable groups and their proximity to hazard sources (Fuchs *et al.* 2011; World Bank 2010). China has experienced more than 600 natural disaster events over the last century (1900–2011) that resulted in significant losses, i.e. 12 million people lost their life in these events (Chen *et al.* 2013). The country is home to several megacities, such as Shanghai, that are exposed to very high risks associated with natural disasters. Indeed, the Intergovernmental Panel on Climate Change's (IPCC) Fourth Assessment noted that the coastal city of Shanghai is one of the country's climate change hotspots, situated in a zone of escalating risks of accelerated sea-level rises, cyclones, storm surges and flooding (Cruz *et al.* 2007, 493).

One of the pressing issues for Shanghai, and China generally, is that the general public have not actively engaged in disaster risk management. Restricted access to

the policymaking process contributes to this problem, but an equally important factor is the low awareness and propensity to act among local residents (Li 2013; Lo 2010). Although Shanghai is frequently affected by and is vulnerable to natural hazards, it is not clear that local residents are adequately prepared for the increasingly intense and frequent extreme weather events. One reason is that a large number of residents are inland migrants who are not familiar with coastal hazards and are poorly informed regarding the associated risks (Wang *et al.* 2012). The lack of relevant knowledge and experience has severely limited their capacity to cope with natural hazards.

However, some researchers have raised questions about the importance of commonly discussed personal attributes, including knowledge, experience and attitude, in driving behavioural response to disaster risk (Bubeck *et al.* 2012; Lo 2013b; Lo *et al.* 2012). In particular, they find that the relationship between risk perception and behavioural response is non-linear and far more complex than previously assumed. One source of complexity is the individual's cultural bias which significantly influences perception of the climate (Hulme 2009; Renn 2008; Rayner 2004). Evidence of such perspectives is far from adequate in China.

Only a handful of Chinese studies have attempted to identify the perception factors that influence the propensity to adopt risk-mitigating measures. Analytical breadth remains limited because they have focused on the perception and personal experience of extreme weather, but have not engaged with broader socio-cultural considerations. As we point out in the next section, the socio-cultural context, which encompasses wider issues, including societal, ecological and technological risks, plays a crucial role in influencing the propensity to act. This implies that the disaster risk management practice of individuals may be driven by generic concern over public risk issues, and not merely specific concern over extreme weather. Such perspectives are lacking in Chinese risk perception research. This limitation in current knowledge has constrained our ability to deploy a wider range of strategies for promoting disaster risk management at the household level.

This research investigates the importance of disaster risk-mitigating measures as perceived by Shanghai residents. The primary objective is to ascertain the extent to which the perception is associated with awareness of extreme weather and other public risk issues. The latter are not directly related to extreme weather, but can indicate new avenues for motivating people to engage in disaster risk reduction on a voluntary basis. This research is based on a structured questionnaire survey administered to the general public of Shanghai city. It offers new insights into household's resilience to the effects

of extreme weather. The findings presented will be to local policymakers, emergency managers and community and aid organisations to help develop creative strategies for enhancing the adaptive capacity of Shanghai's local communities, with wider implications for other mid-income megacities.

## Research problem

In the study of meteorological risk perception there has been an emphasis on the ways in which individuals perceive the *specific* disaster events. This is particularly common among Chinese risk perception studies. For instance, Huang *et al.* (2010) and Ge *et al.* (2011) have investigated variations in stated acceptance of different risk events in Nanjing and the larger Yangtze River Delta region, respectively. Their empirical investigation is almost exclusively focused on individual risk attributes, such as perceived controllability and newness of the risk events. In a case study of Shanghai, Wang *et al.* (2012) identify the relationship between individual response to natural hazards and risk perception, which is defined in terms of knowledge, expected impacts and perceived importance of a hazard mitigation strategy. The analytical focus on specific risk properties, impacts and responses was also advanced by an empirical study of Beijing residents' perception of climate change (Yu *et al.* 2013). Attitude toward climate change action is assumed to be a function of the perception of various aspects of climate change, such as causes, impacts and knowledge (Yu *et al.* 2013). Few non-hazard factors are included in these Chinese studies, such as socio-economic traits and trust or confidence in government.

In these Chinese studies risk perception is construed as a culturally independent construct. The broader socio-cultural context in which risk is produced, understood and dealt with is not put into perspective. The limited scope falls short of the wide range of influencing factors identified by international studies. The cultural portrayals and creative *re-presentations* of disaster and risk events are an increasingly popular theme of risk perception research (King 2004; Hulme 2009; Douglas 1992; Couch 2000). Hulme (2009) argues that individuals and societies attach a variety of cultural and ideological meanings to the changes in the climate. His analysis in part draws on the cultural theory of risk, which suggests that risk perception has deep cultural and moral underpinnings (Douglas and Wildavsky 1982; Thompson and Rayner 1998). Individuals select aspects of information about risk to which they pay attention and respond, in accordance with their pre-existing cultural bias and values. 'An act is culturally rational if it supports one's way of life', argues Wildavsky (1987, 6). This implies that the perception of disaster risk is highly dependent on the socio-cultural and

political contexts in which danger is reproduced and responsibilities and blames are assigned (Beck 1992; Douglas 1992; Douglas and Wildavsky 1982).

Empirical research has demonstrated that belief in climate change is associated with fundamental values and political ideologies (Corner *et al.* 2012; Whitmarsh 2011). These values and ideologies select a proprietary socio-cognitive strategy for interpreting messages about climate and meteorological risks. For example, some individuals conflate climate change with stratospheric ozone depletion because they are concerned about human-induced damage to the atmosphere, rather than the atmosphere *per se*. As Thompson and Rayner explain,

the climate change issue is perceived as part of a wider problem concerning humankind's disturbed relationship with nature. In this sense, climate change and ozone depletion are the same thing. (1998, 152)

This means that individuals respond to an abstract, morally charged symbol, i.e. human damage on the environment. Climate change is just one of many items subsumed under that symbol.

What is the 'wider problem' underpinning individuals' response to natural hazards? We propose that *security of the human world* is a commanding generic concern that drives people's propensity to adopt protective measures against extreme weather. Concern for human security, is not limited to extreme weather, but broadly includes a suite of societal, ecological and technological risks, such as terrorism, biodiversity loss and nuclear war, that could potentially affect the well-being and even the survival of humanity. Conceptually these non-meteorological public risks are member issues of the wider problem, i.e. security of the human world. Meteorological risk perception may be just another 'cultural shadow' of this wider problem. This implies that personal strategies for coping with meteorological risk might be understood in terms of such non-meteorological public risks because, symbolically, they pertain to the same problem and share cultural underpinnings. To explore this issue we developed the following two working hypotheses:

H1: The perceived importance of hazard response strategies is related to experience of extreme weather, meteorological risk awareness and public risk awareness.

H2: Awareness of public risks is a more significant factor than either extreme weather or meteorological risks.

These hypotheses are empirically tested using primary data collected from Shanghai. The research method is described in the next section.

## Survey design

A structured questionnaire survey was conducted to solicit public attitudes towards household-based hazard response strategies, risk perception and hazard experience. It was based on a collaborative research project involving the Chinese Academy of Social Sciences (CASS) and the Shanghai Meteorological Bureau (SMB). The questionnaire was intended to be user-oriented and prepared by the CASS in consultation with the SMB to inform municipal disaster management practice. It was designed on the basis of several formal discussions among the CASS project team, representatives from the SMB and other municipal government departments, as well as a series of intensive pilot interviews with a small group of local residents.

The final questionnaire included a total of 19 substantive questions, each containing up to 8 sub-questions. Four of these substantive questions, concerning the importance of hazard response strategies, personal experience of extreme weather events, seriousness of meteorological risk and other forms of public risk, were directly used to address the objectives of this research.

### Dependent variable

The perceived importance of hazard response strategies was probed by a question comprised of five constituent items, each describing one possible way of preparing for or reducing exposure to the adverse consequences of extreme weather events. These measures included purchasing personal or household insurance, relocation, soliciting specific meteorological information, participating in disaster-response training activities, and retrofitting homes to withstand extreme weather. Respondents indicated the importance of these measures on a six-point scale, with 0 denoting 'totally unimportant' and 5 denoting 'extremely important'.

### Independent variables

- 1 Respondents' personal experience of extreme weather was recorded using an eight-component question. These components described different possible situations where people's daily activities are disrupted by extreme weather events. Examples included cancelling travel plans, breakdown of power supply and inundation of houses or offices as a result of extreme weather events. Respondents indicated how frequently they, or their family members, experienced these incidents on a six-point scale, with 0 denoting 'never' and 5 denoting 'always'.
- 2 Awareness of the risks of climate-related natural hazards (Meteorological risk awareness) was measured by a survey question that required respondents to rate

the seriousness of six climate-related natural hazards confronting Shanghai. These include flooding, typhoons (or cyclones), heatwaves, prolonged rainfall, frost and accelerated sea-level rise (hereafter collectively referred to as meteorological risks). Responses to each of these items were recorded on a six-point scale.

- 3 Awareness of other forms of public risks (public risk awareness) was gauged by another question comprising six components. Each item represented one form of public risk confronting international society, which was not, or not directly, related to those natural hazards identified above. These include energy security, terrorism, food and water security, biodiversity loss, HIV and the threat of nuclear weapons. Respondents rated the seriousness of each of these threats on a six-point scale, with 0 denoting 'not serious at all' and 5 denoting 'extremely serious'.

## Study area and sampling

The survey was conducted in Shanghai in March 2012. Shanghai is one of the most populous cities in the world. The municipality recorded a population of 23.5 million in 2011, or 3706 per km<sup>2</sup>. It is also one of the world's largest seaports as well as the commercial and financial centre of China, with a GDP per capita of US\$13 400 in 2011. Since the 1990s, the Shanghai metropolitan area has rapidly expanded eastwards into the Pudong new development area (Figure 1), and a large number of rural residents moved into cities, creating pressures to accommodate the expanding population (Zong and Chen 1999). The high concentration of population and economic activities has increased the vulnerability of this hazard-prone coastal city.

The Shanghai region experiences a wide range of tidal and fluvial conditions (from low flows through to extreme floods). It is bounded to the east by the East China Sea, located at the mouth of the Yangtze River, and is in the vicinity of Taihu Lake and Hongze Lake, which are among the five largest freshwater lakes in China. Thus, Shanghai is a typical floodplain settlement with low terrain and numerous rivers, lakes and canals (Ge *et al.* 2011). In 2011, direct economic loss due to storms and flooding was estimated to be RMB0.1 billion (China Meteorological Administration 2012, 119), or approximately US\$16 million. In addition, Shanghai has a subtropical monsoon climate and is situated in a cyclone-prone area. About 200 typhoons affected the coastal city from 1947 to 2007, with an annual average of 3.5 (Wang *et al.* 2012). Tropical cyclones caused an estimated economic loss of RMB 0.25 billion in 2011 (China

Meteorological Administration 2012, 119), or approximately US\$41 million.

The main survey was administered to the general public of Shanghai. Samples were collected from four districts of the municipality, namely, Xuhui District, Baoshan District, Qingpu District and Fengxian District. Adult residents (aged 16 or above) were randomly selected and approached in public areas (e.g. public squares or parks) of the selected study sites.<sup>1</sup> They were invited to participate in a face-to-face interview with a student research assistant who was trained as an interviewer and supervised by CASS or SMB staff members in the field. Respondents who were unable to complete the interview on-site returned the questionnaire via the internet. The survey was conducted in Mandarin.

## Results

### *Descriptive statistics*

A total of 349 questionnaires were returned to the project team, 28 per cent of which were completed and submitted via the internet.<sup>2</sup> The survey managed to achieve an overall response rate of about 40 per cent. Forty questionnaires were incomplete, i.e. with a number of missing responses, and therefore were excluded from analysis. The final sample has 309 observations. There are fewer male respondents (46.9%) than female (52.4%). Half of the respondents (55.3%) were educated to university level. The average respondent was 40.3 years old. Those who receive a monthly income between RMB1000–3500 and 3500–7000 accounted for 37.2% and 27.8% of the sample, respectively.

Descriptive statistics for the four variables tested are presented in Tables 1–4. All of the possible hazard response strategies received moderately high ratings, except purchasing insurance cover for natural hazards (Table 1), which is not very common in China and the public is generally not aware of its availability (Surminski 2013). Retrofitting homes was the most acceptable response strategy, probably because it would involve physical change to the existing structure and may visually provide some safety 'assurance' to the individual. The composite variable representing perceived importance of hazard response strategies, labelled 'Hazard response strategies', has a Cronbach's alpha of 0.84, suggesting that it is reliable.

Individuals' personal experience of extreme weather conditions was dominated by memories of feeling unwell or the inconvenience of being stuck in a traffic jam (Table 2). The last three entries in the table concern material damage to properties or supplies and have a rating of less than 1.5, indicating that these events were occasional. These results are reasonable since substantial damage occurs less frequently than milder impacts, such

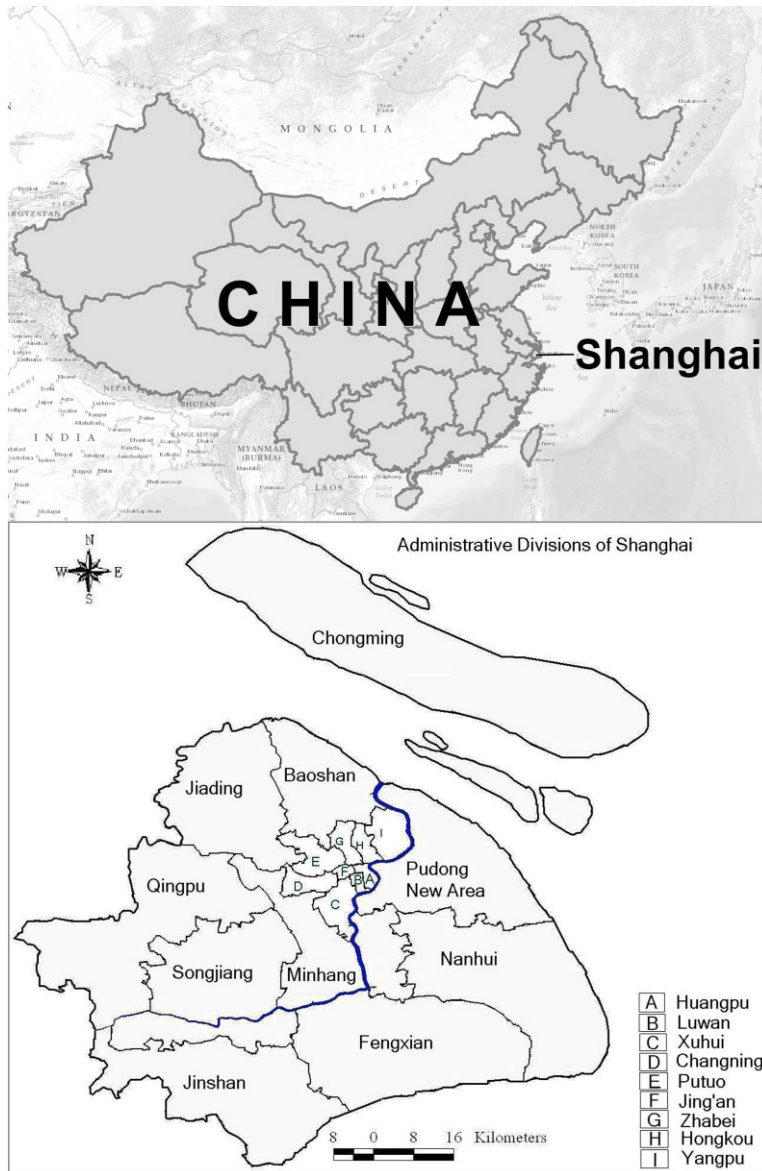


Figure 1 Maps of Shanghai

as traffic jams. The composite variable, ‘Hazard experience’, combining the eight items, yielded an alpha value of 0.85.

Many respondents believe that heatwaves and prolonged rainfall have had serious impacts on Shanghai (Table 3). Rare events, such as accelerated sea-level rise and flooding, are less frequently considered as serious. A possible reason is that people assess seriousness in terms of frequency of encounter, so that those hazardous events that can be linked to everyday weather have received

more attention (Whitmarsh 2008; Lo and Jim in press). The composite variable, ‘Meteorological risk awareness’, had an alpha value of 0.80.

Resource-related and ecological risks, such as energy and food security and biodiversity loss, are more frequently described as serious problems (Table 4). Societal and technological risks, such as nuclear weapons and terrorism, have received relatively less attention. The former are chronic and enduring problems that are common in China and even familiar to some individuals

**Table 1** Descriptive statistics for perceived importance of hazard response strategies (N = 309)

Hazard response strategy	Average <sup>a</sup>	Frequency of indicating 'extremely important' (%)	SD
Retrofitting home	3.23	26.5	1.55
Relocation	3.20	25.8	1.51
Participating in disaster-response training	3.02	21.8	1.51
Soliciting meteorological information	2.85	16.6	1.50
Purchasing insurance	2.45	13.5	1.56

Hazard response strategies: Cronbach's alpha = 0.84

<sup>a</sup> Range: 0–5, where 0 = 'Totally unimportant' and 5 = 'Extremely important'

**Table 2** Descriptive statistics for personal experience with extreme weather (N = 309)

Personal experience with extreme weather	Average <sup>a</sup>	Frequency of indicating 'always' (%)	SD
Feeling unwell	2.62	14.7	1.55
Being trapped in traffic jam	2.31	9.6	1.58
Cancellation of travel plans	1.88	8.2	1.55
Home inundation	1.69	5.6	1.52
Drinkwater contamination	1.60	6.1	1.57
Power supply breakdown	1.47	3.7	1.39
Witnessed dangerous falling objects	1.44	6.3	1.57
Home electric devices damaged	1.17	3.0	1.39

Hazard experience: Cronbach's alpha = 0.85

<sup>a</sup> Range: 0–5, where 0 = 'Never' and 5 = 'Always'

**Table 3** Descriptive statistics for meteorological risk awareness (N = 309)

Form of meteorological risk	Average <sup>a</sup>	Frequency of indicating 'extremely serious' (%)	SD
Heatwave	3.59	31.0	1.34
Prolonged rains	3.40	22.2	1.30
Typhoon (cyclone)	2.84	20.5	1.55
Frost	2.84	11.8	1.38
Sea-level rises	2.80	16.7	1.50
Storm and flooding	2.71	17.6	1.61

Meteorological risk awareness: Cronbach's alpha = 0.80

<sup>a</sup> Range: 0–5, where 0 = 'Not serious at all', 5 = 'Extremely serious'

who have rural experiences, whereas the latter are acute and rare events to which most Shanghai residents do not have immediate experience. It is then possible that individuals see the former as more real and urgent issues. Terrorism, in particular, is not widely regarded as a major threat to the Chinese public and has not received extensive mass-media coverage compared to that received in

**Table 4** Descriptive statistics for public risk awareness (N = 309)

Form of public risk	Average <sup>a</sup>	Frequency of indicating 'extremely serious' (%)	SD
Energy security	3.79	43.5	1.44
Biodiversity loss	3.63	36.8	1.44
Food and water security	3.49	32.7	1.45
HIV	3.04	21.1	1.50
Nuclear weapons	3.04	21.4	1.54
Terrorism	2.70	17.8	1.60

Public risk awareness: Cronbach's alpha = 0.84

<sup>a</sup> Range: 0–5, where 0 = 'Not serious at all', 5 = 'Extremely serious'

the USA and Europe. The composite variable 'Public risk awareness' had an alpha value of 0.84.

### Regression analysis

Analysis of the survey data collected was completed using basic statistical techniques. Linear regression was employed to identify the relationships between the



dependent and independent variables. That is, how the perceived importance of hazard response strategies was associated with personal experience of extreme weather events, awareness of meteorological risk and other public risks. Based on the statistical significance of independent variables and adjusted R<sup>2</sup> values of the regression model, we assessed the extent to which these variables could explain variations in the perceived importance of hazard response strategies.

The three independent variables, hazard experience, meteorological risk awareness and public risk awareness, were highly correlated (all  $p < 0.01$ ; Table 5). The positive signs indicate that hazard management measures are considered to be important to the extent to which the respondent has experienced and been impacted by extreme weather, believes that extreme weather events are severe in Shanghai, and is concerned about the other forms of public risks confronting international society. These variables collectively explained 34 per cent of the variations in the perceived importance of hazard response strategies.

Further analysis was conducted to examine the explanatory power of these variables. A stepwise regression procedure was used to compare R<sup>2</sup> values between models and helped determine whether public risk

**Table 5 Linear regression analysis of perceived importance of hazard response strategies**

	Standardised coefficients	Standard error	Significance
(Constant)		1.091	0.015
Hazard experience	0.150	0.036	0.005**
Meteorological risk awareness	0.242	0.047	0.000**
Public risk awareness	0.349	0.053	0.000**
Adj. R <sup>2</sup>	0.34		
F statistic	46.659		
Standard error	4.710		

Dependent variable: hazard response strategies

\*\* Significance at 0.01 level

awareness was greater than the impact of the other factors.

Public risk awareness was the primary predictor and alone explained 26 per cent of the variation in the dependent variable (Table 6). Introducing meteorological risk awareness into this model increased the explanatory power by about 6 per cent and hazard experience added a further 2 per cent to the second model. This suggests that public risk awareness is a more important factor influencing perception of hazard response strategies.

### Discussion and conclusions

The survey data collected from Shanghai did not result in a rejection of the proposed hypotheses that the perceived importance of hazard response strategies is positively related to the previous experience of extreme weather, meteorological risk awareness and public risk awareness. Furthermore, it is important to note that public risk awareness had a greater impact than the other two factors. This suggests that awareness of other forms of public risks confronting the international society, which are not directly related to natural hazards, more strongly influences the propensity to take protective actions against extreme weather (Rossi *et al.* 1983; Douglas 1992; Douglas and Wildavsky 1982). The analytical importance of the wider context in which risk issues are situated clearly warrants further attention.

These findings can be explained by the core idea of the cultural theory of risk. According to this theory, risk-related decisions are a response to the larger cultural and political process by which the risk issues are produced and reproduced (Douglas and Wildavsky 1982; Wildavsky 1987). Concern over non-meteorological public risk issues, such as energy security, HIV and terrorism, emanates from a generic concern over the security of society at large, or what Thompson and Rayner (1998) call the 'wider problem'. The generic concern forms the context in which the public envisage the risk of hazard impacts (Douglas 1992; Beck 1992). Shanghai residents are more likely to prepare themselves for climatic contingencies to the extent to which they are concerned about

**Table 6 Repeated linear regression based on stepwise procedures**

Included variables	Standardised coefficients	Standard error	F statistic	Adj. R <sup>2</sup>
Public risk awareness	0.514	4.969	96.732	0.26
Public risk awareness	0.358	4.772	64.305	0.32
Meteorological risk awareness	0.290			
Public risk awareness	0.349	4.710	46.659	0.34
Meteorological risk awareness	0.242			
Hazard experience	0.150			

human security issues generally. This generic concern acts as a socio-cultural backdrop that contextualises the ways individuals understand extreme weather and determines how they respond to it. Perception of various extreme weather events is one of the cultural shadows of this generic perception framework. Attitudes toward individual risk-mitigating measures depend not only on the ways in which extreme weather is perceived and experienced, but also on the perception of other public risk issues (Thompson and Rayner 1998). Personal responses to extreme weather are therefore manifestations of wider concerns regarding the security of the human world.

Such cultural perspectives have received some attention in the international literature (King 2004; Couch 2000), but are missing from existing studies of natural hazard perception among the Chinese public (Wang *et al.* 2012; Huang *et al.* 2010; Ge *et al.* 2011; Yu *et al.* 2013). The analytical scope of these Chinese studies has been limited to specific risk issues and their properties or consequences, and therefore failed to capture the richness in the ways that individuals engage in notions of risk. Our exploratory study has addressed this methodological limitation by showing that what matters most is not concern about the disruptive changes in climatic conditions *per se*, which is an implicit assumption underlying those Chinese studies, but wider human security concerns.

However, more evidence is needed to substantiate this argument. A possible direction for further research is to employ a more systematic research technique, such as the 'grid-group analysis' developed by founding cultural theorists (Douglas and Wildavsky 1982; Wildavsky 1987). This could help examine the effects of cultural bias, such as individualism and egalitarianism, on the propensity to act and disaster preparedness. Conceptualising the risk cultures in China might also take into account the distinction between 'emic' and 'etic' factors, or the different ways in which they are rationalised within the society and by independent experts (Pike 1954).

The findings have practical implications for disaster risk management. Individuals are more likely to adopt risk-mitigating measures if they are concerned about other public risk issues confronting international society. This lends support to the use of creatively crafted messages for risk education and communication. Preparation for local extreme weather can be more broadly framed and articulated in terms of response to a human security problem, such as global climate change, and not merely a natural hazard event that is restricted to a particular time and place. The geographic orientation of risk messages can be extended from the locality concerned to the larger society, without specifying the scale. Such a broadening strategy could harness the wider cultural-cognitive space in which individuals understand and cope with extreme weather. This could help local policymakers, emergency managers,

and community and aid organisations to formulate effective strategies for promoting the adoption of risk-mitigating measures at the household level and, ultimately, enhancing residents' resilience to the disruptive impacts of extreme weather.

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### Notes

- 1 Interviewers were instructed to select every third visitor of the sampling sites or person passing by.
- 2 The majority of the online questionnaires were returned within two weeks after the street survey, with very few after a month. Therefore the impacts of delayed submission should be negligible.

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