



## **The MICRODIS Project Report**

**Integrated health, social and economic impacts  
of extreme events: evidence, methods and tools**



MICRODIS is an Integrated Project funded under the European Commission's  
Sixth Framework Programme - Thematic Priority 6.3 Global Change and Ecosystems  
(Contract number GOCE-CT-2007- 036877)



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**MICRODIS**



## PART 1

### THE MICRODIS PROJECT : INTRODUCTION



## 1. DISASTERS

The World Health Organization defines a disaster as “serious disruption of the functioning of a community or a society causing widespread human, material, economic, or environmental losses which exceed the ability of the affected community or society to cope using its own resources”. Using another phrase, the Centre for Research on the Epidemiology of Disasters (CRED) defines a disaster as “a situation or event, which overwhelms local capacity, necessitating a request for national or international external assistance”. Disaster is practically originated from an impact of extreme events (intense physical phenomena) on human life and environment. It is commonly formulated as a cross-product of hazards and vulnerability.

In general, disasters could be classified on the basis of the causative agents into two broad categories, i.e., natural and human-made disasters, although in practice, many disaster conditions show a mixture of the two types. Natural disasters have occurred throughout human history and around the globe, affecting many nations. In the modern context, however, recent data show that the trend of natural disasters has increased sharply since 1975 and that natural disasters occur at higher frequencies in developing countries.

Among the factors influencing developing countries, poorly controlled urban development, rapid population growth in disaster-prone areas, and a lack of appropriate preparedness contribute to the increase in the overall impact of disasters. The United Nations has noted that “one of every two large cities in the developing world is vulnerable to natural disasters”. Concerning the death toll, according to CRED, from 1995 to 2004, on average more than 77,000 people in the world died every year because of natural disasters.

## 2. CATEGORIES OF DISASTER IMPACT

Disaster impacts can be placed into three basic categories: health, social, and economic. With respect to health impacts, for example, floods can potentially increase the transmission of communicable diseases, including water-borne diseases such as typhoid fever, cholera, leptospirosis, and hepatitis A, and vector-borne diseases, such as malaria, dengue fever, and yellow fever. Other health risks from flooding include drowning and injuries or trauma and hypothermia. Although communicable disease outbreaks may not always occur, the risk of transmission of certain endemic and epidemic-prone diseases can increase following natural disasters closely related to the size, health status, and living conditions of the displaced population, and the disaster management employed. Improved detection and response to communicable diseases are important for monitoring the incidence of diseases, to document their impact, and to help better quantify the risk of outbreaks following natural disasters. Other health impacts can include nutritional effects and impacts on mental health.

The social impacts of disasters can be complex. In some cases, households are disrupted and forced to change location, while in other cases, people affected by disaster report a greater closeness in the community. There have been associations established between coping skills for a disaster and level of community involvement. Finally, economics, health, and social impacts come to a crossroads in the social impacts, in which stressors from one or two of the areas influence outcomes for the third. For example, economic stressors might have adverse influences on mental health, which in turn affects social relationships.

Economic impacts can be many and integrate with other impacts. Among economic effects of disasters are, of course, loss of livelihood or possessions, but other outcomes include the taking of loans, often at high rates of interest, and the necessity of leaving one's location in pursuit of work. An example of economic impacts of a disaster is the effects of floods. According to CRED, worldwide from 1995 to 2004, floods have wrought economic damage averaging 20 billion US\$ per year, which is the highest



• Health Working Group experts meet to plan work on the conceptual model and protocol development in Hanoi, Vietnam in year one.

monetary value as compared to other disaster types, such as earthquake, volcanic eruption, tsunami, windstorm, surges, slides, drought, and famines. Altogether, CRED has reported that disasters result in an average annual economic damage totalling 65.5 billion US\$.

Disaster losses are increasing with great consequence to the survival, dignity, and livelihoods of individuals and communities, particularly of the poor in both developed and less-developed countries. Disaster risk arises when hazards interact with the physical, social, economic, and environmental vulnerabilities. In the past two decades, according to CRED, more than 200 million people have been affected, on average, every year by these extreme events.

Many societies are vulnerable to disaster because of weaknesses in these various affected categories. Environmentally unsound practices, global environmental changes, population growth, urbanization, social injustice, poverty, conflicts, and short-term economic visions produce these vulnerable societies. This vulnerability takes on particular urgency in the face of long-term risks brought about by climate change and goes beyond environmental degradation or the mismanagement of natural resources. There is now international acknowledgment that efforts to reduce disaster risks must be systematically integrated into policies, plans, and programmes for sustainable development and poverty reduction.

### 3. MICRODIS

The MICRODIS project locates itself within the framework of this international acknowledgment of the need for systematic and integrated efforts to reduce disaster risks.

#### 3.1. MICRODIS Project Goals

MICRODIS is an Integrated Project funded under the EU Sixth Framework Programme – Thematic Priority 6.3 Global Change and Ecosystems (Contract number GOCE-CT-2007-036877). The MICRODIS project acknowledges, “efforts to reduce disaster risks must be systematically integrated into policies, plans and programmes for sustainable development and poverty reduction”, and the project has **the overall** goal of strengthening preparedness, mitigation, and prevention strategies to reduce the health, social, and economic impacts of extreme events on communities.

**The broad objectives** of the MICRODIS project are as follows:

- To strengthen the scientific and empirical foundation of the relationship between extreme events and their health, social, and economic impacts
- To develop and integrate concepts, method, tools, and databases towards a common global approach
- To improve human resources and coping capacity in Asia and Europe through training and knowledge sharing

For example, the MICRODIS project has, among other aims, specifically targeted developing an integrated impact methodology, establishing an evidence base of primary field research through surveys, and increasing coverage accuracy and resolution of global disaster data.

#### 3.2. The MICRODIS Consortium

The MICRODIS consortium consists of 19 leading academic and policy expert institutions from across Europe and Asia that are specialized in key areas of disaster-related health and social science disciplines. Although Europe hosts a number of large and reputable institutes of earth science, partners for MICRODIS (see Table 1) have been drawn almost exclusively from disaster-relevant health, social, and economic disciplines to ensure tight adherence with the project specifications. MICRODIS partners were selected based on their experience and broad range of scientific and technical skills necessary to fulfil the objectives of the MICRODIS project. The MICRODIS consortium represents the full spectrum of experts (from those involved at the community through the global policy levels) in the following key disciplines:

- **Health:** This area includes specialists in epidemiology and disaster health management, tropical health and hygiene, public health researchers, health system analysts, trainers, and policy experts.
- **Social:** Specialists with insight into the social impacts of disasters have been drawn from the fields of sociology, social and medical anthropology, and development and gender studies. In addition, experts in environmental and earth sciences strengthen the MICRODIS multi-faceted framework.
- **Economics:** These partners were selected for their expertise in development economics, environmental and resource economics, international trade and regional economics, and representation from organizations such as the Asian Development Bank, the World Bank, various academic institutions, and a private consultancy company. All have contributed to disaster impact studies at the micro- and macroeconomic levels.

- **Integration:** The consortium has both specialists in integrated models for disasters who research the concepts of vulnerability across sectors and themes. In addition, there are specialists in more than one thematic area, such as social and economics, health and economics, and social and health. This latter attribute has strengthened substantially the ability of this consortium to generate interdisciplinary models that are credible in all individual disciplines.
- **International policy:** In addition to the existing overlapping expertise of many of the partners, some consortium members were engaged for their particular relevance to disaster-related international policy and cross-sector integration.

While the consortium partners have been clustered into broad thematic areas, it should be noted that in many cases, the individual organizations and experts also represent multidisciplinary skill-sets and capacities. In this way, the consortium has drawn together the very best of specialized knowledge to facilitate a new level of integration and synergy across the health, social, and economic sectors to achieve the MICRODIS objectives.

**Table 1. MICRODIS consortium partners**

<b>Country/Name of Institution</b> • <b>Participation/survey site</b> • <b>Expertise</b>	<b>Name of Principal Investigator</b>
Université catholique de Louvain (Belgium) • Project Coordinator, participation in the three Orissa studies, Morpeth main and annex studies, Tewkesbury, Bahraich annex study, China, and technical support to other sites. • Health; disaster epidemiology, project coordination	Prof. Debarati Guha-Sapir
Università degli Studi di Firenze • L'Aquila • Health; human impact due to earthquake	Prof. David Alexander
SWECO Grøner • Participated in the development of the MICRODIS Health Economic Questionnaire and Hue and Italy studies • Environmental economics	Dr. Stale Navrud
University Hospital Heidelberg • Participated in the MICRODIS main study in Jagatsinghpur (Orissa) • Health; also Health Working Group Leader	Dr. Michael Marx
HealthNet TPO • Participated in the MICRODIS main study in Morpeth • Social	Dr. Ivan Komproe
Jadavpur University • West Bengal • Economics	Prof. Tuhin Das
Työterveyslaitos Finnish Institute of Occupational Health • MICRODIS annex study • Occupational health	Dr. Kai Salvolainen
University of Indonesia • Bojonegoro • Health	Dr. Mondastri Korib Sudaryo
University of Delhi • Bahraich • Social; also Asian Coordinator	Dr. P.C. Joshi
Voluntary Health Association of India • Jagatsinghpur (Orissa) • Health	Dr. Alok Mukhopadhyay and Mr. Shisir Ranjan Dash
Hanoi School of Public Health • Hanoi • Health	Dr. La Ngoc Quang
Hue College of Economics, University of Hue • Quang Nam • Economics	Dr. Tuan Tran

Country/Name of Institution • Participation/survey site • Expertise	Name of Principal Investigator
United Nations Office for the Coordination of Humanitarian Affairs • Dissemination and awareness • Disaster research and policy	Dr. Helen Molen-Valdez
Xavier University • Southern Leyte • Social and Health	Dr. Sharon Linog
Citizens' Disaster Response Center • Albay • Social	Mrs. Lourdes Louella Escandor
Northumbria University • Tewkesbury/Morpeth • Social; also European Coordinator	Dr. Maureen Fordham
University of Greenwich ( <i>in project until Month 21</i> ) • Development of conceptual models • Social and integration	Dr. Terry Cannon
EVAPLAN ( <i>in project until Month 12</i> ) • Development of health conceptual model and literature review • Health	Dr. Michael Marx
Ferurbat SARL • Development of economic conceptual model • Economics	Prof. Guy Chemla

### 3.3. Regions and Disasters of Focus

The two regions that form the focus of the MICRODIS project are (1) the European Union–associated countries (Belgium, France, Finland, Germany, the Netherlands, Norway, the United Kingdom, and Italy) and (2) South and Southeast Asia regions (India, Indonesia, China, the Philippines, and Vietnam). These regions were selected based on their high frequency of extreme events and the impact on affected communities.

There are 12 broad and 23 subgroups of distinct extreme events, ranging from chronic, slow-onset phenomena to acute, rapid-onset events. The health and socioeconomic impact implications differ enormously among these 23 types and addressing all of these would compromise the quality and applicability of the project results, risking over-generalization. In both Asia and the European Union, three types of extreme events—floods, earthquakes, and windstorms—account for almost 75% of the occurrence of all extreme events. The MICRODIS project has concentrated on these three phenomena.

## 4. OVERVIEW OF MAIN STUDY PROJECT SITES

### 4.1. Asia

Asia, the largest and most populous continent where most developing countries are located, has been worst hit by natural disasters. The World Disasters Report, 2006, stated that between 1996 and 2005, Asia as a continent reported the highest number (2,660 of total 6,417) of disasters in the world. The same report described that globally, over 250 million people were affected annually during this period and almost 90% of them were in Asia. Flood is the most common natural disaster worldwide; of the 235 natural disasters reported in 2006, more than half were floods. Between 1990 and 2007, a total of 2,274 flood events were reported, and many of them (896) occurred in Asia.

#### 4.1.1. Albay, the Philippines, Typhoon

Albay province, located in the Bicol Region in the southern part of Luzon (one of the three island groups in the Philippines), is one of the most typhoon-prone provinces in the Philippines. The area is located on the typhoon belt and experiences an average of two major destructive typhoons per year. In November 2006, Albay was one of the areas hardest hit by Typhoon Reming (international name: Dorian). The typhoon brought 466 mm of rainfall, the highest in 40 years. A number of communities in Albay were immediately buried under tons of rocks and mud that rushed down from the slopes of the Mayon Volcano during the typhoon.

The MICRODIS survey was conducted in the municipality of Polangui and the city of Legazpi in Albay. Eight villages were identified from the sampling. There were 400 household interviews (50 for each barangay, or village) conducted for the quantitative component, and four focus group discussions and 12 in-depth interviews for the qualitative part.

#### **4.1.2. Bojonegoro, Indonesia, Flood**

One important determinant of the 2007 flood event in Bojonegoro that was the focus of the MICRODIS survey was the great river Bengawan Solo, the longest river in Java Island, flowing across Central Java and East Java provinces. The Bojonegoro district was the worst flood-affected area with more than half of the regency inundated with flood waters about 3 m deep within the 16 subdistricts. The flooding caused 30 deaths, affected 24,573 houses, and displaced at least 229,000 people.

The Bojonegoro districts consist of 435 villages, among which 167 villages were flooded during the December 2007 event. A total of 25 was randomly selected for each group with 245 and 244 respondents representing 1016 and 1021 of household members in the flooded and non-flooded populations, respectively.

#### **4.1.3. Southern Leyte, the Philippines, Flood/Windstorm**

Southern Leyte is a province located in Eastern Visayas, the Philippines, consisting of 19 municipalities (502 barangays). The province is classified by the Mines and Geosciences Bureau as one of the 10 areas in the Philippines that is prone to landslides. The MICRODIS survey was carried out in the municipalities of Hinunangan and St. Bernard. Hinunangan, a fourth-class municipality, is subdivided into 40 barangays and had a total population of 27,712 persons in 2007. The municipality experienced an earthquake in 2007 with a magnitude 6.0 on the Richter scale that did considerable damage to both public and private infrastructure. A landslide triggered by two weeks of heavy rainfall occurred in Guinsaugon, St. Bernard, destroying properties and leaving hundreds dead/missing.

From each municipality, four barangays were selected, two of which were least affected and another two that were most affected by natural disasters. The general objective of the study was to uncover the effects of and the coping mechanism for disasters at the household and the individual levels. A total of 500 households participated in the study.

#### **4.1.4. Hanoi, Vietnam, Flood**

In the last days of October and the first week of November 2008, heavy, intense rains in Hanoi resulted in a historic flood, the biggest flood in Hanoi since 1973. According to a primary evaluation of the heavy rains and 10 days of flooding, 22 people died, three were injured, and many assets at 90 flooded points in street routes and residential areas were damaged. To ascertain the flood vulnerability, health risks, and social and economic impacts of the historic flood, a MICRODIS cross-sectional study was conducted through household surveys of 440 rural and 500 urban households, total, in flood-affected and unaffected districts.

#### **4.1.5. Quang Nam, Vietnam, Flood**

Located in the heart of Vietnam, about 865 km south of the country's capital of Hanoi, Quang Nam is one of the most flood-prone provinces in Vietnam. Recent evidence has indicated an increased frequency and intensity of floods that caused severe impacts on a diverse set of biological, physical, and economic systems in Quang Nam. In 2007, nine extreme floods hit this province from October 1 to December 7. The death toll was 67, and the injury count was 339 people with total damage costs in VND of 2000 billion (almost 103 million US\$).

Various research methods were used to collect and analyze data from the provincial to household levels. The survey covered 767 households selected in 25 flooded villages (575 households), and 8 less-flooded villages (192 households).

#### **4.1.6. Orissa, India, Flood**

India is among the world's most disaster-prone areas. It is vulnerable to wind storms, earthquakes, floods, droughts, and tsunamis. These hazards threaten millions of lives and cause large-scale losses that hinder India's development. Orissa is one of the poorest states situated on the east coast. The Voluntary Health Association of India (VHA) selected Jagatsinghpur district in Orissa as one of the survey sites under the MICRODIS Project. The September 2008 flood in Orissa was the result of heavy rainfall in the upper as well as lower catchments of the Mahanadi River system, resulting from the effect of a deep tropical depression in the Bay of Bengal. The magnitude and severity of this flood surpassed even the ferocities of both the 1982 and 2001 floods, previously known to be the greatest floods in the system, and caused massive and unprecedented damage. The MICRODIS study to examine health, social, and economic impacts of this flood was done from November 2008 to January 2009.



• Professor P.C. Joshi gives the opening speech at the MICRODIS Second Annual Meeting in Delhi, India in February 2008.

The study covered 757 respondents from the flood-exposed population and 816 from the unexposed population. Because of the focus on child nutrition in this study, anthropometric measurements also were performed on members of respondent families who were under age five years.

#### 4.1.7. Bahraich, India, Flood

This study was undertaken in Bahraich district of Uttar Pradesh, India, immediately after the September floods of 2008 in Bahraich. The study compared the four worst flood-affected areas of Block Fakharpur with the adjacent unaffected areas to understand the social impact of floods. The study design was case-control and the two-stage sampling followed a simple random sampling method. The study used the pre-tested MICRODIS questionnaire and focus group discussion methods for data collection.

Ultimately, the survey targeted a total of 660 households, and six focus group discussions were held. Further, interviews were conducted with key informants, and participatory rural appraisal activities were held.

#### 4.1.8. West Bengal, India, Floods

Floods regularly affect vulnerable districts in West Bengal. The most susceptible of these, Medinipur in West Bengal, was selected on the basis of a vulnerability index. Medinipur district is divided into two parts: Purba Medinipur and Paschim Medinipur. Paschim Medinipur was selected for the West Bengal study as a severely and regularly flood-affected district, in which the Ghatal Subdivision is a severely affected subdivision. This block within the district lies near a confluence of rivers.

Both qualitative and quantitative data were collected. Focus groups consisted of a small number of carefully selected people brought together on a common platform, divided between male and female members. For the qualitative portion, a total of 525 households was surveyed, and 443 households provided a complete response for a response rate of about 84.4%.

### 4.2. Europe

The natural disaster impact-monitoring climate in Europe is particularly weak. According to the European Commission, more evidence is needed about the impact of floods on public health. In Europe, the health care systems in general have a higher standard compared to developing countries, even though there are differences among the Member States.

Floods are the most common disaster worldwide and in Europe and therefore a focus of research and decision makers, but the effort has been targeted more to early warning, physical impact, risk analysis, and infrastructure and population vulnerability and not so much on the health impact. The reason may be the generally high health status in Europe, the smoothly functioning first-aid assistance efforts in the case of a disaster, and a different level of problems in Europe than in less-developed countries.

Thus, in Europe, other flood-related health effects come to the fore and have a longer-term orientation, including chronic disease or mental health issues. Monitoring such effects and especially linking them to specific flood events is more difficult than establishing associations with short-term effects, such as injuries or an increase in waterborne disease.

#### 4.2.1. Tewkesbury, UK, Flood

Tewkesbury in Gloucestershire is part of the Severn River Basin District, the third largest in England and Wales with an area of 21,590 km. Situated at the confluence of the rivers Avon and Severn, the town has always been prone to fluvial flooding. On July 20, 2007, it received 80–90 mm of rainfall within two days, equal to two months of rain and leading to severe floods in the area. A MICRODIS UK research team, comprising staff and student members from the University of Northumbria, Université catholique de Louvain, and HealthNet TPO, visited Tewkesbury in January 2009 to conduct a survey to assess the social, health, and economic impacts of this flood.

Ultimately, because of a low response rate, 136 flooded households and 76 non-flooded households completed the questionnaires among an overall sample number of 503. The team also engaged in intensive qualitative investigations through informal interactions and two in-depth interviews with spouses in the household.

#### 4.2.2. Morpeth, UK, Flood

The MICRODIS Morpeth survey was the second main survey carried out in the UK. The survey measured the social, health, and economic impacts of a large September 2008 flood in Morpeth and focused particularly on the role of social capital in disaster preparedness, response, and recovery, and the mental health impacts of the flood. A census of around 950 affected households was carried out and a total of 236 interviews completed. In addition to the quantitative survey, the UK MICRODIS team (in collaboration with the Université catholique de Louvain, HealthNet TPO, and Northumbria University postgraduate students) implemented qualitative work within the community, community engagement activities, and several annex studies.

#### 4.2.3. L'Aquila, Italy, Earthquake

On 6 April 2009 a seismic event of magnitude 6.3 struck the province of L'Aquila. Università degli Studi di Firenze (UNIFI) was the lead partner, with collaboration from University of L'Aquila and Marche Polytechnic University at Ancona. The main object of the study was to evaluate the social impact of the disaster on the population of Abruzzo Region in terms of their welfare over the immediate, short and medium terms. The event was evaluated in terms of mortality and morbidity, analysing the causes of death and injury in relation to the demographic characteristics of the people involved and possible correlations with the performance of the specific buildings in which they resided, the emergency response, early and mid-term recovery phases of the disaster. Various quality of life indicators of different affected and displaced populations comprised a major focus of the research.

## 5. MICRODIS FROM THE BEGINNING

### 5.1. The MICRODIS Project: Year One

The first 12 months of the MICRODIS project encapsulated many fundamental objectives. There were no major deviations from the planned work, and minor disruptions that occurred were dealt with quickly without significant effects to progress.

The earliest achievement of the project was planning/holding the MICRODIS kickoff meeting in Brussels, Belgium. In the context of this meeting, each thematic working group held its own workshop session and produced a report based on the session. The MICRODIS flyer was distributed, and partners collaborated to translate the project flyer into five languages.

During the kickoff meeting, each thematic group agreed on available dates for their additional thematic workshop session. Some groups were quicker than others to organize these meetings, due to the availability of group members and venues. The Integration Working Group held their first of three workshop sessions of this reporting period June 19–20, 2007, in Paris, France.

Shortly following this, the Health Working Group had their thematic workshop session August 30–September 1, 2007, in Hanoi, Vietnam. The Social Working Group held their workshop session in Newcastle, UK, September 3–7, 2007. This meeting coincided with the “Dealing with Disasters” conference, which the partners also attended. The Economic Working Group was the final group to hold their thematic workshop session, in Kolkata, India, November 1–4, 2007. Members of the Integration Working Group were present at all thematic workshop sessions.

The Integration Working Group, the leaders of each thematic working group, and the Asian Coordinator met in Potsdam, Germany, October 4–7, 2007, while attending the “SHIFT – 07: Shift in Thinking Perspectives of Vulnerability and Hazard Assessment” conference hosted by the Potsdam Institute for Climate Impact Research. An integrated model for the surveys was developed called the “SHE Model”.



• Economic Working Group members from HCE and SWECO discuss the revision of the assessment protocol at the MMW.

A similar meeting took place at the end of November in London between the Integration Working Group and the leaders of each thematic group on November 27–28, 2007, on the campus of the University of Greenwich. At this meeting, methodologies were suggested for consideration in the surveys as well as extensive discussions about the integrated format of surveys and conceptual models.

Informed by literature reviews and relevant discussions among consortium members, conceptual models were drafted for each of the social, health, and economic thematic working groups. These conceptual models were continually revised and reworked in efforts to aid the Integration Working Group in developing a combined integrated conceptual model.

## 5.2. The MICRODIS Project: Year Two

The second year of the MICRODIS Project put many of the conceptual tools developed in the first year into practical application. The year commenced with the First Annual Meeting in Delhi, India, February 17–19, 2008. This event included important discussions about the achievements and challenges for each partner in the first year, along with planning for the upcoming project field work.

During the Annual Meeting, each Country Team presented 2–3 suggested survey sites in their countries for consideration of the thematic groups. These presentations included a contextual report on the area, disaster profile for the site, and its overall relevance to the thematic areas and objectives of the project. Afterwards, thematic groups met to vote on the sites that they saw as most relevant to their discipline and research focus. These votes were presented and discussed in the plenary and finalized in the months to follow by the Country Teams.

The Consortium then began the preparations for their empirical studies, which included finalizing the tools and methods for each survey site. The Health, Social, and Economic Working Groups worked diligently and meticulously to develop two questionnaires for the use of the project. First, each group came up with an exhaustive questionnaire tool that would assess the impacts for their given group in situations of floods, earthquakes, and windstorms.

The first order of business was selecting the main questions out of this large document to create a thematic core questionnaire for each Working Group. Intensive discussions and revisions were made by each group to develop these tools. Simultaneously, the Integration Working Group was developing the MICRODIS core questionnaire, which would include the consent form and demographic and general information that each group would need to know about its respondents. The MICRODIS core was then combined with each of the thematic cores to be used in every MICRODIS household survey. Thus, the MICRODIS integrated protocol was developed as a foundational document for each Country Team to then be adapted to their cultural- and research-specific contexts.

Following completion of the MICRODIS and thematic cores, the remainder of the original expansive questionnaire document was revised to produce a secondary tool: the Thematic Extended Questionnaires, helpful tools for Country Teams to use when going into more detail about a specific area of focus for their research (e.g., nutrition or migration).

Based on their sites, the Country Teams each developed a survey design and sampling calculation. This included information on the site, areas of research focus, number of households to be interviewed, how many focus group discussions and key informant interviews would take place, survey budget, training of interviewers and data entry staff, planning the pilot study, and the adaptation of the questionnaires. Each

Country Team was responsible for adapting the integrated field protocol and their chosen extended questions for their specific site, which were then translated and back-translated to ensure the significance of the wording in the questions was not lost or ambiguous. Country Teams also submitted contextual information on their sites, which was combined to produce the Contextual Report of the MICRODIS sites.

In the second year, successful and efficient field studies with the MICRODIS questionnaire tools were completed in Bahraich and Orissa, India (University of Delhi and VHAJ, respectively); Tewkesbury, United Kingdom (University of Northumbria); Bojonegoro, Indonesia (University of Indonesia); and Albay and Southern Leyte, the Philippines (Citizens' Disaster Response Center and Xavier University, respectively). Various revisions of the tools were the result of a collaborative effort of both the Country Teams and the consortium thematic experts.

Along with the field-work preparations, other achievements were recorded for year two. A Review Report on existing disaster-related university courses was created. The literature review from the Economic Working Group and the revised literature review from the Health Working Group were also completed. A new version of the MICRODIS website was created, with a public and a private domain ([www.microdis-eu.be](http://www.microdis-eu.be)). The public site gives information about the project, progress in each year, partner information (including maps where partners can be located), project flyers (in five languages), PowerPoint presentations, and contact information for the coordination team. A new portion on survey information was added with the contextual information for each site, timelines for work done by each team, and a map to locate each survey. The Secure Network Zone is a place for partners to access and distribute documents, information on courses and conferences, and details on meetings and other relevant events in the project.

MICRODIS partners attended many conferences and training events in the second year. These included the COP14 United Nations Climate Change Conference in December 2008, where two members of the consortium presented the MICRODIS project at a European Commission side event on current research on the Health Impacts of Climate Change.

### 5.3. The MICRODIS Project: Year Three

The third year of MICRODIS was an exciting time, as the results from surveys were starting to materialize from six completed and three remaining main studies, and smaller annex studies were also successfully completed.



• MICRODIS family during the Multi-Meeting Workshop in Depok, Indonesia in October 2009.

To start the year, partners came together for the Second Annual Meeting in Brussels, Belgium, on February 25–27, 2009. Survey site posters and field work experiences were shared among consortium members and invited guests from other integrated research projects and related research fields. Three main studies and three annex studies were conducted in the course of the third year. MICRODIS integrated questionnaires were administered and qualitative research was done for main studies in Morpeth, UK, and Hanoi and Quang Nam, Vietnam. In addition to these main studies, smaller and more focused annex studies took place in India, the UK, and Vietnam. Studies in India focused on the nutrition of children under five after floods in Bahraich and Orissa, respectively. Hue College of Economics performed the first annex study dedicated to economic impacts after floods in their research in Quang Nam. These annex studies had focused questionnaires along with key informant interviews and focus group discussions.

Starting from the beginning of the third year, the consortium addressed technical issues about database management, led by the coordination team at the Université catholique de Louvain. The enormous task of creating a common codebook and data shell from all of the adapted protocols was achieved, with substantial efforts from each cooperating survey partner, in the attempt to standardize data and coding across all sites. The intensive task of cleaning, validating, and then later recoding the data was successfully completed by eight survey teams in December 2009.

After the consortium members had started the analysis on the data, together or with other partners, ideas and results for publications began to surface rapidly. Ten working scientific papers were produced and prepared for submission for publication to high-impact journals. These include health, social, and integrated impacts of disasters based on MICRODIS survey data.

The Citizen's Disaster Response Center led the charge on promotional materials created for the project with several eye-catching products such as a calendar, a Southeast Asian DVD documentary, and disaster-preparedness day planner. Years two and three field site posters were produced and displayed at various events. The project website underwent a complete reconstruction with migration to another content management system that was easier to use and provided more aesthetic benefits.

#### **5.4. The MICRODIS Project: Year Four**

The fourth year of the MICRODIS project has seen the completion of two main studies and several annex studies, with the production of this final report summarizing the findings. Partners completed designs, protocols, survey reports, preliminary analysis and submitted cleaned and validated datasets for each study completed. These and other partners focused more intensely on the analysis of data from these and previous studies done in the duration of the project to produce scientific papers and reports. These articles are being submitted to high-impact peer review journals.

Statistical briefs along with attractive one page briefs for each site have been developed and disseminated on the website and other important events. A more detailed policy brief per survey country has also been completed, along with a combined literature review on social, health and economic impacts of disasters. Another important publication was titled "Public Health and Floods in Europe", done by Université catholique de Louvain and University Hospital Heidelberg, providing descriptive analysis and mapping of various health impacts of floods across Europe and specific MICRODIS European countries. Disasters were geo-referenced from the EM-DAT data, and maps were produced on each MICRODIS country to represent impact over the period of 2000-2009. Several other promotional materials were produced, including multiple documentaries from the University of Delhi, a special issue of Health for the Millions journal by Voluntary Health Association of India and both a children's activity book and a new desktop calendar from Citizen's Disaster Response Center.

Two very important regional symposiums took place in the fourth year that provided massive publicity and knowledge sharing for the MICRODIS consortium and disaster research community. The first was organised by Hue College of Economics, University of Delhi and Université catholique de Louvain in Hue, Vietnam on August 25-27, 2010. Over eighty participants attended this event, spanning across 13 different countries. Important issues of disaster impact and assessment in Asia were discussed at this successful event, which hosted both MICRODIS and many other non-MICRODIS participants who have done research or policy work in Asia. On September 9-10, 2010, Northumbria University hosted the European Symposium on Integration Strategies for Extreme Events, in Newcastle upon Tyne, UK. In this meeting, a group comprising a mix of MICRODIS European partners and other invited delegates took the opportunity to deliberate the current state of integration in extreme-event research and practice and to make suggestions for its future development. Both of these regional events created strong networks for the consortium that will live on after the lifetime of the project and hopefully lead to even more interesting research and findings on disasters in Asia and Europe.

In addition to these two important events, partners also shared their results and knowledge at a number of different international conferences and visiting lectures. This includes national workshops organised in Indonesia, the Philippines, Germany and India; and local awareness events in all MICRODIS survey countries. Opportunities were provided for young staff and graduate students in order to build their capacity and encourage them to undertake further research in the area of disasters and human impacts. Another successful Assessing Public Health in Emergency Situations (APHES) course was hosted by Université catholique de Louvain and attended by 6 different MICRODIS partners. A final Steering Committee meeting was held on December 3-4, 2010, to bring partners together to discuss the next steps for project outputs and continued collaboration beyond MICRODIS.

After four challenging but incredibly productive years, MICRODIS partners have become a research family committed to addressing human impacts of these extreme events which affect so many people across Asia and Europe. The strong partnerships created throughout the project will last a very long time, with the experiences and lessons learned only to be further built upon by the entire consortium. Continued analysis, knowledge-sharing and dissemination of the data and narratives collected in each MICRODIS site will continue in efforts to promote our original objective to strengthen preparedness, mitigation, and prevention strategies to reduce the health, social, and economic impacts of extreme events on communities.

### 5.5. Overview of the Report

Part II of this final report provides a summary of each of the main MICRODIS surveys with background, methods, results, and conclusions. Part III is a series of interviews with the MICRODIS partners in which they provide their insights into the conduct of the studies, development and application of the questionnaire, and future plans in the context of the MICRODIS experience. The annex studies are summarized in Part IV, while Part V offers a summary of relevant disaster-related studies ongoing in Europe.

## 6. CONCLUSIONS

Critical to effective response and recovery in the post-disaster phase, scrupulous studies in the area of disasters have become an urgent need. Asia remains a focus because it lies in an extremely hazardous zone. According to EM-DAT, between 2000 and 2009, 85% of fatalities due to disasters occurred in Asia. In the year 2009, Asia accounted for 69% of disaster deaths as well as six of the top ten disasters in the world. Disasters in Asia have severely affected local capacities, requiring multi-pronged actions for prevention, mitigation, assessment, and management in an enabling environment, with the goal of sustainability. Disasters in Europe, on the other hand, have more subtle, long-term effects that also require a multi-dimensional approach to understanding. The multi-dimensional nature of disaster impact requires multi-disciplinary and multinational cooperation, a primary goal of the MICRODIS Project.

As an example of an endeavour seeking to take an integrated approach to problem-solving research, the ongoing MICRODIS project has drawn on a range of disciplinary backgrounds (including sociology, epidemiology, anthropology, psychology, geography, environmental management, and development studies) and from experts representing various European and Asian countries. The project has focused on the micro (individual/community) level of disaster impacts but also on the wider social and political context. The project's overall goal has been to strengthen preparedness, mitigation, and prevention strategies to reduce the health, social, and economic impacts of extreme events (floods, storms, and earthquakes). The aims of the project have included developing an integrated impact methodology and establishing an evidence base of primary field research through quantitative surveys, various qualitative methods, and community engagement activities. Based on the findings in this report, this evidence base now exists and is available as a source and a springboard for further in-depth studies.

A key methodological challenge to the concept of integrated research is reconciling the perceived differences between quantitative and qualitative research methods and epistemologies. For example, with regard to the MICRODIS project, while many health and economic impacts may be placed in a quantitative framework, social impacts are much more difficult to define in a manner that promotes quantification. Aspects of conceptualizing the MICRODIS research are also challenging because of differing perspectives among multiple disciplines and practices. The consortium members of the MICRODIS project overcame these challenges, integrating qualitative and quantitative research and revealing and incorporating multicultural and multidisciplinary perspectives into the findings. Thanks to their patience, diligence, and hard work, the results of the MICRODIS studies are integrated and multidisciplinary, with a framework that can serve as a guide for future investigators.

For more information see the MICRODIS website at <http://www.microdis-eu.be/>.





**MICRODIS**



## PART 2

### **MICRODIS MAIN SURVEYS : DISASTER CONTEXT, EXPERIENCES AND ANALYSES**



This part presents summary reports for each of the main MICRODIS study sites including study context, disaster background, the disaster of focus, the methods, the qualitative and quantitative findings, and conclusions.

## 1. ALBAY, THE PHILIPPINES, TYPHOON

### 1.1. Introduction

#### 1.1.1. Context

The province of Albay is one of two MICRODIS main survey sites in the Philippines. It lies in the Bicol region in Luzon, and its capital is Legazpi City (Figure 1.1). The best-known feature of Albay is the Mayon Volcano, which lies 15 km north of Legazpi. The province consists of 15 municipalities, 3 cities, and 720 barangays, or villages.

Albay covers a total land area of 2552.6 km<sup>2</sup> and is the 26<sup>th</sup> smallest province in the country, although in terms of population, it is the second most populated province in the Bicol Region. Most of it lies on a mainland peninsula, but there also are four major islands that lie east of the mainland that belong to the province. The topography is mountainous with fertile plains and valleys, and 40% of the land area is flat. The province is primarily agricultural, and 61% is devoted to crops. Another 19% is forest. Erosion is present in about 42% of the land area, with 7% experiencing severe erosion, specifically where logging and slash-and-burn farming are done. Surface water drains through five major rivers, and one third of Lake Bato lies within its jurisdiction.

The provincial population was 1,090,907 as of the 2000 census, much of it concentrated in Legazpi City, Tabaco City, and Daraga. The main industry of agriculture primarily involves coconut, rice, sugar, and abaca, and rice makes up almost half of the province's agricultural production. Of the 215,216 families in Albay, 72% earn below the provincial average family income.

In terms of health, there are nine government hospitals, 27 private facilities, 15 rural health units, and 194 village health stations. There is one doctor for every 31,200 people, one nurse per 22,700, and one midwife per every 6300 persons. A total of 87.9% of households have access to potable water, while 54% have access to sanitary toilet facilities. Infant mortality rate is 11.9 per 1000 live births.

#### 1.1.2. Disaster Background

Albay has three types of climate. The eastern areas experience no dry season with a very pronounced maximum rain period from December to January, the western areas have more or less heavily distributed rainfall throughout the year, and the central areas have no pronounced maximum rain period with a short dry season from November to January. The province experiences a yearly average of 20 typhoons ranging from 60–180 kph. Average rainfall is 233 mm with a low of 130 mm in April and a high of 389 mm during December.



• Figure 1.1.  
Location of Albay.



• Houses partially covered by mud and ash flows during Typhoon Reming.

Source:  
Philippine Coast Guard.

As the annual average number of typhoons indicates, Albay is one of the most typhoon-prone provinces in the Philippines. Located on the typhoon belt, the province experiences about two major destructive typhoons per year.

### 1.1.3. The Disaster in Focus

In November 2006, Albay was one of the areas hardest hit by Typhoon Reming (international name: Dorian). Reming was one of the most deadly and destructive tropical cyclones to ravage the Philippines in recent years. The typhoon brought 466 mm of rainfall, the highest in 40 years. A number of communities in Albay were immediately buried under tons of rocks and mud that rushed down from Mayon Volcano's slopes during the typhoon. Furthermore, more recently, back-to-back super typhoons battered the Bicol Region once again, typhoons Lando (Hagibis) and Mina (Mitag). Both typhoons caused flash floods and landslides and affected almost 70,000 families.

## 1.2. Methods

### 1.2.1. Project Preliminaries

The CDRC opened up the project by making courtesy calls to local government officials and the provincial governor while also gathering preliminary data during a pre-survey site visit that involved profiling each municipality. The courtesy calls resulted in approval and support from local officers for the survey and a commitment from local executives to back the project to village-level officials. These initial visits were followed up by visits from the local partner organization and the regional centre of the CDRC, Tarabang Para sa Bicol (TABI) at the village level. TABI also arranged for accommodations for the enumerators who would be conducting the survey, and most village officials offered their barangay, or village, halls for free. This exchange of courtesy and the courtesy calls were integral to the project.

### 1.2.2. The Study Design

The Citizens' Disaster Response Center (CDRC) conducted the MICRODIS field operations in Albay province from September 2008 to February 2009. The two specific survey sites within the province were the municipality of Polangui (Figure 1.2) and Legazpi City (Figure 1.3).

The study was a combination of quantitative and qualitative research. There were 400 household interviews (50 for each barangay) conducted for the quantitative component and four focus group discussions and 12 in-depth interviews for the qualitative part.

For the quantitative portion, an interview schedule was constructed with three major components/topics: social, economic, and health, the MICRODIS integrated questionnaire. Four hundred households were interviewed during the survey in Albay, from December 1–22, 2008.

• Figure 1.2. Location of Polangui.

• Figure 1.3. Location of Legazpi City.



#### 1.2.2.1. Site selection and sampling

Albay province was chosen based on data obtained from the National Disaster Coordinating Council (NDCC). The data from the NDCC indicated that all of the municipalities in the province were declared under state of calamity due to destructive typhoons in 2006 and 2007. The household selection procedure followed a multi-stage cluster design. The first stage was the selection of two municipalities by probability proportional to the size of barangays (barangays as a measure of size). As noted, Legazpi City and Polangui were chosen for Albay province.

The second stage of selection began with the construction of a frame for affected and least-affected barangays. The categorization of gravity of disaster loss (affected and least affected) was based on the assessment of the NDCC and the Mines and Geosciences Bureau (MGB) of the Department of

Environment and Natural Resources Rapid Geohazard Assessment. Two frames were evolved, affected barangays and least-affected barangays, and from each frame, two barangays were selected. Eight villages were identified from the sampling. In Polangui, the most-affected sites were barangays Kinale and Balangibang and the least-affected were barangays Maysua and Napo. In Legazpi, the most affected were barangays Bonga and Matanag, and the least affected were barangays Cabangan and San Francisco.



● Pretest of questionnaires in Caloocan City.

At the outset, this study had established that the sample size needed to be 400 households to give a 5% level of accuracy on estimates derived and a 95% confidence level. The determination of the sample size was accomplished using the Cochran formula. Fifty sample households were selected by systematic sampling from each of the barangays.

#### 1.2.2.2. The survey

The household interview consisted of four modules, the core, social, health, and economic modules of the MICRODIS integrated questionnaire. The questions were grouped into blocks of topics. As noted, the team also held focus group discussions and key informant interviews to gain some qualitative insight into the effects of disaster on the population.

The initial survey questionnaire, developed together with Xavier University, was adapted to the local context and extended to include questions on reproductive health as a focus. In October, the questionnaire was translated from English to Filipino and then pre-tested in a flood-prone community in Dagat-dagatan, Caloocan City. There were 10 respondents, and problems that surfaced during this pre-test were then evaluated and addressed. These issues included some question repetitiveness in the social core questions and the need for the enumerators to have to switch to the second person and rephrase some questions for clarity. Enumerators also felt some hesitation about asking some of the health core questions, such as those related to vaginal discharge, and in the economic core, respondents had difficulty providing estimates for some items, such as repair costs or monthly income. Questionnaire revisions addressed these issues.

The team decided to use seasoned researchers from Xavier University as its field enumerators. The group received training at Xavier in November, which included a standardized interpretation of the instruments and efforts to ensure a uniform understanding of the data entry procedures and guidelines. Enumerators also learned the study design and objectives and reviewed the questionnaire line by line. On the third day,



● Training enumerators at Xavier University.

they deployed to field test the questionnaire in communities surrounding Cagayan de Oro City, where the training took place. This practice session led to identification of several issues to smooth out and gave the enumerators good practice.

On December 1, 2008, seven seasoned enumerators from Xavier University, plus the CDRC field coordinator and the TABI local coordinator, arrived in Barangay Maysua, Polangui, Albay. As standard operating procedure, a courtesy call with the village chief was the first thing that the team did upon arrival. The team introduced themselves to the Barangay Council and explained the purpose of the research and in response received invitations to accept housing in the barangay halls during the survey. The team also asked for the household list from the Barangay Secretary for the sampling of the household respondents. Polangui was surveyed first, followed by Legazpi City.

### 1.3. Results

The surveying occupied the first three weeks of December 2008, covering the municipality of Polangui, Legazpi City, eight villages, 400 qualitative respondents (50 per barangay), 12 in-depth interviews, and four focus group discussions in the barangays that were most affected. Focus group discussions involved participants from the health, women, and youth sectors. After a slow start with an average of two interviews a day, enumerators hit their stride and achieved three to four interviews daily. The final village, Barangay Cabangan, was surveyed from December 18 to 21. The enumerators met immediately afterward for final editing of the questionnaires, and all surveys were taken to Xavier University for data processing.

Thanks to the rapport-building efforts, the survey process went very smoothly and on schedule. More respondents were female (75.8%), possibly because the men were often working the farms during the day. Most interviewees were in the 30–39 age bracket (28%) and the 40–49 age bracket (22.8%), and 80.5% were married.

#### 1.3.1. Qualitative Findings

What surfaced from the focus group discussions and key informant interviews was that the perception of the underlying causes of typhoons, floods, and volcanic eruptions can be clustered into two categories. On the one hand, there were the opinions reflecting naturalistic knowledge; on the other hand, there were views resonating with a more religious outlook. The former pointed to global warming, the geographical location of Albay province, denudation of forests, and aggravation of water and land pollution, among other determinants; the latter ascribed the occurrence of disasters as being a punishment from God.



• Group photo of the hard working CDRC survey team in Albay, Philippines

Residents of Albay who were affected by disasters revealed through the focus group discussions and key informant interviews that intervention assistance chiefly came from local government units (LGUs) and from non-governmental organizations (NGOs) like the Red Cross, churches, and their religious organizations and welfare arms of the big media industry (national television networks like ABS-CBN and GMA). In the province, the LGUs were relatively more active and visible when compared with the NGOs. The provincial governor, town mayor, and village (barangay) chairpersons also played relevant roles. Relief interventions from the LGUs exceeded those coming from the NGOs, as would be expected from the standpoint of resources.

The relief goods came in the form of foodstuffs, clothing, sleeping paraphernalia, and reconstruction materials for dwelling structures, among the tangibles. Also mentioned were provisions for temporary evacuation places and in some instances moral support and advice extended by local authorities. Public school buildings were used as evacuation centres.

However, the informants either in focus group discussions or in key informant interviews were ambivalent about their views of these interventions. There were those who lauded the sense of fairness in the distribution of relief goods, saying “relief goods bring joy to our people, these are free, they do not have to shell out money to buy these”. As one barangay official said, “We give to anyone. We do not choose between the rich or poor. As long as there are relief goods for the barangay, we call everyone to the barangay hall”.

Others appeared to see it differently. There were those who claimed that there was partiality and favouritism, practices that were immediately apparent in the local setting. “The previous administration of the barangay council”, one informant said, “failed to give relief to everyone. They only chose a few recipients. They only gave to their own people”. This was an instance when “there is discrimination because of politics. They play politics even during disasters”, another informant said.

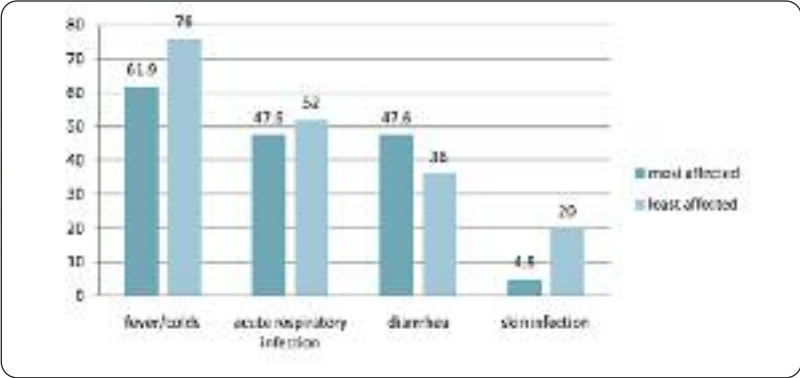
### 1.3.2. Quantitative Findings

In the research sites, the typical person in the disaster-affected areas was a Bicolana Catholic housewife with an elementary-level education. The data indicated extensive damage to livelihoods and properties in the affected areas. Food assistance was extended more than other kinds of assistance by the government, NGOs, and other support organizations. There was no difference perceived between the government and NGOs when it came to support extended to the affected communities.

#### 1.3.2.1. Health

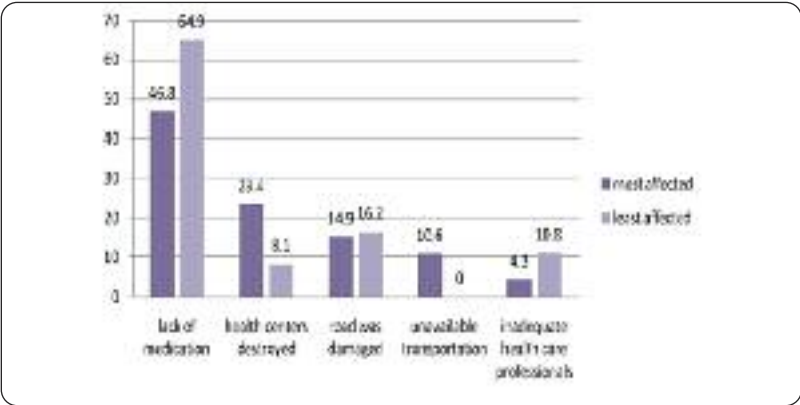
There were large percentages of families with members or friends who became sick, died, or disappeared, as high as 30%. Another 7.5% reported having been personally injured, while 8.5% reported an injured family member. Four types of infectious diseases were identified among the respondents: diarrhoea, acute respiratory infections, skin infections, and fever/colds. Children also suffered from a variety of infectious diseases following the disaster (Figure 1.4), but the results with the exception of diarrhoea indicated a greater occurrence of these diseases (fever/colds, acute respiratory infection, and skin infections) in the least-affected areas.

• *Figure 1.4. Infectious diseases for children since the occurrence of the disaster.*



One out of every four respondents believed that access to health services was compromised after a disaster (Figure 1.5). Road damage may have made visits to health centres impossible. Moreover, obtaining the needed medicine may have been delayed. The difficulty of accessing health services was exacerbated by the destruction of health centres in Albay, especially in the most-affected areas. Other reasons given for poor access to health services included lack of doctors and nurses and unavailable transportation.

• *Figure 1.5. Reasons for poor access to healthcare after disaster (multiple response).*



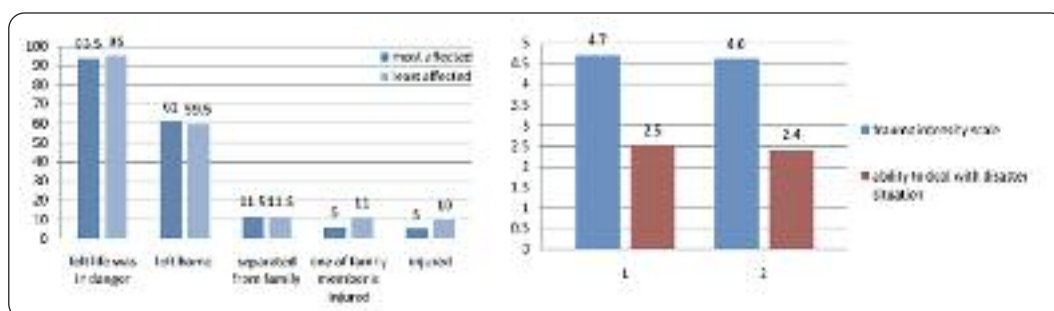
### 1.3.2.2. Social

A very large majority of the respondents (93.5% and 95% in the most-affected and least-affected areas, respectively) shared the apprehension that their lives were in danger during the disaster (Figure 1.6). A majority (61% and 59.5% in most-affected and least-affected areas, respectively) were evacuated during the disaster, leaving their homes and seeking shelter elsewhere.

The disaster event was judged to be “extremely” traumatic for the respondents based on a trauma intensity scale, with a 4.6 to 4.7 for least and most-affected areas, respectively (1 denotes “not at all”, which indicates that the experience did not in any way generate any emotional trauma, and 5 denotes the “extreme” impact of the event). Shock, anxiety, and fear were the pervasive emotions. Cases of extreme despair were reported and expressions of helplessness not uncommon. Respondents indicated a low ability overall in dealing with the situation (Figure 1.7), especially relative to the magnitude of the trauma.

• Figure 1.6. Specific experiences during the disaster.

• Figure 1.7. Extent of coping with the disaster and trauma intensity scale.



In terms of sources of warning, the information about disasters was dominantly supplied by private mass media and friends of the affected communities (71.3%). This was followed by the warning coming from the government sources (18.3%), with the rest receiving warnings from relatives and the NGOs.

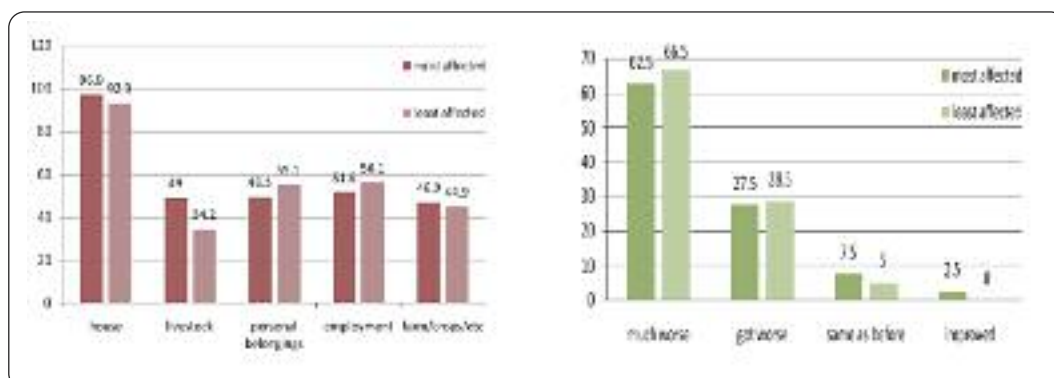
After the warning, there was hardly any help available for disaster preparation. In fact, 56.8% reported having received no help for preparation. Only 20.3% reported that help for preparation came from the government, 20.1% reported help from family and friends, and 1.0% reported help from the NGOs.

### 1.3.2.3. Economic

Ninety-eight percent of respondents reported that the disaster damaged their property or livelihood in the research sites. Indeed, except for two households in Albay, all incurred damages to their properties and sources of livelihood (Figure 1.8). On average, nine out of every ten respondents from both groups reported damage to their houses, and six out of every ten from both groups believed that their economic position was much worse than before the disaster (Figure 1.9).

• Figure 1.8. Percent of households incurring economic damages.

• Figure 1.9. Effect of the disaster on economic position.



Aside from their dwelling units, one half of those in the most-affected areas suffered loss of livestock and personal belongings and loss of employment. On the other hand, in the least-affected areas in Albay, the three top items for which a substantial percentage of households declared losses were personal belongings, employment, and a farm or shop.

The data indicated heavy damage to infrastructure as reported by a large majority (98%). The majority (79%) of households in Albay were temporarily displaced or had migrated because of the disaster.

## 1.4. Conclusions

The excellent coordination on the ground, begun months before the actual survey, was a main factor in the success of this field survey in Albay. Gaining endorsement from the governor, mayors, and barangay captains was extremely important as an entry into the communities. These officials also provided important documents such as maps and town profiles to the research team. The cooperation and hospitality of the village councils, who provided lists of households, accommodation, and even security to the survey team, was also indispensable. Having a local coordinator representing TABI, a trusted entity in the localities, was an additional relevant factor.

Overall the rapport building within the community was key to a successful survey. Finally, the professionalism of the enumerators, all of whom were experienced in field surveying, was crucial, given the sometimes difficult working conditions, poor transport options, and challenging weather. They too worked on building rapport, interacting at the local level, mingling with residents after interview sessions for informal discussions, and attending village gatherings.

The general picture based on the data derived from this study is that residents in the least-affected areas reported similar outcomes in terms of the health, social, and economic impacts. This outcome suggests that the presence and threat of a flood in the vicinity, not the flood itself, may make a significant contribution to aspects of coping and economic impacts that may reverberate from flood-affected to unaffected but adjacent areas.



• Enumerators from CDRC discuss the households to be surveyed on the field

## 2. BAHRAICH, INDIA, FLOOD

### 2.1. Introduction

#### 2.1.1. Context

One of the three MICRODIS survey sites in India is Bahraich, a city and a municipal board in Bahraich district in the state of Uttar Pradesh (Figure 2.1). Located on the Saryu River, a tributary of the river Ghaghra, Bahraich is 125 km northeast of Lucknow, the state capital. Bahraich is connected by railway and roads to the other parts of the nation.

As of the 2001 India census, Bahraich had a population of 168,376 and was 53% male. At least 15% of the population was under 6 years of age. The average literacy rate was 59%, lower than the national average of 59.5%, with 57% of males and 43% of females being literate. The main occupation of the residents of Bahraich is agriculture, with wheat, rice, sugar cane, pulse, and mustard as the major crops. Industry, except as it relates to agriculture, is fairly limited.

The towns of Barabanki, Gonda, Balrampur, Lakheempur, and Sitapur share local boundaries with Bahraich. A factor that makes this town important is the international border shared with the neighbouring country, Nepal.

#### 2.1.2. Disaster Background

As noted, Bahraich is located on the Saryu River, a tributary of the Ghaghra, and almost every year it floods. According to Uttar Pradesh statistical reports, Bahraich was the most flood-affected area in the state in 2007. An important geographical element in the area is the Belha Behrauli Bandh (a checkdam), built in 1954, which divides the flooded and non-flooded villages. The villages selected for the present study are situated close to the Ghaghra River, which floods the villages, and the villages on one side of the Bandh are vulnerable to flood impacts.

#### 2.1.3. The Disaster in Focus

This study was undertaken in Bahraich immediately after the September floods of 2007. The study compared the four worst flood-affected areas of Block Fakharpur with the adjacent non-affected areas to understand the social impact of floods. At the block level, the most flood-affected blocks were Kaiserganj, Fakharpur, Mahsi, Shivpur, and Mihinpurwa. Some 173 villages were affected by floods. The government and volunteer groups attempted to provide relief, but much more needed to be done. Some areas of concern include misappropriation of relief materials, displacement of villagers, a lack of potable water, problems faced by females during the floods, and crimes against women.

### 2.2. Methods

#### 2.2.1. Project Preliminaries

Before conducting actual field work, the University of Delhi (UoD) conducted three exploratory studies at the field site. These were done to pre-test the MICRODIS questionnaires to adapt them to the local context. The pilot study also helped by exposing the difficulties and challenges the team would face and providing experience with the real field situation. The first study was conducted in the Badaun district of Uttar Pradesh (June 5–7, 2008). After visiting Badaun, the UoD team decided to change its initial site because the area had experienced no severe floods in 2007. Thus, Bahraich was chosen, having reported maximum floods in 2007. In June 20–26, 2008, UoD performed a second pre-testing of the questionnaire and adapted it accordingly.

A third pilot study in Bahraich district was done with the objectives of selecting the Gram Panchayats (GPs) and villages within the GPs as the sampling frame for the experimental and control groups; of testing the MICRODIS questionnaire, the version resulting from translation and back translation of the English version of the questionnaire; and of introducing the study to district officials and seeking their support during the main study.

#### 2.2.2. Study Design

The aim of the MICRODIS Bahraich field study was to learn about the integrated health, social, and economic impacts of floods on the people. There were in all eight GPs selected for the study, four affected and four non-affected. The study made use of both qualitative and quantitative methods of data collection.



• Figure 2.1.  
Map of Bahraich

For collecting the quantitative data, the MICRODIS integrated questionnaire was used along with some secondary data collected from district headquarters. The qualitative data were collected with the help of focus group discussions, key informant interviews, and participatory rural appraisal activities (PRAs).

The study compared the four worst flood-affected areas of Block Fakharpur with the adjacent non-affected areas to understand the social impact of floods. The study design was case-control.

#### 2.2.2.1. Site selection and sampling

The technique of random sampling was used to draw the sample from the total population of the people in the eight villages. A list of all the houses in these eight villages was obtained according to the name of the head of the household and was sent to the Université catholique de Louvain (UCL) for selecting the households through a simple random method for the survey. A random list generated by UCL was used as the sample.

The district of Bahraich is divided into four subdistricts, or tehsils, and each subdistrict is further divided into 2–3 blocks for a total of 12 blocks. Each block further is divided into GPs and each GP has many villages within it. The block chosen for study was the Fakharpur block, in the Mahsi tehsil. This block lies at the confluence of the Ghaghra, Bhada, and Sharda rivers and thus is the most flood-affected block in the district. Four GPs that were the most flood-affected in this block were selected: Naubasta, Baundi, Atodar, and Silauta. These served as the experimental frame. The location of these villages also makes them vulnerable for floods as they lie between the river and the dam.

Each GP is further divided into many small villages or hamlets locally called purvas. At the time of the study, Naubasta consisted of 603 households distributed into eight purvas, and Baundi had 699 households distributed into five purvas. Atodar contained 549 households distributed into eight purvas, while Silauta consisted of 213 households, but these are no longer divided into purvas. Silauta was so badly affected by floods in 2007 and before that most of its people are displaced and the village in terms of territory does not exist.

The sampling frame for the control group consisted of the GPs lying beyond the dam or on the other side of it. The team ensured that these GPs were not at all affected by floods, meaning that neither the houses were damaged nor the agricultural land eroded by flood water. Four such GPs were selected, Dharmapur, Kodahi, Biswan, and Jaitapur. The total number of households in the four GPs was 2269, making up the sampling frame for the control group of villages not affected by the floods.

#### 2.2.2.2. The survey

A social impact questionnaire was developed through rigorous discussion on topics like social capital, received and perceived support, and social cohesion with partners from the University of Northumbria, HealthNet TPO, and Xavier University.



• Group photo of the UoD survey team for the main study in Bahraich, India.

Every day before going to the field, enumerators received the names of the household head where they had to go for conducting the survey. If by chance the person or the entire family had migrated to another place, then the name of the next person on the random list was taken. This ensured completion of the target of 660 households.

## 2.3. Results

The complete field study was conducted in 15 days with the help of 17 enumerators who were responsible for administering the questionnaire. There were six focus group discussions conducted among the NGOs, medical officers, village headmen, village men, marginalized women, and upper caste women. Six key informant interviews were also completed with the chief medical officer, project officer of the United Nations Development Program, NGO representative, additional development officer, sub-divisional magistrate, and the subdistrict officer (tehsildar).

### 2.3.1. Qualitative Findings

The six focus group discussions were held to get a holistic view of the impacts of floods. There were some common questions that were framed for all of the focus group discussions, pertaining to the common definition of floods according to the people of Bahraich; the problems that people face during the floods and how they tackle these problems; and the role of district administration and how far it is successful in providing relief to the people.

Then there were specific questions put forward for discussion in the group like the role of NGOs in pre-flood preparation and mitigation, their coordination with the district administration and other NGOs in the district, and their coordination with the people. The special problems of women in floods were discussed separately while conducting the focus group discussion with village women. All of the focus group discussions were video recorded.

Before starting the focus group discussion with the men and women of the village, a PRA activity was conducted in which they were asked to arrange beans on a chart paper along a line on which five slots were made indicating five years including the present year. Focus group discussion participants were asked to arrange the beans according to the intensity of floods this year and for four previous years with the maximum number of beans kept on the slot depicting maximum floods and so on for all the years. This exercise had two advantages: it was used to gain correct knowledge about the flood intensity for five consecutive years, and it helped in establishing good rapport with the participants before starting the focus group discussions, making them comfortable with the surroundings.



• Enumerator training by UoD for the Bahraich main study in year two.

• Focus Group Discussions led by UoN and UoD.

Another kind of PRA was conducted in which the participants were asked to draw the course of the river in a map of the Fakharpur block, indicating the areas lying under the flood now and areas that were reclaimed after the flood water receded. Areas under flood were marked with the help of coloured chalks. The six key informant interviews were recorded on a tape recorder and later written verbatim in the local language first and then translated into English, as was also done with the transcripts of the focus group discussions.

In all, a total of 80 disaster narratives were also collected by conducting an essay writing competition among the secondary school students (40 girls and 40 boys) of a school where 80% of the students came from flood-affected areas. They were given the topic of “Floods” on which they had to write about their



• Students writing essays about floods.

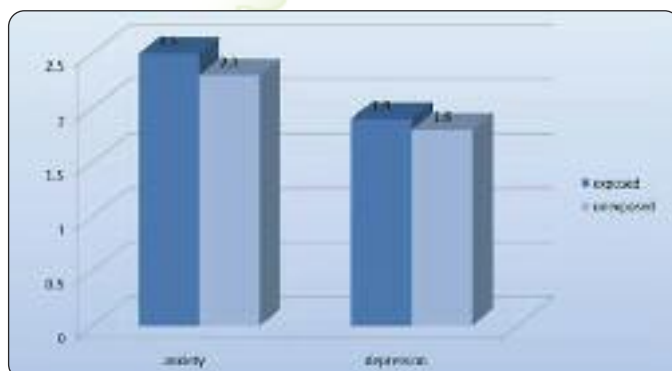
own experience with recent floods in the given time of one hour. After they finished, their copies were checked. Of the entries, the six best essays were selected (three for girls and three for boys), and the students received prizes for their efforts on originality and content.

## 2.3.2. Quantitative Findings

### 2.3.2.1. Health

The mean score for anxiety and depression showed no differences in flood-exposed and unexposed areas (Figure 2.2). The negative impact of recurring floods was very much visible in the flood-affected area, however, as the frequency for each anxiety and depression symptom was higher among the exposed group than the unexposed. The flood victims also reported poorer general health and less energy and experienced more pain that affected their work activities.

• Figure 2.2. Index score, anxiety and depression symptoms.



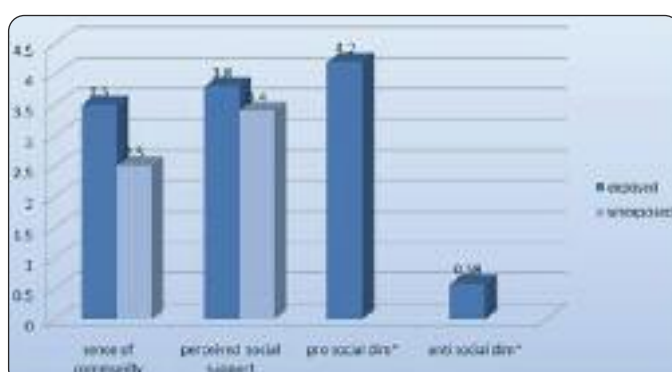
A questionnaire used to collect data on the prevalence of cold and cough among the under-five children in one flood-affected block in the district showed that children belonging to middle-income families had the highest percentage (62.2%) of acute respiratory infection symptoms, followed by children from very small families (54.9%) and poor families (54.9%). Around 75.1% of the children with diarrhoea also showed the symptoms of cough and cold as compared to 14.5% of the children who did not have the symptoms of diarrhoea. The impact of flood on health was more or less neutralized in terms of gender distribution, caste groups, or wasting or stunting, but the long-term impacts were more visible in terms of the health of the children, who were most vulnerable concerning cough and cold and other water-borne diseases.

### 2.3.2.2. Social

The warning communication system is not very good in the area, and there is an urgent need for a good warning communication system during floods. The other major problems were disruption of schools and disruption of transportation due to flood water, which severely affected the health status of the people. During floods, women face difficulties in terms of finding a place for toileting.

The overall composite mean score for sense of community was higher among the flood-exposed group than the unexposed group. This result indicated that respondents in the flood-exposed area experienced more cohesion and trust with other members of the community. For coping mechanisms, the respondents from the exposed areas scored a very high mean for pro-social activities compared to the score for anti-social activities (Figure 2.3). This outcome indicated a collective effort, reliance, and cohesion of the community. In the exposed area, the score for perceived support was higher in comparison to the unexposed area score, suggesting that residents in the exposed areas depended on people for help, had close relationships, and could count on members of their community during a crisis.

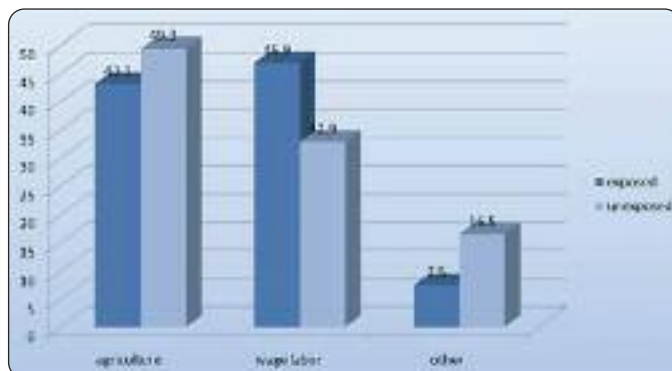
• Figure 2.3. Index scores, sense of community, perceived social support, and communal coping.



### 2.3.2.3. Economic

The percentage of households dependent on wage labour and the percentage of the poor income group were higher among flood-exposed villages (Figure 2.4). This finding indicated that people who were at one point agricultural workers were forced to opt for wage work after the floods.

• *Figure 2.4. Percentage of source of income.*



The displacement of the villages and the reduction in the agricultural lands have changed the socioeconomic profile of the area. One of the main features of the change is the emigration of males; as with the loss of agricultural lands, there is a decreased possibility of getting agricultural work in their own villages. Most of the emigration is seasonal, where the hope is to earn enough from work in the cities to cover the household expenses. Finally, to cope with the damage caused to livelihood and agricultural activities, 61.3% households were compelled to take a loan to fulfil their basic needs.

## 2.4. Conclusions

In terms of health impacts, the people of Bahraich who lived in flood-affected areas reported poorer overall general health and more symptoms of anxiety and depression. Further, there was likely an interaction of economics and health, as people in the flood-affected areas reported more pain that affected their work activities.

Work activities themselves changed as a result of displacement. Particularly evident was the emigration of males and an increase in wage labour as a result of losses in the agricultural sector because of flooding.

In spite of these negative health and economic impacts, residents in flood-prone areas reported better social cohesion and coping. There also were indications of more pro-social activities and a better sense of community and community support among residents in the flood-affected areas. One thing that remains to be improved for the communities is the flood warning communication system.

Overall, these findings indicate a negative influence of flooding on economic and health factors, particularly for children in terms of health and men working in agriculture who must shift to wage labour. Nevertheless, the social cohesion and coping mechanisms of the affected populations proved to be a positive highlight, and the survey team's own efforts at community-level activities, such as focus groups and PRA activities, also demonstrated community building and laid the foundation for a successful field survey effort.



*Flooded area in Bahraich, India*

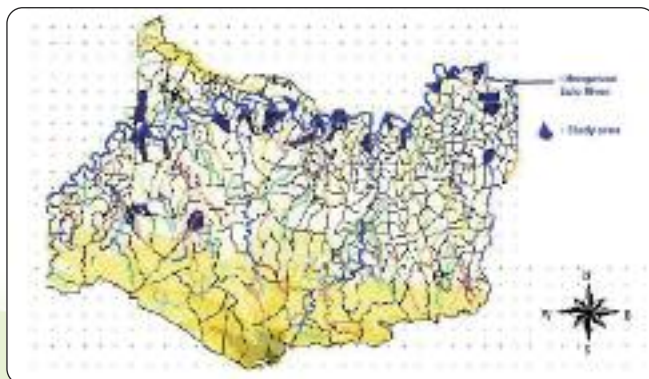
### 3. BOJONEGORO, INDONESIA, FLOOD

#### 3.1. Introduction

##### 3.1.1. Context

Indonesia has a long history of many types of disasters, including cyclones, droughts, earthquakes, floods, landslides, and tsunamis. Likely the most notorious of these are the eruption of Mount Krakatau and the 2004 tsunami that struck Aceh. Since that latter event, Indonesians have become more focused on disaster and disaster management.

- *Figure 3.1. Map of the Bojonegoro study areas.*

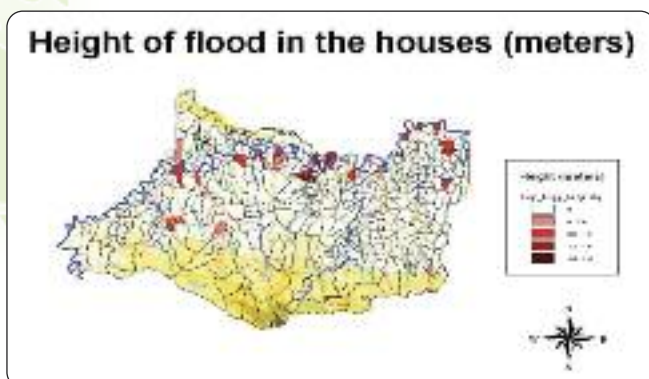


Bojonegoro (Figure 3.1) lies inland on the northern Java plain and consists primarily of low plains along the river, dominated by rice paddy fields. The area experiences a tropical climate with six months of dry season and six months of rainy season, alternating between near drought/water shortages and flooding. The urban centre is the town of Bojonegoro, but most of the population are farmers and foresters, many living in poverty. The main agricultural products of the area are rice and tobacco, and in forestry, teak is a primary industry. Lately, with the recent discovery of an oil field in the area, oil is expected to change the economics of the region.

##### 3.1.2. Disaster Background

The Earth Institute of Columbia University has observed that the southern and western islands of Indonesia, such as Java and Sumatra, are exposed to the largest number of hazards in the region and have high risk levels for droughts, earthquakes, floods, landslides, and volcanoes. However, compared to other hazards, floods carry the largest risk (when weighted by the proportion of gross domestic product and mortality).

- *Figure 3.2. Floodwater depths in affected area*



Bojonegoro is a district under the administration of East Java Province. Much of it lies on the banks of the Bengawan Solo River, the largest river in Java. A good part of the area consists of low plains along the Bengawan Solo, with hilly areas in the southern portion of the district. In the rainy season, rain falls almost daily while in the dry season, rain does not fall for months, causing widespread drought and water shortages. These problems might be related to the loss of forest and other green areas.

In addition to carrying the largest risk, flooding is the most frequent disaster event in Indonesia and indeed is the most common natural disaster worldwide. Given the context and objectives of the MICRODIS project, the University of Indonesia selected Bojonegoro as a target for the Indonesian flood study. This region experienced a disaster flood event in 2007, resulting from the overflow of the river Bengawan Solo. The Bojonegoro district suffered the worst effects, with half of the area under about 3 m of flood water and 16 subdistricts flooded (Figure 3.2).

### 3.1.3. The Disaster in Focus

The Bengawan Solo River played a central role in the 2007 flood disaster in Bojonegoro. Soon after it broke its banks, more than 80 people had died and 12,000 houses had been destroyed or damaged. By the end of the flood event, 17 districts in East Java had been affected, and in Bojonegoro, 30 people had died and more than 24,000 homes affected. Indeed, 229,000 people were displaced to temporary shelters or sheltering near their devastated homes. Hospital access was not possible because of surrounding floodwaters.

Thus, for the people in the Bojonegoro district living around the Bengawan Solo and having frequently been under the threats of serial floods, studying the health, economic, and social impacts of the huge 2007 Bojonegoro flood was certainly both important and relevant.

## 3.2. Methods

### 3.2.1. Project Preliminaries

This study employed the MICRODIS integrated questionnaire in the quantitative field survey portion. As in other study sites, the primary questionnaire underwent some modifications to make it specific to the study area. Questionnaire trials in Jakarta, Depok, and Bojonegoro led to improvements in questions to render them more relevant. Furthermore, data interviewers underwent two days of classroom and field training.

### 3.2.2. The Study Design

The major thematic scopes studied through this population-based survey encompassed the health, economic, and social themes, with particular emphasis on health. The two main hypotheses of the study were as follows:

- Parameters of health status (e.g., status of morbidity, injury, and nutrition) in flooded households would be significantly different from parameters of health status in non-flooded households.
- There would be associations between potential determinants (e.g., demographic, socioeconomic, behavioural, and environment characteristics) and potential waterborne diseases related to flood (e.g., diarrhoea, dermatitis, typhoid fever, and eye infection) among communities living in Bojonegoro villages near the Bengawan Solo River.

The six primary objectives of this study were to identify (1) the basic health status before the flood; (2) the magnitude of health problems attributable to the flood; (3) determinants of flood-related health problems; (4) the magnitude of economic and psychosocial problems associated with the flood; (5) knowledge, attitudes, and practices believed to be related to the flood; and (6) available governmental and other policy and program infrastructure related to flood management.

The study was a cross-sectional, population-based investigation involving primary and secondary (Box 1) data collection. The population survey was performed in the district of Bojonegoro, with households divided into two categories: flooded households (those experiencing flood either inside the home or in the surroundings) and non-flooded households, which served as the referent, non-exposed population.



*Focus Group Discussion during the main survey*

In addition to questionnaires, data collectors also collected qualitative data through focus group discussions and in-depth interviews, often with village leaders or key contacts in various groups, such as religious or community leaders or the local media. Ultimately, there were six in-depth interviews. The focus group discussions took place with four groups, stratified based on demographics: younger women with children under age five; older women; younger men; and older men. All participants were from flooded villages. Three more focus group discussions occurred with, respectively, village midwives, heads of the community health centres, and community leaders.

### 3.2.2.1. Site selection and sampling

To estimate the sample size, the study team used several health parameters (prevalence of certain diseases or health problems closely related to the type of disaster in the provincial/district level). Sample selection in this study was done through an approach of multi-stage cluster sampling. Minimal sample size for both populations (index group, i.e., the flooded population, and the reference group, i.e., the non-flooded population) was estimated using (1) an equation of sample size based on a population proportion with specified absolute precision and (2) an equation of sample size for hypothesis testing for two population proportions. The minimum sample size required for this study was 436, which was rounded to 500 samples. Therefore, 250 households in the index (i.e., flooded) population and 250 households in the reference (i.e., non-flooded) population were selected.

In this study, the cluster was the study village. Selection of the village as the study cluster began with identification and stratification of villages based on exposure or non-exposure to flood, then a list of flooded and non-flooded villages was made together with their populations. It was determined that in the December 2007 flood, out of 435 villages in the Bojonegoro district, 167 were flooded (total population of 438,031) and 268 were not flooded (total population of 808,873). The list of flooded and non-flooded villages was made in MS Excel format, and then the file was transferred to CSURVEY to let the software select 25 cluster (villages) using probability proportionate to size.

Participants were selected randomly from identified Rukun Tetangga (RTs; smallest units of a neighbourhood block) in affected and unaffected areas. The sample unit of this survey was the household, consisting of members who had been living in the study area for at least three months before the occurrence of the huge Bojonegoro flood, i.e., 3 months before December 2007. Each village has a list of RTs. One village can have 15–37 RTs, and on average, each RT consists of 40 households. The research team verified the list of RTs in each village, refined it, and constructed the most accurate list of RTs in each of the villages. From this list, the research team randomly selected two RTs per village.

In the selected RTs, the simple mapping and listing of households was conducted. In the listing process, the information about flooded and non-flooded status of the households was also requested. Based on the household list, five households per RT were randomly selected plus one (one) additional household as a reserve for replacement. The list of selected households with the two replacements then was distributed to the data collection personnel. In a situation where a respondent could not be interviewed after three tries in a day, then that household (where the eligible respondent was not available) was replaced.

### 3.2.2.2. The survey

This population-based survey in Bojonegoro encompassed health, economic, and social themes but focused primarily on health. Within the health domain, of special interest were sanitation and hygiene, mortality, injury and disability, acute disease, and chronic disease. In addition to these health-related factors, the survey also gathered data on economic factors such as household damage, land damage, and damage to public infrastructure. Social factors assessed included quality of life, social support, survival behaviour, and level of willingness to participate in a flood-management program.

A questionnaire of community health status was developed by the research team. Most of the questions were closed. Within each sub-study, specific questions were improved to retain relevance between the questions and type of disaster in the study location. As noted, questionnaire trials had been done in Jakarta, Depok, and Bojonegoro; thus, the validity and reliability of the questionnaire had been established, and the duration of each interview could be estimated (time average, 1 hour). As for the qualitative study, an in-depth interview had been developed. Further, secondary data were collected as a complement to the field survey data (Box 1).

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#### Box 1. Secondary Data Collection

For the secondary data collection, some questions in the health system instrument were addressed using the secondary data/profiles collected from District Health Office and General District Hospital. In addition to institutional profiles, two-year periodic data on mortality and morbidity among outpatients and inpatients (2007 and 2008) were collected from the Bojonegoro District General Hospital as the main referral hospital in the district of Bojonegoro. The morbidity data were taken from the monthly recapitulation report of the hospital, sent to the Ministry of Health, Republic of Indonesia, in Jakarta, while the mortality data were taken from doctors' death certificates. This certificate provides information about date of death, place of death, cause of death, and demography information about the deceased. Data entry was conducted after total study implementation.

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Interviews were recorded and conducted either in the local language or Bahasa and ultimately translated into English. When data collection was completed, transcription into Bahasa was performed by a qualitative researcher and the person who took the notes. Data analysis was performed using NVIVO frame-work analysis in a tree node structure form developed based on the study results to check the consistency of qualitative data using a triangulation method.

### 3.3. Results

Ultimately, of the 167 Bojonegoro district villages that were flooded, 25 were selected for the study, primarily distributed near the Bengawan Solo River or along one of its branches. Another 25 villages were selected from the remaining 268 Bojonegoro villages that were not affected by the flood. There were 489 respondents from 489 study households, and 245 from flooded households. The households altogether represented 2037 individuals, 1016 from flood-affected households.

About 65% of flooded households reported having experienced previous natural disasters (Figure 3.3), and about a fifth of the flooded households reported having experienced moderate to severe damage to their home during the 2007 flood. Three quarters were displaced by the flood, most using temporary shelters, a relative's home, or public buildings. A third of these displaced persons also were separated from other household members during their displacement, and displacements on average lasted about 8 days (maximum 30 days).

Variables	Total N=245	
	f	%
Experienced any disaster more than once since November 2007?		
No	133	54.3
Yes	88	35.7
Disaster 1		
Flood	245	100.0
Level of severity of disaster 1		
Very severe	134	42.4
Severe	138	43.1
Moderate	21	3.6
Mild	14	5.7
Disaster 2		
Flood	75	87.1
Tornado and/or Earthquake	11	13.8
Level of severity of disaster 2		
Very severe	20	25.3
Severe	18	20.9
Moderate	31	35.0
Mild	17	19.8
Disaster 3		
Flood	44	88.0
Tornado and/or Earthquake	4	12.0
Level of severity of disaster 3		
Very severe	12	24.0
Severe	5	10.0
Moderate	14	28.0
Mild	19	38.0

• Figure 3.3.  
Natural-disaster-related  
experience in flood-  
affected households.

Flooding within the homes reached, on average, about a meter, with water remaining in the house for up to 60 days (average 10 days). Most family members in flooded households (94%) experienced contact with the flood waters, primarily in the home. Of these, 5% swallowed or choked on the flood water, and nine (<1%) were carried away or drowned. Only 3% of respondents in non-flooded households had experienced direct contact with the floodwaters.

#### 3.3.1. Qualitative Findings

Qualitative data collection was done somewhat earlier than the population-based quantitative survey and was collected through focus group discussions among flood-affected villagers and in-depth interviews with targeted community representatives in Bahasa, Indonesia. Focus group discussions were also done for the purpose of capturing local important disaster and health-related concepts in the community needed to construct and refine a good quantitative questionnaire.

During the focus group discussions and in-depth interviews, the team had the chance to meet, discuss, and interact directly with the village leader (formally and informally) and community members, especially important key persons from various groups (males, females, midwives, parents of young children, religious leaders, community leaders, and local media). In addition to collecting relevant qualitative information, the informal meetings with key persons in the communities simultaneously gave the team the opportunity to share information about community empowerment in disaster preparedness and management.

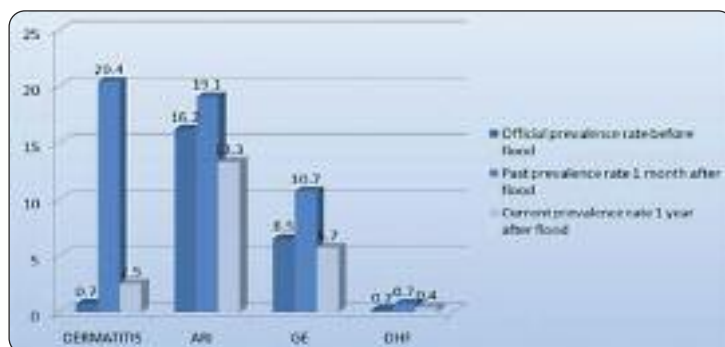
#### 3.3.2. Quantitative Findings

##### 3.3.2.1. Health

In terms of health, prevalence rates of dermatitis, acute respiratory infection, gastroenteritis, and dengue hemorrhagic fever (DHF) at one month after the flood were higher than official rates before the flood. Prevalence rates of dermatitis, acute respiratory infection, and gastroenteritis at one month after the flood were also significantly higher than rates one year later (within one month before the interviews) (Figure 3.4).

Death/mortality among respondents following the flood was <1%, with most resulting from heart attacks or stroke. Acute illness seems to have increased just following the December 2007 flood, especially dermatitis, cough and cold, and gastroenteritis. The three most prevalent doctor-diagnosed diseases

• **Figure 3.4.** Estimated prevalence rate of acute illness.



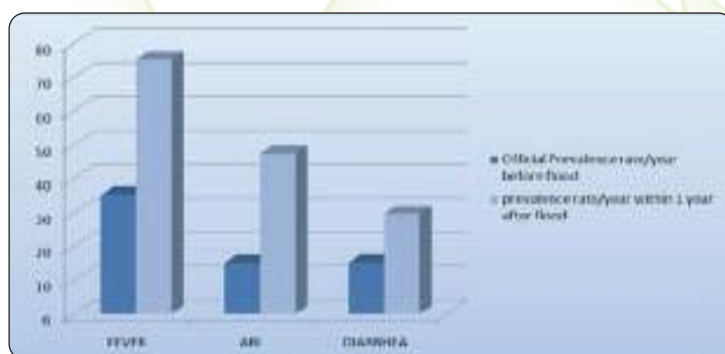
were acute respiratory infection (1.7% prevalence rate), typhoid/paratyphus fever (0.8%), and DHF (0.7%). The true rate of acute respiratory infection likely was higher, at least 19.1%. These diseases, already the leading acute infectious diseases in Bojonegoro, hold the potential to become endemic.

The most common chronic disease was hypertension (2% prevalence), followed by chronic pulmonary disease (0.5%) and renal disease (0.5%). Hypertension was more prevalent among flood-affected households compared to unaffected households.

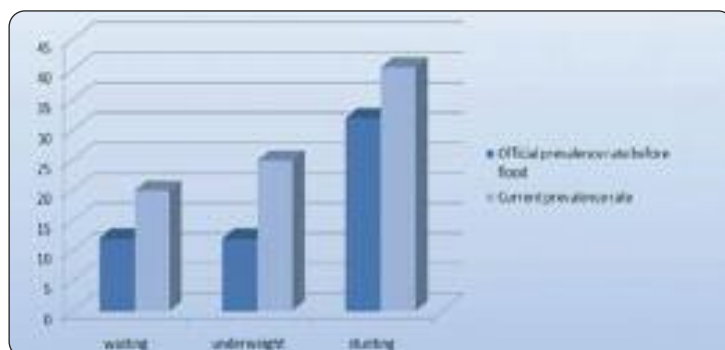
Even though access was open to modern health care facilities following the flood, many respondents who experienced acute complaints following the flood sought care from local traditional healers instead; the main reason given for not seeking treatment in a traditional facility was that the problem was not perceived to be serious. If the situation did not improve, most respondents did ultimately seek care in a modern facility. The inference here is that traditional healers may play an important front-line role in health care in these situations. Overall, the flooding did not seem to affect the general pattern of treatment seeking in the affected populations.

Among under-five children, major illnesses from the flood until the interviews were fever (prevalence rate/year: 75%), acute respiratory infection (45.5%), diarrhoea (29.7%), and dermatitis (15.9%). Prevalence rates/year of fever, acute respiratory infection, and diarrhoea among flooded-household children were much higher than the estimated rates before the flood (Figure 3.5). Also in the under-five age group, the prevalence rates of underweight (29%), wasting (20%), and stunting (41%) within 1 month before the interview were very high, much higher than official rates before the flood, reflecting acute and chronic malnutrition problems (Figure 3.6).

• **Figure 3.5.** Estimated prevalence rate/year of acute illnesses among under-five children.



• **Figure 3.6.** Estimated prevalence rates of under-five child malnutrition.



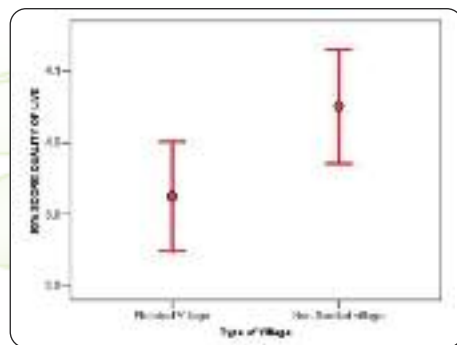
These rates in flood-affected households were considerably higher than those for East Java provinces in 2007. While there are indications that the chronic malnutrition problem predated the 2007 flood, it is reasonable to assume that the December 2007 disaster exacerbated its severity.

### 3.3.2.2. Social

Regarding social impacts, social support for flood-affected households was quite low. Sources of greatest support were family, children, and friends, while government and NGOs received the lowest scores for social support.

Residents in flood-affected areas also reported lower quality of life scores compared to those in the non-flooded villages, although the confidence intervals overlapped, so this could be the result of chance (Figure 3.7).

• *Figure 3.7. Quality of life*

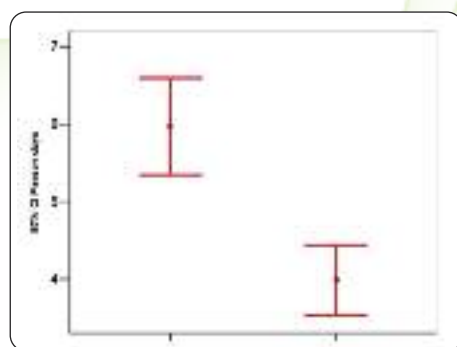


### 3.3.2.3. Economic

In terms of economic impacts, the majority of flooded households reported a significant impact from economic loss (income loss, production loss, repairing cost of properties, or increasing monthly expenditure) in an amount that was more than 5 months of the average household expenditure. The most significant predictors of household economic loss were the highest flood level inside the house, frequency of disaster experience, educational level of the head of the household, head of household occupational type, and type of house.

Most household respondents (about 80%) expressed a willingness to participate in a government program to reduce future flood impacts (Figure 3.8).

• *Figure 3.8. Willingness to participate in government flood-prevention programs.*



## 3.4. Conclusions

The results of this study suggest a few recommendations to ameliorate some of the negative impacts of disasters. As the findings with the early warning system suggest, Bojonegoro needs improved coverage and quality for its disaster warning systems. Further, for households in the river floodplain, an effective mitigation system is required.

The health findings of this study show the need for disaster surveillance that accurately monitors trends for acute illness and disease, especially those that have the potential for endemicity that may progress rapidly to outbreaks. These diseases include gastroenteritis, acute respiratory infection, DHF, and typhoid/paratyphus fever. Further, a behavioural intervention program may help affected people better understand the signs of disease and illness susceptibility.

Of most concern are the findings regarding chronic and acute child malnutrition. There is a need for more intensive nutritional intervention programs specifically targeting children under age five. Immunization coverage also could be improved, as rates fall below national government targets of 80%.

The results of this study are expected to identify community vulnerabilities and increase community and local government awareness of the health effects of such disasters. Ultimately, the data could be used to encourage health promotion and disease prevention programs for post-disaster scenarios.

## 4. HANOI, VIETNAM, FLOOD

### 4.1. Introduction

#### 4.1.1. Context

Vietnam (Figure 4.1), which lies in the tropical monsoon area of the northwest Pacific, is one of the most disaster-prone countries in the world. It experiences almost every kind of natural disaster, including floods, storms, storm surges, whirlwinds, flash floods, droughts, and landslides.

Among the most common of these are the floods, which bring about the greatest loss of life and the longest recovery periods. In 2007, 400 people died in floods, and floods covering the period from 2001 to 2006 caused annual losses equivalent to 1% of the country's gross domestic product. When flooding persists, serious health problems arise, particularly among the elderly or disabled living in poor conditions with limited food availability, unhygienic water sources, and poor sanitation. Epidemics often strike under these conditions, including diseases such as dengue fever and diarrhoea.



• Figure 4.1.  
Map of Vietnam.

#### 4.1.2. Disaster Background

In addition to being the most common disaster, floods are the most threatening natural disasters in Vietnam. In the flooding season, heavy rainfall upstream causes large discharges and large-scale flooding. Different regions of Vietnam experience different flood patterns. In the North, the flooding normally occurs from May to September, earlier than other regions. On average, there are three to five floods in this region yearly. In the South Central Coast, floods on rivers occur from September to December. This region is characterized by short and steep river systems with rapid flows. Dyke systems in this region are relatively low or incomplete.



• Figure 4.2.  
The studied area in Hanoi.

Therefore, floods not only occur on the main streams but also spread across the floodplains, causing huge losses. Floods in the Mekong River Delta (MRD) are generated from upstream floods and also directly influenced by tides and water reserving capacity of upstream reservoirs. The progress of floods in the MRD is slow, and floods last for a long time (4 to 5 months), causing inundation in almost areas of the MRD.

Long and heavy rains with high intensity and large magnitude in Hanoi (Figure 4.2) in the last days of October and the first week of November 2008 resulted in a historic flood in the area of old Hanoi, the worst since 1973.

#### 4.1.3. The Disaster in Focus

The lasting flood in October and November of 2008 had multiple immediate consequences. According to a primary evaluation of the 10 days of heavy rains and flooding (from October 31 to November 9, 2008), 22 people died, three were injured, and material losses were as high as 3,000 billion dong (about 154 million US\$). Heavy rains on a large scale resulted in serious loss in agricultural production: 60,960 hectares of winter plants and vegetables and flowers; 2,684 hectares of winter crops that were not harvested; 11,498 hectares of aqua-cultural production; and 1,367 hectares of farmhouses in the area of Hanoi that were flooded and consequently seriously damaged. Livestock and poultry losses approached 150,000 animals; 87 houses and 14,300 m of walls of private houses, shops, and offices were collapsed. Many of people's assets were lost because they were located in one of the 90 flooded points on street routes and residential areas damaged because of inundation.

About a month after the heavy rains, some areas in the new part of Hanoi remained deeply inundated. The long-term impacts on the economic, social, environmental, and health aspects of people living in Hanoi remained unknown. For the MICRODIS project, researchers from the Hanoi School of Public Health chose to examine these outcomes.

## 4.2. Methods

### 4.2.1. Project Preliminaries

After weeks spent translating the MICRODIS integrated questionnaire into Vietnamese, its contents were circulated among the research team. The team piloted the questionnaires in both Thua Thien Hue province and the Hanoi capital. Thua Thien Hue was originally selected as the field site, but in 2008, heavy rains struck Hanoi instead of Thua Thien Hue, which led to a change in study sites. Because of this change, the MICRODIS integrated questionnaire was ultimately piloted in two sites, first in Quang Dien district and Hue City, Thua Thien Hue province, and later in Huong My district, Hanoi.

In the first pilot, there were a few problems. Because the most recent flood event in Thua Thien Hue had occurred so long ago (a year before the pilot study), it was quite difficult for the respondents to recall information concerning flood impacts. Interviewers went to households during the daytime, which meant that householders who worked during these hours were not available to participate in the questionnaires.

During the pre-test, the six interviewers, five of whom participated in the translation process, worked for two days in a severely flooded commune in Quang Dien district, outside of Hue City and in a severely flooded precinct in Hue. The interviewers worked in pairs in the morning and singly in the afternoons. They met in the evening to review the process and go over feedback to guide editing of the questionnaire. In this pilot process, 10 families in each locale were interviewed. As was noted in other studies, respondents commented on questionnaire length, the detail of the economic questions, and the vagueness of the social core questions. In response to some of this feedback, enumerators suggesting shortening the questionnaire so that it could be completed within 1.5 hours.

Because the field site was changed from Thua Thien Hue province (the central part of Vietnam) to Hanoi capital city (in the north), there was a second pilot effort in January 2009 in the Nam Phuong Tine Commune in the Huong My district, with the team working in two groups, each with a MICRODIS team member, two students, and a local guide. This effort was similar to the first pilot, including review, follow-up, and editing. Respondents had complaints similar to those identified in the first pilot: interview length (1.5 hours on average in the 10 flood-affected households and 45 minutes on average in the eight unaffected households); the detail of the economic core questions; and the vagueness of the social core questions. In general, however, respondents were pleased to be able to talk about their experiences, especially those in affected households.

### 4.2.2. The Study Design

This study was cross-sectional with the unaffected population as a control group. Quantitative surveys and in-depth interviews with key informants were used to gain insights into the social, economic, and health impacts of the flood.

In keeping with the MICRODIS goal of strengthening preparedness, mitigation, and prevention strategies to reduce the health, social, and economic effects of disaster events, the objectives of the Hanoi survey were fourfold. The first goal was evaluation of the social, economic, and health effects of the historic and devastating 2008 flood. In this context, the team also sought to identify differences in specific socioeconomic indicators between households that were and were not affected by the flood. Two further goals were identifying differences in morbidity patterns in affected and unaffected households and the relationships between socioeconomic factors and health-related problems in affected and unaffected households.

#### 4.2.2.1. Site selection and sampling

Two Hanoi sites were chosen, the Hoang Mai and Huong My districts, because they both sustained serious damage during the historic 2008 flood. Within the Hoang Mai district, an urban district of Hanoi, the Thanh Let precinct was the severely flooded locale, while the Thanh Tri precinct served as the less-affected area. In the rural Huong My district, the Nam Phuong Tine commune was the severely affected area, and the Dong Son Tine commune was the less-affected location. The districts and areas were selected for their similar socioeconomic status, and household selection within each area was random.

A formula was used to determine the necessary sample sizes for each group, with the results that 199 each of affected and unaffected households per district would be necessary. The team anticipated high collaboration in the rural district and thus oversampled by 10%, for a total of 440 households. In the urban district, they oversampled by 25%, randomly and systematically selecting 500 households. Lists of households were relatively easy to prepare thanks to newly updated information from the latest census. For each household, the head of the household was invited to participate, and if unavailable, his or her partner was then asked.



- Enumerators are trained on how to administer the questionnaire by the HSPH research team.

#### 4.2.2.2. The survey

As noted, the MICRODIS integrated questionnaire was first tested in Quang Dien district and Hue City, Thua Thien Hue province and later in Huong My district, Hanoi, which yielded some changes for the Hanoi context. Training workshops for the enumerators targeted providing a standard interpretation of survey instruments for the enumerators and field teams.



- HSPH researcher conducts a household questionnaire.

### 4.3. Results

#### 4.3.1. Quantitative Findings

##### 4.3.1.1. Health

In the area of health effects, much higher proportions of people in flood-hit areas reported a worsened health situation compared to proportions in non-flooded areas (84.1% and 63.1% in Nam Phuong Tien and Thinh Liet, respectively, versus 36.6% and 34.8% in Dong Son and Thanh Tri, respectively). Interestingly, the incidence of hypertension showed a similar pattern. Further, communicable disease such as red eye and skin diseases were more prevalent in flood-hit areas than in non-flooded areas (Table 4.3). Cases of dengue fever were sparse in the study sites, but the number of cases in the flooded areas was higher after the flood compared to unaffected areas.

• Table 4.3. Communicable diseases in flooded and non-flooded districts in Hanoi.

Communicable conditions	Rural area of Hanoi				Urban area of Hanoi			
	Dong son Non-flooded		Nam P. Tien Flooded		Thanh Tri Non-flooded		Thinh Liet Flooded	
	Total	After flood	Total	After flood	Total	After flood	Total	After flood
Having red eye diseases after the heavy rain and flood	42	27	69	64	11	5	10	10
Having skin diseases after the heavy rain and flood	38	22	229	219	23	21	34	30
Having dengue fever after the heavy rain and flood	1	0	15	13	3	2	7	6

Altogether, respondents in the severely flooded communes reported having been substantially affected by the floods at much greater rates than respondents in the unaffected commune (76.6% respondents in Nam Phuong Tien versus 18.5% in Dong Son). Respondents also described being unable to access health care or medication because of road damage, health facilities damage, or lack of transportation.

#### 4.3.1.2. Social

The social effects were greater for the flooded areas than for unaffected areas, with mean scores for emotional support of 2.37 in Nam Phuong Tien (urban, flooded) versus 2.06 in Dong Son (urban, not flooded) and 2.11 in Thinh Liet (rural, flooded) versus 1.79 in Thanh Tri (rural, not flooded). The mean scores for sense of community and membership, however, did not differ among the areas (Table 4.4), and neither did scores for family support or children support (Table 4.5).

• Table 4.4. Sense of community in flooded and non-flooded areas of Hanoi.

Sense of Community	Rural area of Hanoi		Urban area of Hanoi	
	Dong son Non-flooded	Nam P. Tien Flooded	Thanh Tri Non-flooded	Thinh Liet Flooded
Sense of community	3,89	3,72	3,6	3,62
Membership	4,46	4,17	4	3,95
Need fulfillment	2,69	2,49	2,69	2,58
Influence	3,56	3,53	3,28	3,4
Emotional connection	3,94	3,77	3,81	3,86

• Table 4.5. Network of social support.

Network of social support	Rural area of Hanoi		Urban area of Hanoi	
	Dong son Non-flooded	Nam Phuong Tien Flooded	Thanh Tri Non-flooded	Thinh Liet Flooded
Family support	2,56	2,55	2,31	2,46
Children Support	2,37	2,41	2,05	2,27
Other family member	2,31	2,38	1,96	2,14
Support from friend	2,13	2,16	1,83	1,95
Support from Govt. organization	1,33	1,75	1,1	1,67
Support from Non-Govt. organization	1,1	1,26	1,03	1,07

The scores for support from government organizations were higher in the flooded areas compared to the unaffected areas (Figure 4.6). School activities were also reported to have been affected, with children having to take at least a day or in some areas up to a week off from schools.

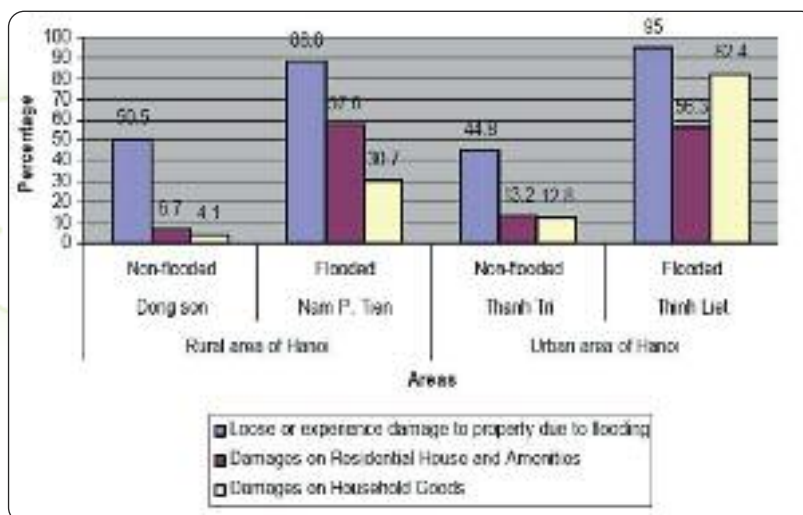
#### 4.3.1.3. Economic

The economic effects were significant. Almost all residents of the flooded communities described their economic condition as having gotten worse or very worse after the flood. Indeed, even though people in the non-flooded areas of Hanoi still experienced some damage from the heavy rains, the percentages of people in flooded areas who experienced flood-related damage were substantially higher than those in the non-flooded areas.

About half of the people in Nam Phuong Tien and about a fifth of the people in selected households in Thinh Liet had migrated because of the flood, 54.6% and 22.6%, respectively. The majority of people (more than 86% in all sites) who had migrated stayed in a relative's or friend's house. In communes that were severely affected by flood, such as Nam Phuong Tien, some people (5.3% respondents) reported that they stayed in temporary shelters provided by the government, such as schools and community houses.

Routine activity and the main occupation of respondents were reported to be affected substantially, especially in severely flooded communes; 76.6% of respondents in Nam Phuong Tien were affected, compared to 18.5% in Dong Son.

• Figure 4.6. Network of social support.



The income per person per month in communes in the urban area of Hanoi was almost double that of the rural commune, 63 US\$ compared to roughly 29 US\$. Within the rural area, there was a difference in income between the severely affected commune and the less-affected commune (33 US\$ vs. 26 US\$ per person per month). Almost all people in flooded communes mentioned that their economic condition got worse or very worse after the flood (92.1% and 80.6% in Nam Phuong Tien and Thinh Liet, respectively).

Because the heavy rain occurred in a widespread area of Hanoi, even people in non-flooded areas reported some damage to property and livelihoods (44.8% in Thanh Tri and 50.5% in Dong Son). However, the proportions of people reporting damages in flooded communes were substantially higher than those of the non-flooded area.

#### 4.4. Conclusions

From the data, differences emerged in terms of health, social, and economic aspects between the flooded communes and non-flooded communes and between the rural and urban areas of Hanoi. The negative health and economic impacts stood out the most, with economic factors worsening by large margins among flood-affected households compared to unaffected households. For health, impeded access to healthcare because of flood-damaged transportation routes may have been an issue, while increased communicable diseases and hypertension deserve more investigation in the flood/disaster context. From the economic perspective, the forced migrations, damages to households, and negative impacts on occupations and income all require greater attention.



• HSPH enumerator conducts a household interview using the MICRODIS integrated protocol in Hanoi

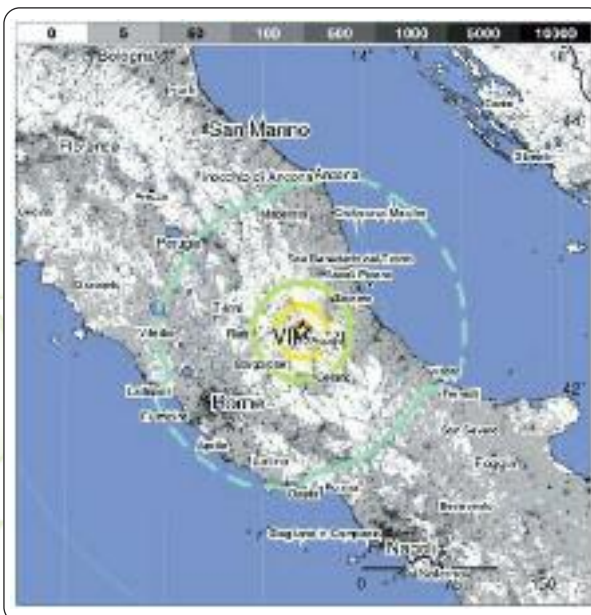
## 5. L'AQUILA, ITALY, EARTHQUAKE

### 5.1. Introduction

#### 5.1.1. Context

On 6 April 2009 a seismic event of magnitude 6.3 struck the province of L'Aquila (Figure 5.1). It caused damage to 100,000 buildings in 57 municipalities, left 67,500 local residents homeless, killed 308 people and injured 1,500, 202 of them seriously. Local government buildings and the regional hospital were put entirely out of action by the tremors. Over the following six months, the homeless survivors were accommodated in 171 tent camps, as well as in public buildings and prefabs, at a total cost of 1,064,300,000 euros.

Some 308 people died in L'Aquila city, mostly in the centre rather than the suburbs, where mortality was limited and highly dispersed. Between 62 and 84 of them died in the collapse of only seven multi-storey apartment blocks. In fact, in terms of mortality, the main urban agglomeration of L'Aquila city can be divided into three zones. In the north-eastern sector no one died. In part this reflects a slightly higher quality and state of maintenance of buildings with respect to the rest of the city centre. In the north-western sector people died singly or in pairs, mostly as a result of the collapse of masonry into the street due to the dismemberment of external architectural details and fall of roof tiles from unreinforced masonry (URM) buildings. In the south and south-west people died in greater quantities and concentrations as a result of the partial or total collapse of reinforced concrete (RC) buildings.



• Figure 5.1.  
L'Aquila earthquake  
population exposure map.  
Source: USGS

### 5.2 Methods

#### 5.2.1. Study Design

Two studies were organised that comprise the L'Aquila MICRODIS efforts. The main object of the study was to evaluate the social impact of the disaster on the population of Abruzzo Region in terms of their welfare over the immediate, short and medium terms. As the study needed interdisciplinary input from a variety of sources, the leader, Prof. David Alexander of CESPRO, the Centre for the Study of Risk and Civil Protection, University of Florence, created a consortium comprising Florence and L'Aquila universities and the Marche Polytechnic University at Ancona.

UNIFI Study Design:

For the University of Florence the research aims can be summarised as follows:

- to evaluate the seismic event in terms of mortality and morbidity, analysing the causes of death and injury in relation to the demographic characteristics of the people involved and possible correlations with the performance of the specific buildings in which they resided
- to study the emergency response, early and mid-term recovery phases of the disaster, by means of an objective evaluation of the quality of life of the survivors lodged in temporary accommodation, and eventually in transitional housing (special attention was given to the question of access to basic services)

The survey was designed to measure specific major elements in order to describe and classify each new settlement with respect to the adequacy of solutions adopted for temporal housing. It also addressed their direct and indirect effects on the resettled population's welfare as the aftermath of the disaster wore on. The observations were noted during a single visit to each residential site. A questionnaire was compiled from one personal interview per site addressed to new residents who were encountered during the visit. Their perceptions, views and opinions were personal rather than statistically valid for the entire community. The aim here was to establish the physical characteristics of the settlement (e.g. distance to services) but not to measure the consensus regarding satisfaction with them. Hence, respondents were selected by convenience sampling: the target of each interview could be an individual, a group or a family, providing there were beneficiaries of the C.A.S.E. and M.A.P. temporary housing projects.

The content of the survey is listed in the attached protocol. It referred to very specific features of buildings and public open spaces, as well as less tangible aspects, such as the environmental context, proximity to pre-existing settlements and linkage to the closest urban services. Observations included notes on:

- manufacture and material quality of building construction
- diversity of the settlement in terms of the number and typology of buildings
- number of households planned per settlement
- presence of recreational space for adults and children
- maintenance of public open spaces
- waste management
- distance and accessibility to the closest bus stop and frequency of transportation service, as listed on posted timetables or by the website of the local service.
- The ratio of built surface to public open space was estimated on the basis of available project plans and was considered as an index of quality for the social component of resettlement.

For each settlement, we sought additional information by means of questionnaires. For each questionnaire, we registered the type and name of settlement, number of male and female respondents, range of ages of those who participated in the interview, and judged level of reliability of the respondent. Using the subjective perception of the interviewer, the last of these criteria evaluated the motivation of the interviewee when participating in the survey, his or her apparent level of knowledge and awareness about the characteristics of the settlement and the level of partiality or partisanship shown, which, if present, could bias the answers.

The 29 questions were divided into three thematic sections:

- quality of transitional housing, including quality and state of maintenance of buildings, and perception of safety regarding earthquakes and other natural hazards
- level of provision of social and healthcare services
- accessibility to the closest available services and provision of public transport.

Most questions were evaluated according to pre-classified categories, such as ranges of distance or frequency, or by multiple choice. The only opportunity to answer freely was related to addresses or geographical data. For quantitative assessment of the service needs of the resettled population, the numerical values and pre-defined categories were used to obtain the indices specified in Part 2. Addresses were located by geo-coding using Yahoo and Google API.

During the personal interviews, remarks and criticisms spontaneously provided by the respondents were registered. General comments were specifically referenced to each site. These notes, of considerable value, were processed in order to provide qualitative assessment of social aspects not directly related to material elements, while at the same time striving to avoid bias and prejudice.

A preliminary analysis of answers obtained during the survey conducted between 25<sup>th</sup> and 27<sup>th</sup> September 2010 gave the opportunity to check the composition of the resulting unstructured sampling in terms of the number and typology of settlements, the demographic composition of the population sample (in terms of gender and age), and the level of qualitatively perceived reliability of answers in relation to the availability of different social services and facilities. This preliminary assessment helped estimate the possible level of bias in the declared level of feasibility and reliability of services under examination, used for estimating indicators of material elements that influence the well-being of the resettled population.

• **Table 5.2 Surveyed settlements by temporary housing typology**

Type of temporary h.	n. settlements
C.A.S.E.	16
C.A.S.E. + M.A.P.	3
M.A.P.	18

• **Table 5.3 Demographic composition of the convenience sample of the resettlement area population contacted through personal interviews**

Type of temporary h. Settlement	Male	Female	Min. age	Max. age
C.A.S.E.	12	11	15	70
C.A.S.E. + M.A.P.	1	3	40	68
M.A.P.	22	20	35	80

University of L'Aquila Study Design:

The principal objective of studies conducted by researchers from the University of L'Aquila was the evaluation of psychological resilience and quality of life in survivor populations lodged in the transitional housing of the C.A.S.E. (Complessi Antisismici Sostenibili ed Ecocompatibili - "Antiseismic Sustainable Ecologically Compatible Housing") and M.A.P. (Moduli Abitativi Provvisori - "Temporary Living Modules") projects. The Marche Polytechnic University studied the degree to which community cohesion was maintained and other aspects of the quality of life in the transitional housing, as well as to investigate the forms of injury sustained by people caught up in the disaster.

The survey made use of a shortened version of the Brief COPE questionnaire, which has in the past been used on cancer patients and hurricane victims (Carver 1997). It is designed to explore the ways in which people face up to stressful situations. Brief COPE is composed of 28 items, with dichotomous answers articulated on 14 scales. Coping is measured in relation to operability, self accusation, planning, containment, use of social support mechanisms, use of emotional support mechanisms, expression and focalisation of emotions, positive reinterpretation, acceptance, religion, humour, negation, negative behaviour, attention deficit and substance use.

The study enquired into the social, demographic and psychological dimensions of well-being. Some 15,500 people live in the C.A.S.E. housing in a total of 4,500 apartments that are 40 or 60 sq. m. in size. In the municipality of L'Aquila 1,273 units of the M.A.P. housing have been constructed. At the time of the survey 4,258 units of the C.A.S.E. had been assigned to a total of 14,474 people and 955 M.A.P. units had been allotted to 2,161 survivors. Of 16,635 inhabitants 288 were selected for survey by sampling them from the official list of housing beneficiaries. A questionnaire was administered to these people after they had been contacted at their homes and the purpose of the survey had been explained to them. Interviewees were guaranteed anonymity, and participation in the study was entirely voluntary.

Sampling used the probability-proportional-to-size method (Yates and Grundy 1953). The 'design effect' value used to calculate the sample size was 2.2, indicating a prevalence of post-traumatic stress estimated at 16 per cent, which is comparable with values for other central Italian populations surveyed after earthquake (Priebe et al. 2009). Sampling error was estimated as  $S=0.03$  and average cluster size was 3. This gave 96 clusters corresponding to family nuclei in transitional housing, which amounted to 288 individuals.

The survey made use of a shortened version of the Brief COPE questionnaire. It is designed to explore the ways in which people face up to stressful situations. It is composed of 28 items, with dichotomous answers arranged on 14 scales. Coping is measured in relation to operability, self accusation, planning, containment, use of social support mechanisms, use of emotional support mechanisms, expression and focalisation of emotions, positive reinterpretation, acceptance, religion, humour, negation, negative behaviour, attention deficit and substance use.

Data for the above analyses were collected in September and October 2010.

## 5.3 Survey

### 5.3.1 Preliminary Results

#### *UNIFI Study*

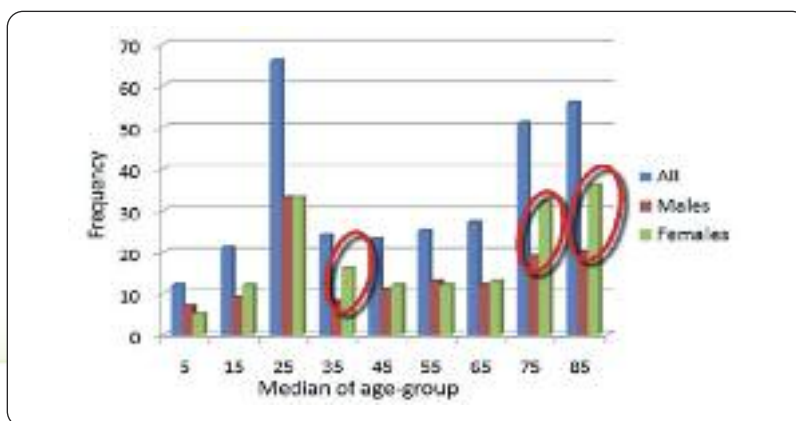
##### Mortality

The first analysis of mortality by age-group and sex, reported in Figure 5.4, indicates that the mortality is dominated by the age groups 20-29 years old and over 70 years old. Moreover an excess of females is visible especially in age groups 30-39 and 70-79 years.



• Damaged house in the heaviest hit area of L'Aquila

• Figure 5.4. L'Aquila earthquake mortality by age-group and sex.



The excess of females cannot be explained purely by demographics, as if mortality had followed the M/F and age-group distributions of the population, it would have been 168, not 308 as reported in Figure 5.5, assuming a fixed fatality rate of 0.05.

• Figure 5.5. Proportionality of deaths to demographic age-group.

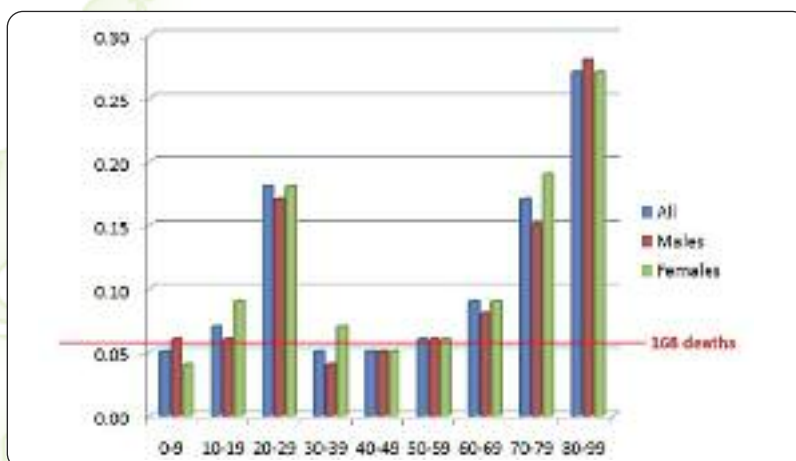


Figure 5.6 reports the male/female ratios of all earthquake victims (308 from all the 57 municipalities affected by the earthquake) and only from L'Aquila city (202 deaths).

• Figure 5.6. Male/female ratios of all earthquake victims and L'Aquila city victims.

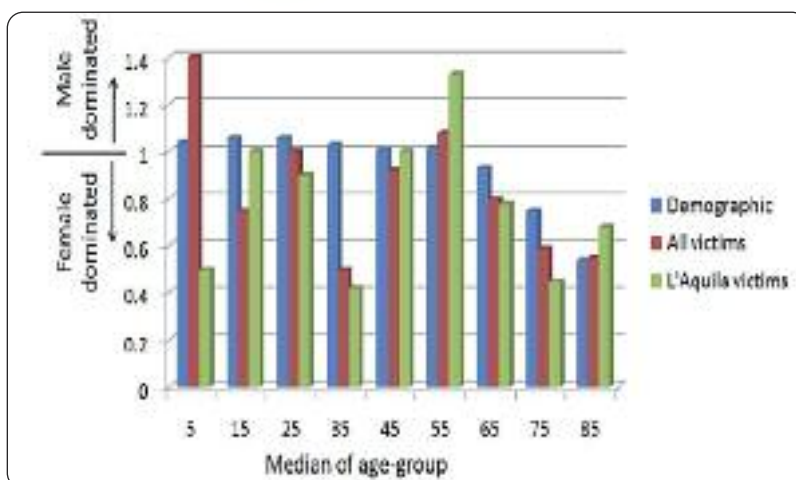
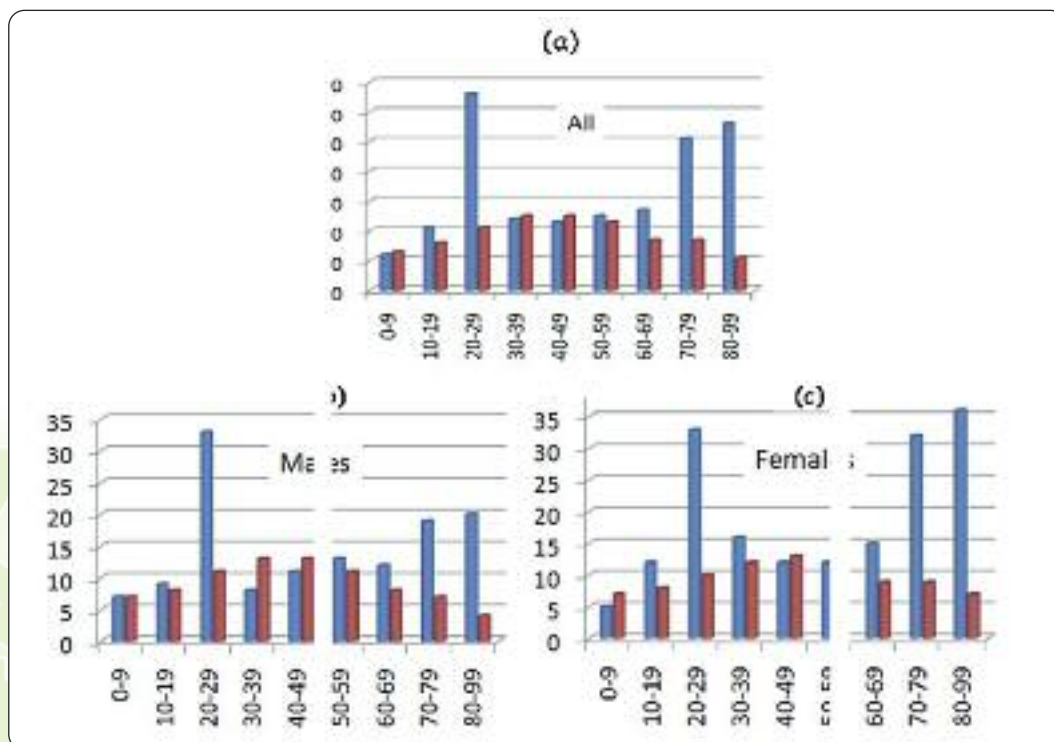


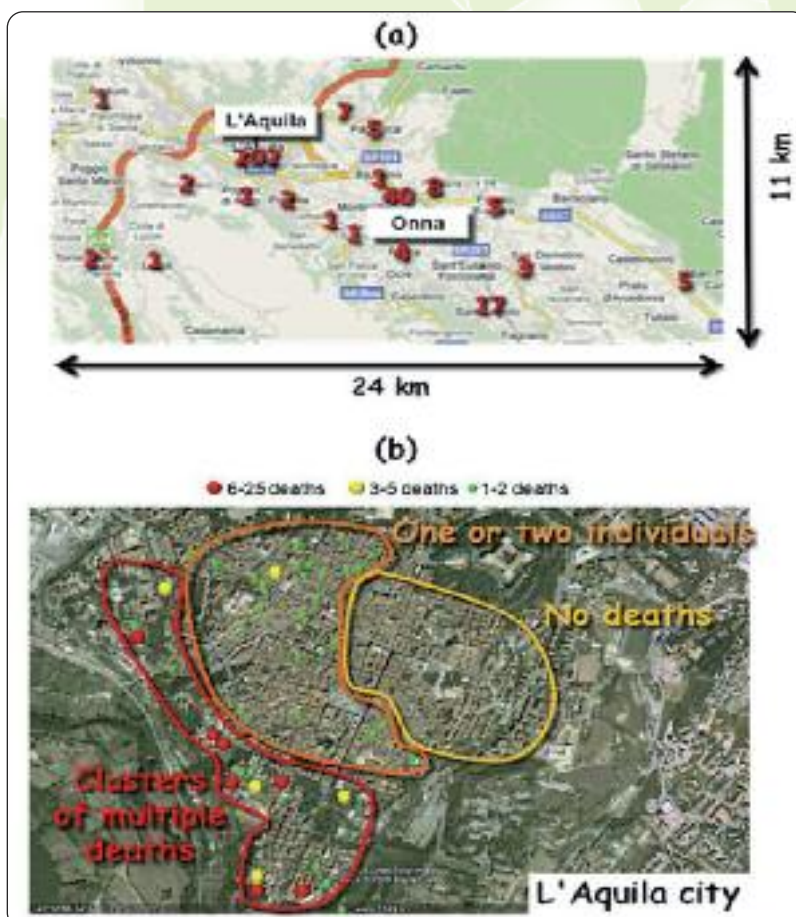
Figure 5.7(a), (b) and (c) show a comparison between the expected death tolls based on proportionality of age-group and sex (red) and the actual death tolls (blue).

- Figure 5.7. (a), (b) and (c). L'Aquila earthquake of 6 April 2009. Expected death tolls based on proportionality of age-group and sex (red) and the actual death tolls (blue).



By considering the distribution of deaths throughout the affected area (see Figure 5.8a) and in L'Aquila city (see Figure 5.8b) it is possible to see that one fifth to one quarter of deaths occurred in only seven buildings and that deaths were clustered in areas of topographic amplification and poor quality buildings. Apart from student housing, death clusters were not particularly differentiated by age group and the location of deaths corresponded closely with partial and total building collapse.

- Figure 5.8. L'Aquila earthquake of 6 April 2009. Distribution of deaths in (a) the entire affected area and (b) L'Aquila city.

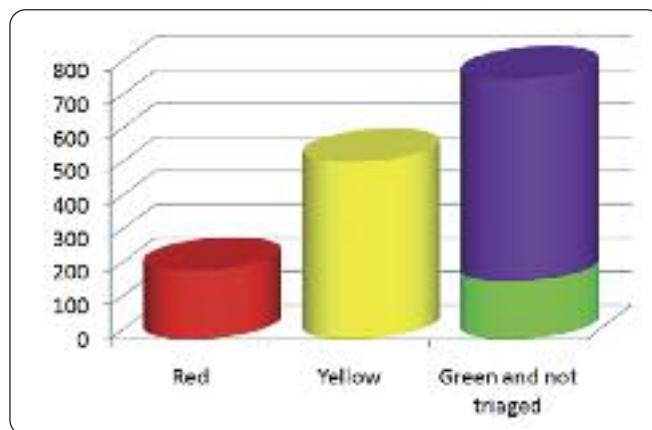


## Morbidity

By analyzing the number of injuries and their distribution according to the clinical severity (see Figure 5.9) it is possible to obtain the following ratios and compare them with the general trend.

- death/injury ratio = 0.20 – this index is lower than the expected index (circa 0.3 - 0.35 encountered during lethal earthquakes)
- case fatality rate = 0.17 (lower than normal: moderate seismic events like the L'Aquila earthquake often cause relatively low tolls of death relative to injuries)
- case fatality rates 0.41 - 0.60 for serious injuries (rather higher respect according to the general trend: this indicates a high chance of dying of serious injuries)
- ratio of serious to all injuries = 0.13 - (50-70 per cent of the expected value, which indicates a relatively large proportion of non life-threatening injuries).

• *Figure 5.9. L'Aquila earthquake of 6 April 2009. Distribution of injured patients.*



## Quality of life of temporary housing population:

Currently the most relevant indicators for the analysis have been defined as follows:

### I. Acceptance of the resettlement situation

Indices have been calculated for each C.A.S.E. or M.A.P. site.

A) Extraction from housing demand census: (each participant household was requested to rank its preferences regarding the location of C.A.S.E. sites):

- site preference: number of people who chose a particular site as one of its three most preferred localities
- most disliked sites: number of people who considered a particular site as the worst possible option (within the last 5 ranks).

B) Relationship between user requests and assigned houses

- extract comprising the families that were located in sites that were not their top choices. Analysis of:
  - Number of people in the household
  - Average age

### II. Settlement design quality

An index was calculated for each C.A.S.E. or M.A.P. site, on the basis of:

- total surface area
- housing density (household per unit area)
- percentage of public open space (landscaped green areas)

### III. Distribution of logistic facilities and services

Different weights were associated with each facility in order to evaluate their relative importance. These weights were evaluated differently for each of three classes of population:

- the elderly: the over 65s
- family: families with children;
- the young: teenagers (14-18 years old).

Table 5.10. below shows the scores associated with each type of facility for different class of population. The weights were normalised in relation to each class of population. From the combination of presence/difficult availability/absence of the facilities and services considered, as obtained through the interviews and site survey, and in relation to the weights applied, a logistic disadvantage index was determined for each settlement, taking into account the three class of population listed above.

• Table 5.10. **Relative weights for different categories of users - preliminary data.**

Name	Code	Weight			Normalised Weights		
		Elder	Family	Young	Elder	Family	Young
Bus stops	<i>Bus</i>	10	6	8	0.10	0.06	0.11
Pharmacy	<i>Farmacia</i>	10	10	4	0.10	0.11	0.06
Health services	<i>Ambulatorio</i>	10	8	5	0.10	0.08	0.07
Post Office	<i>Uff_postale</i>	10	6	3	0.10	0.06	0.04
Kindergarten	<i>Asilo</i>	5	10	0	0.05	0.11	0.00
Primary School	<i>Scuola_el</i>	5	10	0	0.05	0.11	0.00
Bar	<i>Bar</i>	10	3	8	0.10	0.03	0.11
Drugstore	<i>Alimentari</i>	10	10	8	0.10	0.11	0.11
Supermarket	<i>Supermercato</i>	10	10	10	0.10	0.11	0.14
Church	<i>Chiesa</i>	10	8	6	0.10	0.08	0.08
Community Centres	<i>Luogo_ritrovo</i>	10	8	10	0.10	0.08	0.14
Sports Centre	<i>Sport</i>	3	6	10	0.03	0.06	0.14
<b>Total</b>		<b>103</b>	<b>95</b>	<b>72</b>	<b>1</b>	<b>1</b>	<b>1</b>

#### IV. Socio-economic indicators: impact of the earthquake on the University of L'Aquila

The study revealed:

- variations in enrolment related to faculty, and age and sex of the students.
- Analysis of the geographical origins of the students: variation of students coming from different regions and geographical areas, attempts to estimate the impact of these variations on the local economy of L'Aquila.

##### University of L'Aquila Study

The analysis of data referred to 180 questionnaires completed by respondents. The results were compiled into a data base.

##### Socio-economic description of the sample population

The sample population was 44 per cent male and 56 per cent female, with a mean age for both sexes of 43 years. The occupations represented were: worker (62%), student or student-worker (18%), pensioner (6%) and unemployed (13%). The educational attainment of the people interviewed broke down as: 49% lower school diploma, 22% middle school diploma, 10% three-year degree and 19% four- or five-year degree. Some 77 per cent of the respondents lived in units of the C.A.S.E. project. The rest were accommodated in the prefabs of the M.A.P. project. Some 99 per cent were Italian citizens and only one family were foreigners, in this case from Macedonia. About 89 per cent of the interviewees stated that the most traumatic event they had lived through was the earthquake; 4 per cent said it was the death of a loved one, and 3 per cent cited serious illness.

##### POLYTECHNIC UNIVERSITY OF THE MARCHE REGION

The total number of people interviewed was 114, apportioned between the study locations listed in Table 5.11. The average age of the respondents was 50, with the youngest at 18 and the oldest 85. The most widely represented age range is 30-50, follow by 50-70 (Table 5.12).

• Table 5.11. Number of questionnaires collected in interested areas

Areas	Frequency	Percentage	Valid percentage	Cumulative percentage
Sant'Elia 2 (C.A.S.E.)	11	9.6	9.6	9.6
Sant'Elia 1 (C.A.S.E.)	4	3.5	3.5	13.2
Coppito 2 (C.A.S.E.)	9	7.9	7.9	21.1
Coppito 3 (C.A.S.E.)	12	10.5	10.5	31.6
Pagliare di Sassa (C.A.S.E.)	5	4.4	4.4	36.0
Bazzano (C.A.S.E.)	21	18.4	18.4	54.4
Cese di Preturo (C.A.S.E.)	14	12.3	12.3	66.7
Preturo (M.A.P.)	10	8.8	8.8	75.4
Pianola (M.A.P.)	4	3.5	3.5	78.9
Bagno (M.A.P.)	4	3.5	3.5	82.5
Tempera (S.Angelo) (M.A.P.)	1	0.9	0.9	83.3
Poggio di Roio (M.A.P.)	3	2.6	2.6	86.0
Sassa/Colle Sassa (M.A.P.)	12	10.5	10.5	96.5
Poggio Santa Maria (M.A.P.)	4	3.5	3.5	100.0
<b>Total</b>	<b>114</b>	<b>100.0</b>	<b>100.0</b>	

• Table 5.12. Respondents' age range

Age range	Frequency	Percentage	Valid percentage	Cumulative percentage
18-30	18	15.8	15.8	15.8
30-50	42	36.8	36.8	52.6
50-70	36	31.6	31.6	84.2
70	18	15.8	15.8	100.0
<b>Total</b>	<b>114</b>	<b>100.0</b>	<b>100.0</b>	

As is evident from Table 5.13, a slight majority of the interviewed people was male (53%). Table 5.14 shows that 57 per cent of the respondents were parents, 20% sons, 18% husbands or wives and only 4% were single. Generally, the households were composed by 3 or 4 people (25 and 32 per cent, respectively), while the single-person (3%), sex-person (1%), and seven-person (1%) households were less frequent (Table 5.15). In terms of schooling level, 51% of respondents had been to senior high school and 23% had graduated from university (Table 5.16). The vast majority (79%) of the respondents were Catholic, but 17.5% of them were unbelievers (Table 5.17). Among respondents, 41% had experienced the death in family members or friends, 4% had had relatives or friends permanent injured, and 50 % had not had these experiences (Table 5.18). A mere 6% of respondents had already experienced a disaster (Table 5.19).

In the following and aforementioned tables, frequency represents the number of respondents for the specified parameter analysed (e.g. location, age, gender...); 'Percentage' include the percentage on all answers; 'Valid percentage' excludes missing answers or "don't know" or blanks, and. cumulative percentage is the progressive sum of the valid percentage.

• Table 5.13. Respondents' gender

Gender	Frequency	Percentage	Valid percentage	Cumulative percentage
Male	60	52.6	52.6	52.6
Female	54	47.4	47.4	100.0
<b>Total</b>	<b>114</b>	<b>100.0</b>	<b>100.0</b>	

• **Table 5.14. Respondents' roles in the family**

Respondents role	Frequency	Percentage	Valid percentage	Cumulative percentage
Parent	65	57.0	57.0	57.0
Son	23	20.2	20.2	77.2
Husband	12	10.5	10.5	87.7
Wife	9	7.9	7.9	95.6
Single	5	4.4	4.4	100.0
Total	114	100.0	100.0	

• **Table 5.15. Family composition**

Number	Frequency	Percentage	Valid percentage	Cumulative percentage
1	3	2.6	2.6	2.6
2	25	21.9	21.9	24.6
3	29	25.4	25.4	50.0
4	36	31.6	31.6	81.6
5	19	16.7	16.7	98.2
6	1	0.9	0.9	99.1
7	1	0.9	0.9	100.0
Total	114	100.0	100.0	

• **Table 5.16. Respondents' education**

Education	Frequency	Percentage	Valid percentage	Cumulative percentage
Graduated from primary school	6	5.3	5.3	5.3
Graduated from junior high school	23	20.2	20.2	25.4
Graduated from senior high school	58	50.9	50.9	76.3
Graduated University	26	22.8	22.8	99.1
Other	1	0.9	0.9	100.0
Total	114	100.0	100.0	

• **Table 5.17. Respondents' religion**

Religion	Frequency	Percentage	Valid percentage	Cumulative percentage
Catholic	90	78.9	80.4	80.4
Buddhist	1	0.9	0.9	81.3
None	20	17.5	17.9	99.1
Other	1	0.9	0.9	100.0
Total	112	98.2	100.0	
Missing data	2	1.8		
Total	114	100.0		

• **Table 5.18. Injuries or deaths among family and friends**

Death or permanent injury	Frequency	Percentage	Valid percentage	Cumulative percentage
Permanent injury	4	3.5	3.5	3.5
Death	47	41.2	41.6	45.1
None	57	50.0	50.4	95.6
Other	3	2.6	2.7	98.2
Don't know/Forgot	2	1.8	1.8	100.0
Total	113	99.1	100.0	
Missing data	1	0.9		
Total	114	100.0		

• **Table 5.19. Respondents' disaster experiences**

Disaster experiences	Frequency	Percentage	Valid percentage	Cumulative percentage
Yes	7	6.1	6.1	6.1
No	105	92.1	92.1	98.2
N/A	2	1.8	1.8	100.0
Total	114	100.0	100.0	



• *Buildings turned into piles of rubble by the powerful earthquake.*



• *Collapsed building from the 2009 earthquake with one floor completely flattened.*

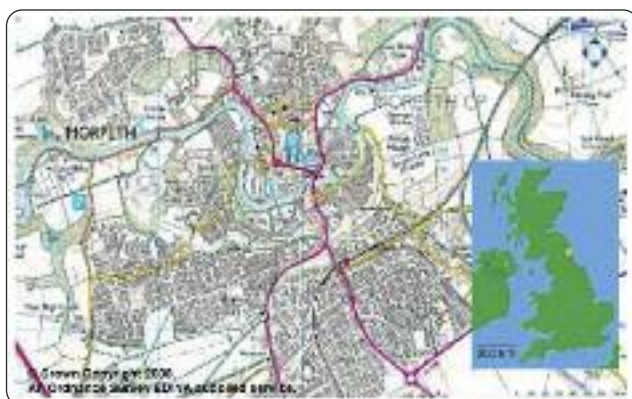
## 6. MORPETH, UK, FLOOD

### 6.1. Introduction

#### 6.1.1. Context

With the global increase in the number and severity of extreme events and in the number of people affected by disasters, disaster risk reduction and the development of resilient communities are now considered central priorities in disaster mitigation and management. Flooding events in the UK have the largest effect on the population, and implementation of the MICRODIS surveys was conducted at two UK sites, Tewkesbury in Gloucestershire and Morpeth in Northumberland (Figure 6.1). This section of the final report summarizes the process and findings for Morpeth.

• *Figure 6.1. Morpeth and its UK location.*



The increased occurrence of flooding and growing effects of the floods have demonstrated how ill prepared for and vulnerable to such events British communities can be. Widespread summer flooding in 2007 inundated 55,000 properties and caused billions of pounds worth of damage. Thirteen people died, and 7,000 had to be rescued. England currently has about 5.2 million properties (one in six) that are at risk from fluvial or coastal flooding. Climate change is anticipated to exacerbate flooding-related problems.

Morpeth, an ancient market town, lies within a loop of the river Wansbeck in northeast England, about 12 miles west of the North Sea. Its physical layout was established in the medieval period. The Wansbeck floodplain is about 100 to 300 m wide, and the town lies within this floodplain. The dominant soil types are slowly permeable and thus poorly drained and seasonally waterlogged, which leads to rapid runoff in winter. The area around Morpeth has problems with sediment accumulation for a variety of reasons, including drift geology and drainage into the flat, low-lying area around Morpeth. Rainfall averages about 740 mm but varies greatly by season.

The town lies in the county of Northumberland, which has a population of about 310,000. Of these, the Morpeth district is home to 49,000 and about 13,800 live within Morpeth proper in more than 6,300 households. Most households consist of one or two people, and the mean age in the town is 43.6 years. The population, which is almost completely white (99%), is aging, and a large proportion live on pensions. Nevertheless, Morpeth is one of the wealthier towns in northeast England and is a popular tourist destination.

#### 6.1.2. Disaster Background

Flooding is the only major disaster risk in the Wansbeck catchment area, and Morpeth is the main flood risk area within the catchment. Morpeth's apt town motto is *Inter Sylvas et Flumina Habitans* (Living amid the Woods and Waters), and flooding has been a regular occurrence in Morpeth since the town was first built because of its location and topographic and soil characteristics. Most floods in Morpeth occur in winter when the ground is already saturated and runoff increased. Summer floods can occur due to localized summer storm events directly over the catchments of the smaller tributaries of the Wansbeck in Morpeth town, which can cause localized flooding independent of the river levels of the Wansbeck.

After a 1963 flood event, flood defences were erected but could not be built in all parts of town because of opposition. These defences were in good condition at the time of the devastating September 2008 flood that is the disaster of focus for this study, thought to be a 1 in 115 year event in which the river poured over the defences. Additionally, the borough council and a number of other agencies engaged in awareness-raising activities and developed a flood action plan and recovery and restoration guidance document. Further, two multi-agency flood exercises were conducted in October 2001 and 2003 to prepare responders for a major flood event. A 2008 survey of public awareness, however, uncovered that only a minority of residents had made preparations for an emergency.



• Property damage from the Morpeth 2008 flood. Source: Judy Evans.

### 6.1.3. The Disaster in Focus

As noted, Morpeth experienced a severe flood on September 6 and 7, 2008, when river levels exceeded those of the 1963 flood. The flood was caused by heavy slow-moving storms, which gave the area one month's rainfall (up to 140 mm=200–300% of average September rainfall) in just 24 hours on a catchment already saturated because of greater than average rainfall during July and August. Furthermore, prolonged rainfall over Morpeth coincided with the arrival of the flood peak from the higher areas of the catchment, which had received prolonged overnight rainfall. Structural failure of Highford Weir upstream of Morpeth likely further increased the volume of water flowing downstream.

The Wansbeck River rose well above its banks and overtopped and damaged the town's flood defences. A peak water level of 3.99 m was recorded in the river channel, the biggest flow ever recorded in the Wansbeck. The huge volume of water also caused the drainage system to back up, contributing to the flooding of the town, while the substantial structure of Oldgate Bridge obstructed the flow of the flood waters in the river channel and exacerbated flooding of the town.



• The 2008 Morpeth flood. Source: Alex Bennett.

An error made by the Environment Agency warning system meant that 200 people did not receive flood warnings, although the Environment Agency issued 22 flood warnings and seven severe flood warnings and successfully reached over 500 properties on the 5th and 6th of September 2008. On average, residents reported a duration of between one and three hours between receiving the first flood warning and water entering their homes.

On September 6, 2008, more than 400 residents were evacuated. However, delays in initiating evacuation after the first warning had been received and the speed of the onset of flooding meant that many evacuation routes had already been flooded, hampering the speed of evacuation and increasing the risk of injury and death for residents and rescue personnel.

Overall, the flood caused direct damage to 1,012 properties, including 913 residential properties of which 615 were 'severely affected'. Many people were displaced and the economic damages were probably the greatest ever experienced in Morpeth.



• Morpeth in the 2008 flood. Source: Alex Bennett.

What remained to be elucidated were the socio-psychological and mental health effects of the event. Questions addressing these aspects were added to the MICRODIS core questionnaire. Further, the study also assessed the social capital of the community, characteristics such as social and political participation, social networks, and collective effectiveness.

## 6.2 Methods

### 6.2.1. Project Preliminaries

The Morpeth study built on two earlier MICRODIS studies. A pilot study was conducted in Morpeth, Northumberland, on November 25 and 26, 2008, and then the first full UK site survey was carried out in Tewkesbury January 4–23, 2009. Both studies were valuable as standalone studies but also contributed much to the Morpeth survey design in terms of practical experience and a better understanding of flood impacts in the UK context. The lessons learned during these surveys are reflected in the methodology and approach to the Morpeth survey.

### 6.2.2. The Study Design

The objectives of the UK field surveys were development, evaluation, and validation of data collection tools and entry system, and development of a UK-specific understanding of the health, social, and economic effects of flooding, especially social impacts. The study design relied on the two previous MICRODIS UK studies. While both are valuable stand-alone studies, the questionnaire adaptations made for the Morpeth pilot and then the Tewkesbury study were incorporated for the full Morpeth site survey. The UK Country Team, in association with the University of Northumbria, decided to contract an independent professional survey and research consultant firm, ECOTEC, to conduct the quantitative survey in Morpeth to free up more of the team's time for in-depth qualitative fieldwork and community engagement.

The Morpeth study did not include an independent control group survey. Instead, the team decided to use a cross-sectional design and categorize flood-affected survey respondents according to the severity of flooding of their homes during data analysis to account for differential impacts due to 'level of affectedness' of households.

In addition to the quantitative survey, the qualitative aspects of the Morpeth site survey included participation of MICRODIS researchers in flood-related community meetings, in meetings with the local flood action group, extensive contact and interviews with representatives from the flood action group and Environment Agency, interviews with mental health professionals, the operations director of the British Red Cross, and flood-affected residents for in-depth information gathering and, among the residents, to raise awareness and motivate further discussion. Some of these projects were completed as self-contained annex studies that are described elsewhere in this report.

#### 6.2.2.1. Site selection and sampling

Because flood disasters in the UK generally affect a relatively small number of households, in comparison to many disasters in developing-world contexts, a census approach to sampling was used for the Morpeth survey. Because the non-response rate for quantitative surveys in the UK context is relatively high, it seemed logical to approach all affected households. Moreover, a list of addresses of affected households in Morpeth could be obtained, which avoided the need for geographical sampling. However, during the Morpeth survey, it transpired that this address list was not complete, so further adjustments and additions had to be made to the list while the survey was under way.

#### 6.2.2.2. The survey

The Morpeth survey particularly focused on the socio-psychological factors and mental health impacts of floods, which had been identified as important in the UK context through the Tewkesbury survey data analysis. Thus, data collection tools for an integrated mental health study were developed in collaboration with the MICRODIS partner HealthNet TPO, the Netherlands, and added to the core questionnaire. In addition to this mental health study, the theme of social capital was extended to better capture the characteristics of the community (e.g., social and political participation, neighbourhood problems, collective efficacy, and social networks) and the importance of social relationships in mediating impacts of flooding on individuals, households, and communities, as well as to determine the impact that disasters, specifically flooding in the UK, have on those social relations.

Another adaptation was required for the European context. The economic questions from the MICRODIS survey that had targeted households in developing countries had to be altered to better fit the UK, including questions about credit card use and overdrafts.

### 6.3. Results

The survey covered 236 affected households for a total of 407 household members. Minimum respondent age was 18 years, but the average age of respondents was 66 years. The average age of all members in a responding household was 57.74 years. Families with children made up only 16% of the sample.

The major challenges of this effort were the non-response and some refusals to participate. Because of the short time between the flood event and the survey, some residents were not yet comfortable talking about their experiences. However, the completion of 236 questionnaires can be considered a solid achievement.

#### 6.3.1. Qualitative Findings

In addition to establishing the presence of MICRODIS researchers at and participation in flood-related community meetings with residents and public representatives (local authority, Environment Agency, police, fire and rescue service, water services companies, etc.), the team has conducted to date 28 interviews with flood-affected residents to attain in-depth information on various subjects (displacement, mental health impacts, insurance issues) and to raise awareness about the subjects discussed among participants and motivate further discussion within their immediate social environment. These efforts have contributed to raising social and disaster awareness and preparedness within the community.

The team also has disseminated information letters and MICRODIS leaflets to all identified flood-affected residents and project leaflets to unaffected residents, and attended or held meetings, discussions, and interviews with representatives of the local flood action group (Morpeth Flood Action Group) and representatives of the Environment Agency and local authority.



• Getting schoolchildren involved in the disaster discussion.  
Source: Joelle Yap.

Further anticipated or ongoing qualitative activities (e.g., the involvement of schoolchildren depicted in are a continued presence at flood-related community meetings, articles in the local newspaper to raise awareness about the MICRODIS project, and dissemination of project findings to Morpeth residents through an organized event at a central location that also gives residents the opportunity to voice concerns and discuss results. Indeed, this last activity is expected to contribute further qualitative information to the survey and provide feedback to the project team on how residents received the quantitative survey, as well as identifying concerns and issues that may not have been addressed by the questionnaire and that can be taken up through qualitative methods.

In addition, there will be dissemination of summary report to local authorities, Environment Agency, local NGOs and others with the expectation that this information will initiate and/or inform discussion among different groups and organizations and contribute to preparedness measures in the future that are more participatory and focused on residents' needs, thus enhancing community resilience.

The qualitative results are of great value in identifying concerns and issues important to households and the community and will help the UK Country Team to make detailed recommendations for the questionnaire content and local adaptations to the UK context and compare these to the methodology and findings of other European surveys. Furthermore, the qualitative fieldwork has been felt to be a valuable opportunity to study the social, health, and economic impacts of the flood that had been quantified in the questionnaire tool in more depth and to give further validation to the survey findings.

## 6.3.2. Quantitative Findings

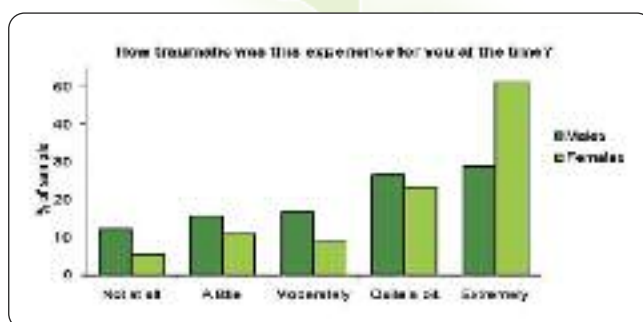
### 6.3.2.1. Health

The flood had a moderate impact on health. Only a quarter of respondents reported illness in the household resulting from the flood, most of them (75%) stress related (Table 6.2). Five people reported having sustained a physical injury, and another five reported that someone in the household had died because of the flood. All reported deaths occurred more than one month after the flood, in a hospital or health care centre, from the following causes: pneumonia (2 cases), heart attack (1 case), long illness (1 case), and blood poisoning (1 case).

• **Table 6.2. Most reported illnesses were stress related (64%).**

Reported incidences and types of illnesses (n=133)	Frequency	Percent
Fever	1	0,8
Diarrhoea	3	2,3
Acute respiratory tract infection	2	1,5
Skin infection	2	1,5
Cancer	3	2,3
Heart problems/angina	3	2,3
High blood pressure	4	3
Infectious disease	1	0,8
Insomnia	9	6,8
Feeling depressed	29	21,8
Feeling anxious	28	21,1
Stressed to an unusual extent	19	14,3
Other	19	14,3

• **Figure 6.3. Extent of trauma from flood, based on gender.**



The general mental health score of respondents at the time of the interview was significantly negatively correlated with the maximum depth of floodwater in rooms inside their property ( $p=0.001$ ). A large majority (93%) reported that the 2008 flood was their first and only experience of disaster, and 85% rated it as “very severe”. While 29% of men rated the flood as “extremely traumatic”, 51% of women did so.

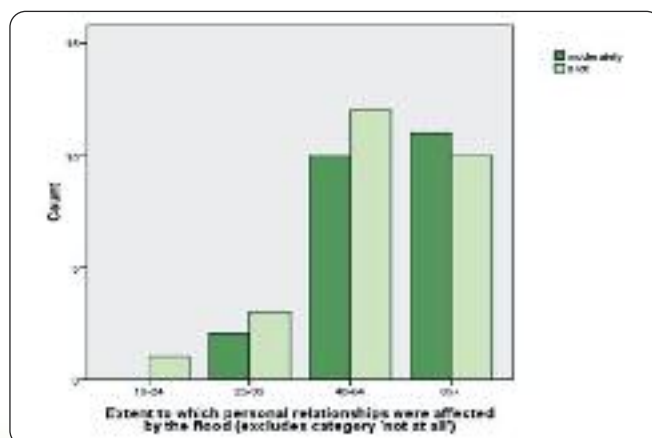
The data will also be investigated further with a view to the findings from Tewkesbury on the differential mental health outcomes and coping strategies used by men and women and the link between coping strategies and mental health outcomes. As noted, women rated the extent of trauma of the flood event more highly than men ( $p=0.008$ ) (Figure 6.3), which may indicate similarities with the Tewkesbury findings (section 9). It would be a valuable confirmation of the Tewkesbury findings if similar observations are made in Morpeth.

### 6.3.2.2. Social

The effect of the flood on social factors was limited. Most respondents reported no effect on contacts with other people, although a few did describe an effect on their social relationships (Figure 6.4). A minority (16% of women, 9% of men) reported increased social contacts because of the flood, while 11% in total reported some impact—either positive or negative—on personal relationships in the form of increased

family support (positive) or increased family arguments (negative). Stress from the disruptions of leaving home and disruptions of daily and work life were rated as having been more serious than the stress of the flood itself. A large percentage of households (81%) were displaced; 98% of these had a temporary displacement, while the remainder experienced permanent displacement.

• *Figure 6.4. Effect of flood on personal relationships.*



In terms of community factors, almost all respondents reported that their neighbourhood was a good place to live, and 83% viewed themselves as a part of their community. In spite of this latter, the group scored low overall on structural social capital (i.e., voluntary association membership), yet scores were still relatively high for sense of community and social cohesion. Scores for cognitive social capital and collective efficacy were a little lower but still above average.

A total of 59% of respondents sought help after the flood, many from family and friends. For many, their friends, family, and neighbours were a major source of support and continued to be so. The Red Cross and Lions Club, both NGOs, were also often mentioned as sources of support.

Half of the women and just under a third of the men reported the flood as having been extremely traumatic, but more than half of respondents also reported that they thought they were able to cope pretty well. The same percentage of respondents (53%), however, also thought of themselves as victims of the flood to a considerable extent. Based on the responses, coping was passive for many responses, and average scores for the different coping mechanisms were low overall. Social support proved to be most important, while religion was the least.

The flood warning system did not work without error during this flood, and 48% of respondents reported having received a flood warning. Of these, 89% received it before the flood and 11% during it. Most warnings came via the Environment Agency. The average time between the warning and water entering the home was 3.4 hours, with a minimum of 3 minutes and a maximum of 15 hours.

There are indications of differences in flood experience and flood impacts between respondents who had received a warning (n=112) and respondents who had not received a warning (n=124). These relationships will need further systematic analyses to determine whether any of them are statistically significant. The UK team is very interested in exploring this further and also in comparing the differences in disaster impacts and experience between these groups to other MICRODIS survey country data.

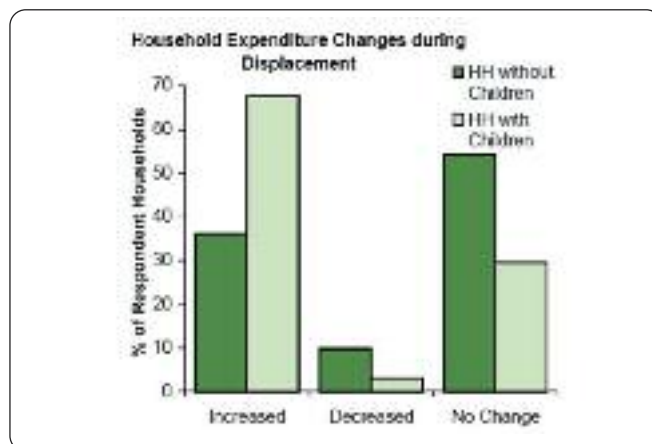
Following the event, 41% of respondents in the MICRODIS survey expressed a willingness to pay toward a flood defence scheme through increased earmarked taxation to avoid physical damage to their homes. Another 39% stated a willingness to do so to avoid the stress and hassle a flood can cause. Willingness to pay towards a flood defence scheme differed significantly ( $p=0.021$ ) by the amount of building damages respondents experienced.

### 6.3.2.3. Economic

Regarding economic impacts, the mean annual household income before the flood was only slightly higher than the mean after the flood (£19,845 [31,289 US\$] before vs. £19,778 [31,188 US\$] after). Only 7% of respondents reported that the flood had affected a household's occupation, and of these households, 74% said that their occupation had recovered to a high or very high extent.

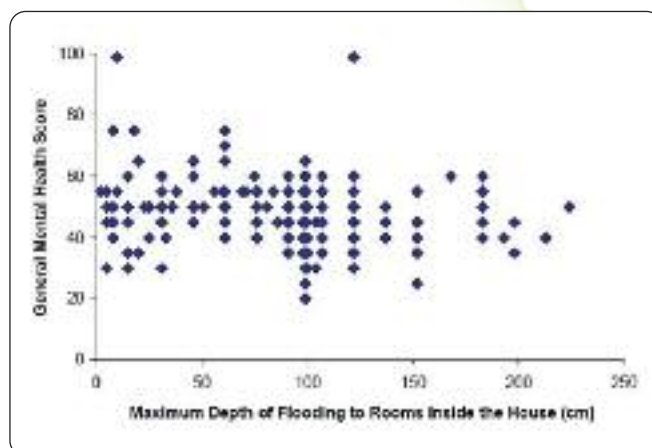
The presence of children in the household appeared to influence the economic impact of flood for displaced households, with households with children experiencing significant changes in household expenditures ( $p=0.003$ ) (Figure 6.5).

• **Figure 6.5.** Changes in household expenditures relative to the presence of children.



Respondents were asked what would be the minimum amount to compensate for their flooding-related losses, and an average figure of £35,318 (55,693 US\$) was the outcome, almost twice the mean annual income. The losses rated as being most serious were damaged household goods and furniture, followed by damage to the value of the home and personal items and damages to the building structure. Most (69%) ultimately stated that the flood had not affected their economic position, and a very small minority (2%) stated that it had improved. About one half and one quarter of respondents, respectively, received financial and material support after the flood, including insurance payments and smaller payments from a flood fund and some material support from entities like NGOs. Respondents on higher incomes disagreed significantly more often with the statement, “People who had better connections with powerful people got more support”, than people in lower income ranges ( $p=0.001$ ).

• **Figure 6.6.** Inverse correlation between mental health score and flooding depth in the home.



Respondents reported that they were on average flooded to a mean depth of 87 cm, and 23% of the sample had no flooding of rooms inside their property. There was a significant correlation between mental health score and the depth of flooding ( $p=0.001$ ) (Figure 6.6).

## 6.4. Conclusions

The UK team’s extensive community engagement has led to considerable interest among residents in the MICRODIS study site. Many residents have expressed their interest in participating in qualitative activities, which is a significant achievement as well as a challenge in terms of accommodating and following up on this interest. The UK team was able to build good rapport with residents and other groups, which has contributed to a better understanding of the background of the disaster and has enabled the team to observe and continue to observe the lengthy recovery period much more closely.

Indications based on the data are that respondents who had and who had not received a flood warning differed in their experiences and in how the flooding affected them. The UK team expects to focus in more depth on this aspect. Also requiring further investigation will be mental health outcomes and coping strategies relative to gender. In the Tewkesbury study, women rated the extent of trauma from the flood event there higher than did men, and the MICRODIS Morpeth survey team expects to explore indications that this was also the case for Morpeth.

## 7. ORISSA, INDIA, FLOOD

### 7.1. Introduction

#### 7.1.1. Context

Orissa, a state located on the east coast of India (Figure 7.1), has a population of 36.8 million. Along the coastal alluvial plain, the dense population consists primarily of non-tribal speakers of Oriya, the official state language, while the indigenous peoples, the Adivasis, inhabit the hilly, mountainous interior. This state is the poorest of the 14 major Indian states, with 17.35 million people living below the poverty line.

The state has the lowest social and human development indicators in the country; for example, the infant mortality rate is 87 per 1,000 live births, compared to a national average of 63 per 1,000. Its low ranking does not necessarily derive from a lack of resources but instead from poor management related to delivery systems, decision making, and policy making. Progressive programmes often have little effect in Orissa because of a lack of accountability and an absence of social mobilization.

The focal MICRODIS survey site in Orissa is the Jagatsinghpur district (Figure 7.2), which lies 14 m above sea level and covers about 1913.6 square miles, 132.92 square miles of which is forest. This district has good connections via road and roadways, and four main rivers flow through it: Devi, Mahanadi, Kathajodi, and Biluakhai. Two main canals also transect the district, the Taladanda and Machhaon. Eight administrative blocks make up the district, with a total population of 1,139,126, about equally divided between males and females. Most of this population is rural, and the total number of households is 223,530.

The economy of Jagatsinghpur district relies primarily on agriculture, and its key crops are paddy, sugar cane, turmeric, and cotton. Other economic contributors are fishing, processing, manufacturing, handicraft, and daily wage work. There is a substantial service sector.

The district infant mortality rate is 55.3 per 1,000 live births while the child (1–5 years) mortality rate is 61.2. These are, however, government figures and the reality is much worse, with widespread morbidity from diarrhoea, skin infection, malaria, tuberculosis, dysentery, and parasitic infection, among others.

The entire geography of the Jagatsinghpur district is coastal plain land with network of rivers and canals. The survey blocks all lie near the Bay of Bengal. Three of them are particularly disaster sensitive: Ersama, Kujanga, and Tirtol. The other two, Balikuda and Biridi, also experience high-intensity disasters: the 1999 super cyclone and a gas leakage from Paradeep Phosphates Ltd., and in 2001, 2005, 2007, and 2008, heavy floods, the last of which caused massive devastation and unprecedented damage.

In each of these events, those at the lower socioeconomic levels also were those who lived in the areas most vulnerable to these disasters. The worst affected were people living in poverty, households headed by women, people with physical challenges, pregnant women, the elderly, and children. In spite of this fairly regular series of devastating floods, there is still a lack of necessary infrastructure such as embankments or areas for dams or storage, and the situation continues to worsen.

#### 7.1.2. Disaster Background

India is among the world's most disaster-prone areas. It is vulnerable to windstorms originated from the Bay of Bengal and the Arabian Sea, earthquakes caused by active crustal movement in the Himalayan mountains, floods brought by monsoons, and droughts in the country's arid and semi-arid areas.



• Figure 7.1.  
Map of Orissa.



• Figure 7.2.  
Jagatsinghpur district.

These hazards threaten millions of lives and cause large-scale financial, infrastructure, crop, and productivity losses that hinder India's development. In the decade 1990–2000, an average of about 4,344 people lost their lives and about 30 million people were affected by disasters every year. Because of its subtropical littoral location, Orissa is prone to tropical cyclones, storm surges, and tsunamis. Its densely populated coastal plains are the alluvial deposits of its river systems. The rivers in these areas with a heavy load of silt have very little carrying capacity, resulting in frequent floods, compounded by breached embankments.

As noted, the Voluntary Health Association of India (VHA) took Jagatsinghpur district in Orissa as one of the survey sites under MICRODIS. For the convenience of administration, the district is divided into one subdivision, four tehsils, and eight blocks.

In 2008, the district was struck by a flood of very high intensity that caused massive devastation to a large number of populations and affected a larger geographic area. The vulnerability of the district as well as the blocks was clearly observed during the last super cyclone and consecutive floods.

### **7.1.3. The Disaster in Focus**

The flood in Orissa in September 2008 resulted from heavy rainfall in the upper as well as lower catchments of the Mahanadi River system that came from a deep tropical depression in the Bay of Bengal. Massive and unprecedented damage was caused to public properties like canal/river embankments, roads, bridges, culverts, drains, water works, tube wells, lift irrigation points, electrical installations, telecommunications infrastructure, and government buildings.

In the Jagatsinghpur district, all the blocks were affected by the flood, with 61 GPs, 188 villages, and 147,427 people severely affected. The preliminary report showed that 8,072 houses were completely damaged in the flood. The magnitude and severity of this flood surpassed even the ferocities of both the 1982 and 2001 floods, previously known to be the greatest floods in the system.

## **7.2. Methods**

### **7.2.1. Project Preliminaries**

Before widespread deployment, a set of MICRODIS core and thematic core questionnaires was tested in June 2008 among 32 families. A second pilot was conducted in November 2008 among 45 families. Of this latter group, 21 who responded were female. The 11 interviewers had undergone a one-day orientation before moving into the field for the surveys. Based on feedback from this preliminary process, the questionnaire underwent some modifications to better facilitate the survey.

### **7.2.2. The Study Design**

The MICRODIS project model calls for improving human resources and coping capacities through training and knowledge sharing. To meet this goal, the Orissa project focused on analyzing the effect of the flood of 2008 on social, economic, and health endpoints. Further, the project homed in on a vulnerable community in the Jagatsinghpur district of Orissa to assess the effect of repeated disasters on coping mechanisms in that population. Because of the frequency of disaster events in Orissa, another objective was to develop and refine impact assessment models in the context of frequent extreme events. The MICRODIS study to examine health, social, and economic impacts of this flood was done from November 2008 to January 2009.

The research design for this study was exploratory and concurrently collected data using qualitative and quantitative methods. The approach involved exploration of the literature related to the study and compilation of views from different sets of respondents.

The specific objectives of the research were to develop and integrate concepts, methods, tools, and database towards a common approach. Objectives were as follows: assessment and evaluation of social, economic, and health impacts of the Orissa flood in September 2008; analysis of the impact of repeated disasters and their effect on coping mechanisms of the vulnerable community in Jagatsinghpur district of Orissa; validation and strengthening of the relationship between extreme events and their social, health, and economic impacts on an affected community; refinement and development of impact assessment models in considering frequent extreme events; reviewing related literature on disaster impact and integrated vulnerability assessment; and establishment of scientific and empirical tools and applications in terms of disaster management from people's perspective.

Qualitative research methods included focus group discussions, key informant interviews, social mapping, and other methods to identify and build theories to explain the relationship between variables through qualitative elements in research.



• Social mapping exercise.

#### 7.2.2.1. Site selection and sampling

Following training, the enumerators visited their respective assigned villages and began organizing awareness programmes through meetings of opinion leaders and members of local Panchayatraj institutions and through large group discussions. As noted, the focus of this project was health and nutrition, so village health workers, workers who were Accredited Social Health Activists, and Anganwadi workers in the community formed an integral part of these discussions. Enumerators also began formulating lists of families and numbering and choosing households for the survey, with very active participation in the process from the local community. After four days of these preparations and awareness campaigns, the genuine interview and anthropometric measuring in the field began.

The probability proportion to size method was used to draw the sample. This sampling technique is commonly used in multi-cluster sampling, in which the probability that a particular sampling unit will be selected in the sample is proportional to known variables. The team adopted this method to reduce standard error and bias and avoid weighting.

#### 7.2.2.2. The survey

The MICRODIS integrated questionnaire was translated from English to Oriya (the local language) by the VHAI team. The Oriya version of the questionnaire was then translated back into English without translator access to the original English version. The two versions of the questionnaire in English were then compared to isolate inconsistencies and differences in meaning between them. Then the whole team met together, and the differences were resolved in detailed discussions.

After translation and back translation, a cultural adaptation phase was conducted involving a group of 11 community members. The principal investigator of the study started discussing the questionnaire and presented types and examples of cultural equivalence, which helped in revising some of the questionnaire, including replacing problematic items with culturally accepted ones. To evaluate the language used in the instrument and the structure adaptation, the questionnaire was once again discussed with these 11 community members. Some items were adjusted to clarify questions resulting in the final version in Oriya.



• VHAI enumerator interviewing a survey respondent.

A total of 757 respondents from the test group (exposed to flooding) and 816 from the control group (not exposed) were ultimately involved in the survey process. Furthermore, members of respondent families under age five years were measured for determination of nutritional status. The study also covered 42 health institutions with a structured questionnaire to assess the institutional delivery mechanism in a disaster situation.

### 7.3. Results

The entire process was a participatory one at all levels. The VHAI research team involved the government at the block and district levels, closing the gap between the community and the government in the process. The community provided feedback at many stages of the process, suggesting more effective methods of data collection so that throughout, the community owned the process completely.

#### 7.3.1. Qualitative Findings

For the qualitative portion, 22 focus group discussions were organized, 13 in areas exposed to the 2008 flood and nine in unexposed areas. To encourage active participation, the groups were kept small at approximately 10–15 members, and group members were relatively homogeneous. Two facilitators conducted each group discussion; one facilitator moderated while the other took notes. The moderator used a guided questionnaire covering the thematic issues. All discussions were recorded on video camera with the consent and knowledge of the participants, and the notes were elaborated and cross checked using the video recording. Each discussion lasted about 1 to 1.5 hours.

In almost all cases, people participated with great interest and shared their practical experience, often suggesting effective solutions to combat the problems discussed. Accompanying several of these discussions, the group engaged in a participatory activity that included such topics as the seasonal cycles and food availability, flood warning systems, and identifying areas of flood vulnerability.

Some of the major issues addressed during these discussions were people's perceptions about the causes of flood, the effects of flood on the economy, displacement and migration resulting from flooding, sanitation and hygiene issues, self help and coping, and flood warning systems and response.

Regarding the causes of flood, the discussions revealed a solid awareness among the people of the contribution of season, weak embankments, deforestation, and erosion to flooding, and participants recommended more community cooperation at all levels to combat the effects of floods. As would be expected, discussions showed that the floods affected the economy, and participants agreed that shifting agricultural practices to focus on traditional seeds and seedlings that are resilient to floods and expanding livelihood options would be suitable steps. Indeed, a factor that emerged in the displacement and migration discussion was the emigration of young people in particular to look for work elsewhere, leading to participant suggestions that the government seek ways to create local employment opportunities.



• PRA exercise with women, discussing seasonal impact on nutrition.

A big issue was sanitation and hygiene, including clean drinking water. Few households in the community have toilets, and the village open sewage system also serves as a garbage dump, interfering with its drainage. Much bathing is done in the open, preventing proper cleaning, and the use of soap for handwashing is limited, as is boiling water for drinking. Group participants suggested that one way to address these issues is installation of toilets in every household, ensuring adequate drinking water supplies, and enhancing community awareness of good hygiene practices.

Group discussions showed that the women in the community maintain a number of self-help groups that include promotion of income-generation activities, although better low-interest loan programs for such activities would be beneficial. Further, coping mechanisms related to indigenous knowledge were emphasized, and the groups indicated a need to renew understanding of such practices as cultivating paddies that can help withstand floods, instead of the newer variety of paddy that yields more crop but is not flood resilient.

Focus group discussion also revealed that warnings for the floods were adequate and provided a clear message for the community, but also that few people took any measures to escape the flood. The general consensus was that people did not think the extent of the flood would be as severe as the warnings stated. The group participants suggested that whenever evacuation is needed, it should be coordinated at the district level and enforced.

### 7.3.2. Quantitative Findings

It was evident from the study that there were fewer female members than male members in the families in the survey. In the age groups 0–5 and 6–14, the declining trend of female children was clear, indicating that boys are preferred to girls. Nevertheless, the female members in the age groups 18–30 and 31–45 were the respondents in many cases because they were more educated and exposed to the community.

The severity of flood was rated as very high (Table 7.3). People living in the flood-prone area with agriculture as their main occupation suffered significantly during this flood.

• Table 7.3. Residents' perceptions of disaster severity.

Type of Natural Disasters	Scale of severity							
	Severity-1 (Very Severe)		Severity-3 (Moderate)		Severity-4 (Not severe at all)		TOTAL	
	No.	%	No.	%	No.	%	No.	%
Flood (2008)	642	84.7	113	14.9	3	0.4	758	100.00
Flood (2006)	12	1.58	143	18.87	603	79.55	758	100.00
Cyclone (1999)	751	99.08	7	0.92	-	-	758	100.00

In the quantitative study, a comparison was made among three disasters: a cyclone in 1999, a flood in 2006, and the flood in 2008. A large number of the respondents had experienced more than two or three disasters, while some had experienced more than five disasters. Every respondent had experienced multiple disasters in the last decade, with 85% reporting having experienced severe flooding that seriously affected their livelihoods. A total of 33% of respondents reported having been displaced by the flood.

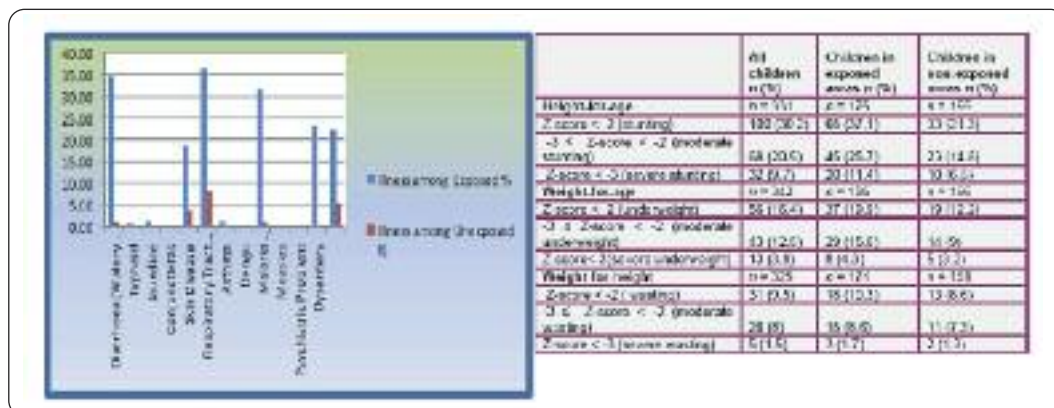
Because social, health, and economic effects were not perceived as discrete, VHA integrated the collected data for analysis.

#### 7.3.2.1. Health

The flood immediately multiplied the health burden of the affected community. The study of 42 health institutions showed that authorities tried to meet extraordinary demands with resources that cannot begin to meet even basic health needs and that often had been drained by the immediate emergency response. There was an increase in the number of hospital visits due to diarrhoeal diseases, acute respiratory infections, dermatitis, and other causes. Also, the transmission of vector-borne diseases from residual water that contributed to an explosive rise in mosquitoes led to malaria and Chikungunya fever.

Because of poor sanitation awareness, most people preferred resorting to open defecation before the disaster, and this practice increased in the post-disaster period. Lack of interest, awareness, and the traditional mindset at the individual level were the major causes behind this preference. Thus, many respondents reported experiences with diarrhoea, malaria, Chikungunya, and respiratory infections due to water contamination and poor hygiene (Figure 7.4). Apart from this, the other common diseases seen were dysenteries, typhoid, jaundice, conjunctivitis, skin infection, asthma, measles, and psychiatric diseases in the post-disaster situation. Some also suffered from cancer, leprosy, pulmonary tuberculosis, anaemia, and stroke.

• **Figure 7.4.** Main acute illnesses experienced after the flood.



• **Table 7.5.** Data on prevalence of factors related to malnutrition among children ages 6 to 59 months.

	All children n (%)	Children in exposed areas n (%)	Children in non-exposed areas n (%)
High maln. age	n = 111	n = 124	n = 145
Z-score < -2 (severe)	182 (36.2)	65 (52.1)	33 (21.3)
-3 < Z-score < -2 (moderate)	58 (20.6)	45 (36.7)	23 (14.6)
Z-score > -2 (mild)	32 (6.7)	20 (11.4)	10 (6.1)
Weight for age	n = 112	n = 126	n = 146
Z-score < -2 (severe)	58 (16.4)	27 (19.3)	19 (12.2)
-3 < Z-score < -2 (moderate)	43 (12.0)	29 (15.8)	16 (9.6)
Z-score > -2 (mild)	11 (3.8)	8 (4.9)	5 (2.2)
Weight for height	n = 125	n = 125	n = 158
Z-score < -2 (severe)	51 (24.5)	35 (28.1)	13 (8.6)
-3 < Z-score < -2 (moderate)	28 (15)	15 (12.0)	11 (7.3)
Z-score > -2 (mild)	46 (18.5)	33 (26.9)	21 (13.1)

Malnutrition among children ages 6 to 59 months was higher in flood-affected households (Table 7.5). It has been established that nutrition has a direct correlation with the persistent disasters.

Post-disaster health costs were a huge issue. Overall, respondents reported spending five times more on such costs after the disaster, with worsening water and sanitation conditions being a major driving force. Of the respondents, 71 % did not have a toilet, and 455, 855, and 1,053 suffered malaria, diarrhoea, and fever, respectively, in keeping with what was observed in health camps organized after the event.

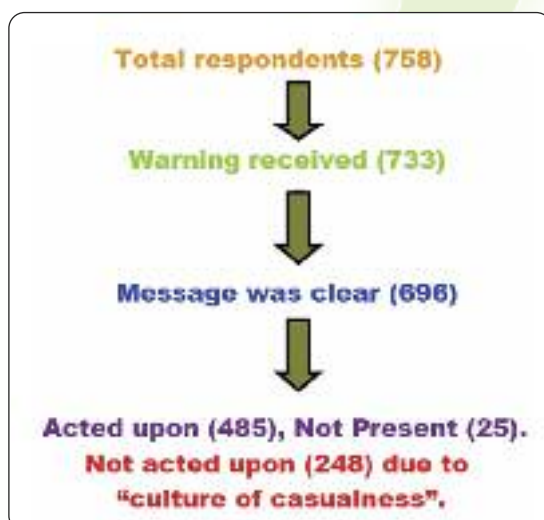
The need for mental health care was present in the total population that experienced the disaster. Although there was a direct correlation between the occurrence of psychiatric problems and the degree of exposure, even those who lived in the disaster area and experienced comparatively less loss were vulnerable to psychiatric problems. This finding suggests that services should be provided to the total population and not only to those who have lost a family member or a significant amount of property.

### 7.3.2.2. Social

The study showed that social impacts, which include psychosocial, socio-demographic, socioeconomic, and socio-political impacts, can develop over a long period of time and can be difficult to assess. But these factors are important because they affect not only the long-term functioning of the households and but also their livelihoods. The study emphasized the need for understanding the social impacts of disasters and development of contingency plans to prevent emergency consequences.

Of 733 respondents, 701 appeared to clearly have received a warning about the disaster. Yet, only 485 took specific preventive action before the disaster struck (Figure 7.6), indicating that people generally take a casual approach to such warnings. Thus, because of a lack of a culture of preparedness, the community did not make the move to safer places. In this area, people tend to perceive flood disasters as periodic phenomena and that if a major flood disaster occurs in a certain year, no major flood disasters will occur for some time after. In addition, many people believe that when embankments, dams, and other structures are newly constructed, floods are completely prevented. These perceptions of the people about natural disasters affect the culture of preparedness in the area.

• **Figure 7.6.** Culture of casualness and response to flood warnings.



• Figure 7.7. Perception of trauma related to the disaster.



As might be expected, during a disaster, people felt insecure about their survival. They were not prepared to face the sudden occurrence of the extreme event, but disaster coping mechanisms varied. Almost half of the respondents (48%) reported that the disaster was very traumatic and that coping with it was difficult.

The flood was an extreme event of trauma for many respondents (Figure 7.7), and people used their religious beliefs as a coping strategy. In the post-disaster situation, people received mutual support from the family and outside. The support received from spouse, children, and relatives was of immense help in coping with the post-disaster trauma. The support received from government and NGOs in various forms also helped people recover from their condition. As the table in Table 7.8 indicates, the degree of resources available to cope with the situation was negatively correlated with the perception of the stressful situation.

• Table 7.8. Correlation between trauma and coping.

		Traumatic Experience	Degree of Coping
Traumatic Experience	Pearson Correlation	1	.072*
	Sig. (2-tailed)		0,046
	N	758	758
Degree of Coping	Pearson Correlation	.072*	1
	Sig. (2-tailed)	0,046	
	N	758	758

\* Correlation is significant at the 0.05 level (2-tailed).

Interpretation: Degree of coping negatively influences the traumatic experience. The above table that the degree of resources available to cope with the situation is negatively co-related to the perception of the stressful situation.

### 6.3.2.3. Economic

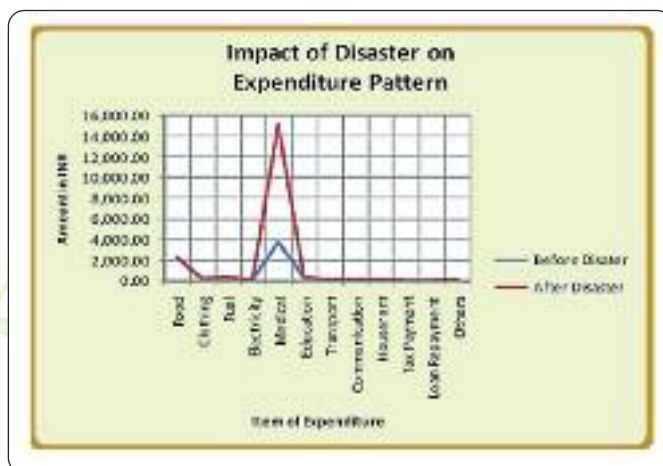
Of 758 respondents, 581 reported inadequate food availability post disaster, describing having skipped meals or choosing cheaper options. Some respondents (133) had taken a loan, usually from self-help groups. Following the disaster, 50% of respondents reported being somewhat satisfied with the material and service report they received, while only 5% reported satisfaction with financial support.

The property damage caused by the disaster impact resulted in direct economic losses, some of which were not replaced. Thus, these losses caused a reduction in consumption and a decrease in the quality of life. In addition to direct economic losses, there were indirect losses that arose from the interdependence on community networks. The flood caused massive loss to the standing crop, and most of the agricultural lands were inundated due to gushing of flood water, affecting the primary occupation of farmers.

Most of the respondents were of the view that their economic condition had worsened after the disaster. Very few people had an improved economic condition after the flood, indicating that respondents in the latter category did not share the same livelihood pattern and socioeconomic status or that their livelihood/trading was augmented by disaster.

The major portion of expenditure was food and medical (Figure 7.9). Expenditure for education came second, followed by clothing, fuel, transport, communication, electricity, and rent. Least were the expenses for tax payment, repayment of loans, and life cycle rituals. Expenditures for fuel, medical, transport, communication, and repayment of loans increased notably after the flood. To meet these

• *Figure 7.9. Disaster impact on expenditure patterns.*



expenditures, people curtailed their expenses on clothing, electricity, and education in the post-disaster period. However, because of price hikes and added burdens on the household, expenditure remained almost the same. The data also indicated that medical expenditure rose drastically, i.e., by 5 times, during the post-flood period in comparison to the pre-flood period.

Before the flood, the highest income of the respondents was from the service sector followed by daily wage labour. Agriculture was another major source of income for the people in this area. In the post-flood period, there was a drastic decrease in income in terms of agriculture and industrial activity, but income from daily wages increased because there was the need for repair and recovery in the affected areas.

Many respondents expressed a willingness to participate in a government flood prevention program. Among respondents unwilling to participate, the primary reason was disgust with what they perceived as corruption.

#### 7.4. Conclusions

The results of this study show that a public health approach to disaster risk management should focus on decreasing the vulnerability of communities through prevention and mitigation measures and increasing the coping capacity and preparedness of the health sector and community. The study also highlighted that a community's vulnerability to all types of disasters depends on demographic growth, the pace of urbanization, settlement in unsafe areas, environmental degradation, climate change, and unplanned development. Poverty also increases vulnerability because of the lack of access to healthy and safe environments, poor education and risk awareness, and limited coping capacity.

Naturally, there were some challenges through the two-month process. For example, because the research area included locations affected and unaffected by disaster, in some instances, the remoteness of an area, bad road conditions, or lack of transport made data collection difficult. Another challenge was the influence of social taboos and beliefs on the data collection process. For instance, there is the belief that measuring the weight of a child will cause the child to lose weight. Further, in most of the communities, men were the communicators in community discussions and the women's voices were not heard.



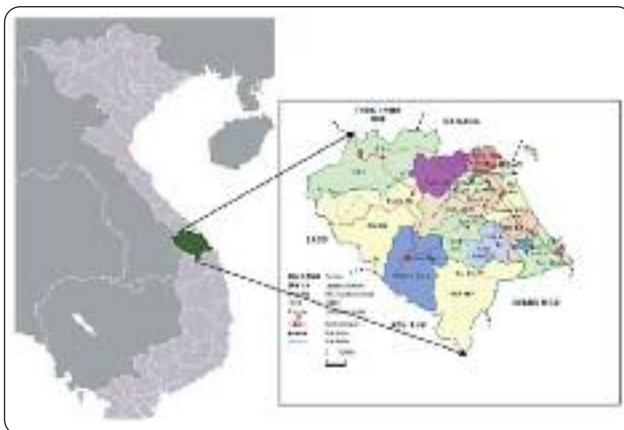
• *Community mapping exercise led by VHAI.*

## 8. QUANG NAM, VIETNAM, FLOOD

### 8.1. Introduction

#### 8.1.1. Context

Located in the heart of Vietnam, Quang Nam lies about 860 km to the north of the city of Ho Chi Minh and 865 km south of the country's capital, Hanoi (Figure 8.1). The province is the point of intersection between the two geographical regions of the North and South, which are characterized by a slope topography from west to east with many mountainous ranges, short rivers, and delta and coastal areas that have created a diversified ecosystem and formed one of the most highly disaster-prone regions in Vietnam.



• Figure 8.1.  
Location and map of  
Quang Nam province.

Quang Nam is one of the poorer provinces in the country. In terms of resources, it has diversified ecosystems and natural resources. During the last two decades of economic renovation, the province has made remarkable economic advances, with an annual growth rate averaging in excess of 10% over the last 5 years. A rapid growth rate of economic development has improved the living standards in both urban and rural communities and has resulted in remarkable progress in the elimination of hunger and reduction of poverty. The proportion of the population living in poverty has dropped by more than half in the last decade, from over 50% in 1993 down to 21% in 2007.

Nevertheless, events such as the historical floods in 2007 have caused a variety of adverse health, social, and economic impacts on local communities, particularly households located in disaster-prone areas. Using the case study of Quang Nam province, this study argues that it is essential to understand the integrated impacts of disasters in terms of health, social, and economic effects for a fuller understanding of climate change and its influence on local communities as well as to strengthen local capacity in preparing prevention and mitigation strategies to adapt to climate change-related extreme events.

The most frequent and severe disasters in Quang Nam are flooding events, which are regular occurrences because of the heavy annual rainfall from September to November. Because of its topography, flooding events in Quang Nam often occur rapidly and cause serious impacts on local communities. The costs of relief, recovery, and reconstruction consume billions of dollars from household savings and government development budgets. Disasters push households toward poverty by destroying their assets, resources, and even their lives and trap them in local poor communities in a vicious circle of poverty. The populations likely to be hardest hit by flood disasters are the poor communities that lack resources and little capacity to cope with and to take protective measures for reduction of the impacts of flooding events.

#### 7.1.2. Disaster Background

More than 82% of the provincial population lives in rural areas, and 67.4% of the labour force works in agricultural sectors. Thus, agricultural production is still the main economic sector creating jobs for local communities in Quang Nam. Most labourers working in the agricultural sector live in local communities that are flood-prone areas, thus rendering them more socioeconomically vulnerable to disasters, especially flooding, than any other groups in the context of Quang Nam. Generally, farming activities in Quang Nam tend to be more subsistence than cash crops. Seeking sustainable livelihood alternatives for local communities, especially for those in flood-prone areas, will play an important role in increasing the resilience of vulnerable communities to climate changes.

Floods in 2007 killed 67 people and left 339 people injured and a total damages cost of VND 2000 billion (almost 103 million US\$). Local authorities had to evacuate about 70,000 people from inundated areas to public buildings, and 200,000 people needed urgent food and water aid. The local government has conducted a resettlement program for over 5,000 households from flooding basins to safer areas. However, its success has been limited because households could not move to a new place without the capital to build a new house and without the potential of practicing their livelihoods in the resettlement areas.



*Meeting with government units at district level to discuss the integrated impacts of the 2007 flood using mapping approaches*

Thus, “living with flood” has become an adaptive strategy for both local authorities and local communities in the flood-prone areas in Quang Nam. Conducting a flood impact assessment and seeking initiatives to mitigate flooding impacts on local communities living in the flood-prone areas will make a significant contribution to sustainable development in Quang Nam.

Based on a literature review and secondary data, Quang Nam was selected as the project site because the 2007 floods were considered historic, having caused serious health, social, and economic impacts on local communities.

### **8.1.3. The Disaster in Focus**

The year of 2007 is recognized as the “year of flooding events” in Quang Nam. Because of the impacts of storms regionally designated as Nos. 5 and 6 in the North provinces and of monsoons, heavy rain occurred throughout the province with rainfall averaging 2000 mm, in some districts reaching almost 3000 mm, from October 1 to December 7, 2007. Within almost 2 months, there were nine flooding events in Quang Nam province. Three of these were big floods occurring in only 20 days. Consequently, many communes were inundated by about 1.5–1.7 m of water, about 0.5–1.5 m higher than water levels of a historical flood in 1999. Especially, the floods caused many serious impacts as local communities had not yet recovered from previous floods.

In addition to their significant immediate human costs, the 2007 floods also had devastating impacts on local infrastructure: In the flood season, rain and overflowing limit transport, and community roads experience serious damage. Floods isolate villages by disrupting community roads, prevent access to services, and suspend business activities. The 2007 floods also caused students to miss school and collapsed information and communication systems. Infrastructures such as sea dykes, village-connected roads, and main roads in coastal communities in Quang Nam were seriously degraded.

The floods also caused serious problems to the health of the local people, particularly the elderly and disabled family members, women, and children living in poor communities with limited food stocks, lack of drinking water sources, and poor sanitation. Epidemic diseases such as marsh fever, malaria, dengue fever, and diarrhoea, among many others, also appeared when floods occurred. In poor communities, sanitation facilities and public health care systems were destroyed after the floods in 2007.

## **8.2. Methods**

### **8.2.1. Project Preliminaries**

The MICRODIS integrated questionnaire had already been administered in many research sites by the time the Quang Nam project study was initiated, including in Hanoi. Thus, the questionnaire had already been translated into Vietnamese by the Hanoi MICRODIS Team. Because of linguistic differences between the north and the south, the Quang Nam team had to make some adjustments to the questionnaire to apply regional Vietnamese terms. Enumerators were trained in the summer before the survey, and following a pilot survey of 20 households in Quang Nam, a few further revisions were made to the questionnaire to facilitate the field study.

### 8.2.2. The Study Design

The purposes of this study were to investigate the integrated health, social, and economic impacts of disasters with data comparability between a heavily flooded village and a non-flooded area. In early 2009, the Hue College of Economics research team made field visits to Quang Nam to collect secondary data and also to select districts for the survey. Based on the research objectives, two districts were selected. Duy Xuyen district and Thang Binh district were randomly selected for the MICRODIS integrated survey, with Duy Xuyen as the heavily flooded district and Thang Binh as the less-flooded area of Quang Nam province. Secondary data collection, focus group discussions, and key informant interviews were conducted in these two districts. A list of communes and villages was collected for identification of communes and villages for survey.

As noted, mixed data gathering methods involving acquisition of secondary data, key informant interviews, focus group discussions, and the questionnaire survey were used for data collection in this study. Each method feeds into and is strengthened by the others, and their combination provides a robust data set to work from.

For purposes of this study, secondary data about integrated health and socioeconomic impacts of floods in 2007 on local communities such as number of dead, injuries, social disruption, and economic damages were collected from the national to local levels. Secondary information about socioeconomics and local livelihoods was also collected from various government authorities. The secondary data also provided basic information for sample size decisions and sampling design in this study.

#### 8.2.2.1. Site selection and sampling

Research identified 92 villages with 26,236 households and a total population of 131,668 people who were heavily affected by the 2007 floods in Duy Xuyen district. Further, there were 131 villages with 47,137 households and a total population of 192,550 person living in Thang Binh district (the less-flooded area).

Based on statistical theory of sample size calculation and actual information collected from Quang Nam province, the estimation of sample size by using Statistical Calculation Module of EpiInfor Package was calculated by experts at UCL. The results indicated that to obtain adequate precision for detecting significant relative risks of 1.5 for a prevalence of 25% in the reference group, the sample size for the survey needed to be 750 households. To avoid non-response, incomplete responses, or recording errors during data collection in the context of vulnerable communities with low literacy and to achieve precise results, the desired sample was 750 households, but the number of households contacted for the survey was targeted at 767. This sample size was distributed between flooded communities and non-flooded communities at a ratio of 75% and 25%, respectively; in other words, a subsample of 575 households was selected from the flooded villages, and the remaining 192 from non-flooded villages.

Lists of villages and the total number of households in each village were entered into an Excel spreadsheet for selection of 25 villages in the flooded district and eight in the less-flooded districts using a probability proportion to size technique. Because a list of households was not available at the district level, after clusters were defined, the researchers collected the list of households of each village from the heads of the villages. A total of 23 households on average was the target sample size per village, and a random selection technique was used to select households for the survey. Local people, most of them heads of villages, were employed as local guides for enumerators to identify households from the list.

#### 8.2.2.2. The survey

The pre-test surveys were conducted with 20 households in flooded districts for the MICRODIS integrated questionnaire. Households were selected randomly based on the list of households provided by the head of the village. Implementing the questionnaire carried some challenges, including respondent fatigue with questions and confirming specific factual assertions from respondents.

To achieve validation for this study, the MICRODIS team focused closely on the role of the enumerators in the success of the final survey. All enumerators in this study were recruited and trained carefully. Enumerators were not only trained in interviewing and recording data techniques but also in methods of raising questions and creating a friendly environment for interviews. Ethical rules and regulations of conducting a survey were also taught to all enumerators. During the process of the final survey, two supervisors from the MICRODIS team conducted checks and cross-checks during the interview and completed questionnaires.

## 8.3. Results

### 8.3.1. Qualitative Findings

Qualitative information for this project was collected from key informant interviews, focus group discussions from the provincial to the village levels, and open-ended questions used in the MICRODIS integrated questionnaire.

There were 10 key interviews conducted from provincial to the local levels, including interviews with representatives from the Department of Agriculture and Rural Development and the Department of Environment and Resources. Conducting these face-to-face interviews allowed for collection of qualitative information about local government awareness and attitudinal responses toward flooding impacts, prevention, and mitigation activities adopted to reduce the adverse impacts of flood, and the constraints and barriers in preparedness and adaptation behaviours. The interviews also gleaned in-depth insights into health, social, and economic impacts of floods in 2007 on local communities with a particular focus on the issue of child nutrition in the context of breastfeeding patterns and dietary diversity.

There were also nine focus group discussions held at the provincial, district, commune, and village levels. These discussions allowed for deep insights into research issues and also validated core themes and questions raised in the MICRODIS questionnaires.

The observations from the fieldwork revealed that both local government and local communities made great efforts to adopt adaptation measures such as structural measures and non-structural measures to reduce the impacts of climate-change-related disasters such as 2007 floods. It is, however, important to note that local government and communities have to deal with many barriers/difficulties constraining their capacity to adapt to climate change.

### 8.3.2. Quantitative Findings

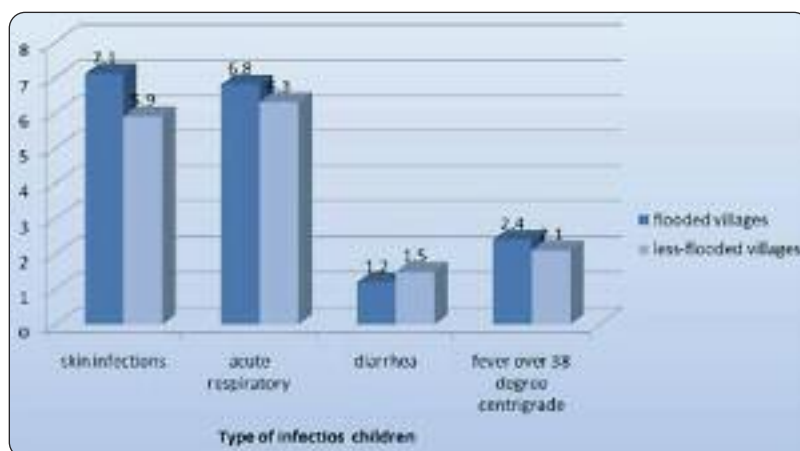
The survey using the MICRODIS integrated questionnaire was conducted with a sample of 767 households selected. There were 743 questionnaires completed. As described, a double-check was conducted right after interview completion, and 35 questionnaires were excised for different reasons, such as incompleteness and low reliability. Thus, ultimately, there were 708 questionnaires used for analysis. The analysis included 580 variables describing integrated social, health, and economic impacts of extreme floods on households in Quang Nam in 2007, of which 503 variables were numeric data and the rest were qualitative information.

The result of secondary data analysis indicated the overall panorama of disasters and impact on local communities in recent years. The 2007 flood events caused severe impacts on a large part (about 75%) of the provincial population. More than 98% of respondents reported staying at home during the 2007 floods, possibly one reason 67 people died and 339 people were injured.

#### 8.3.2.1. Health

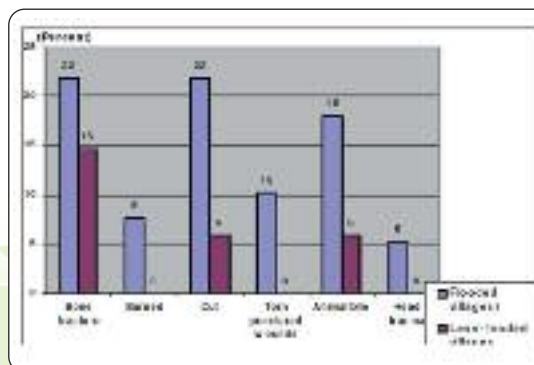
Local health care systems in flooded areas did not meet the high demand in terms of local health treatments, particular first aid in the context of extreme disasters. The data indicated that the local health care system lacked medical facilities and medicines to deal with infectious diseases after floods. As a result, health problems such as diarrhoea, skin diseases, and water-borne diseases were among the serious problems threatening the local community, especially in flooding season and specifically in villages with frequent floods. In the villages where floods occur frequently, there was a higher, not statistically significant impact of the 2007 flood on health infections in children in Quang Nam (Figure 8.2).

• *Figure 8.2. Health infections among children, one month after floods.*

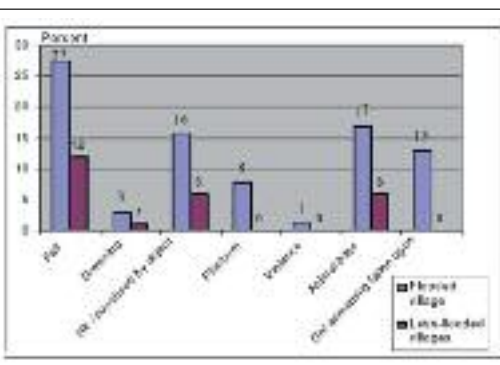


The flooded villages also experienced more injuries and injuries of different types compared to non-flooded villages. Local people living in extremely flooded villages were injured significantly more than those living in less-flooded villages, particularly with bone fractures, cuts, and animal bites (Figure 8.3). There was a statistically significant difference in the reasons for injuries between the flooded villages and less-flooded villages (Figure 8.4).

• **Figure 8.3.** Types of injuries in flood-affected and unaffected villages.



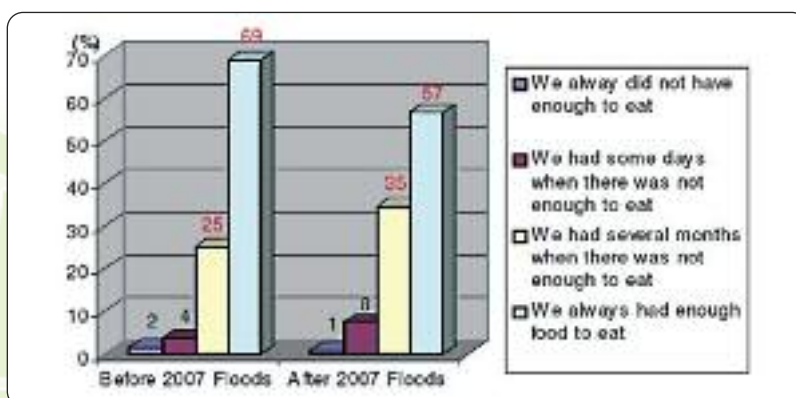
• **Figure 8.4.** Reasons for injuries between flood-affected and unaffected villages.



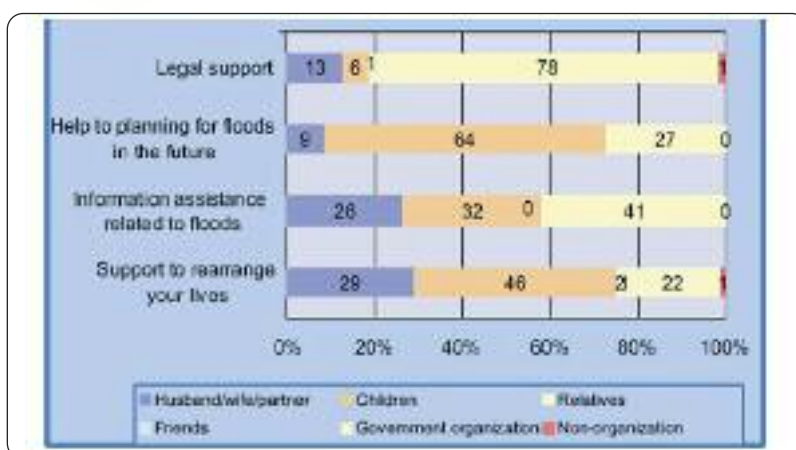
### 8.3.2.2. Social

It is evident that the 2007 floods had severe impacts on main and secondary occupations of the local people as the local livelihood is largely embedded in natural resources-based practices. There was a significant association between floods and local food security (Figure 8.5), indicating that floods have exacerbated food security problems in local communities in Quang Nam. The households themselves (husband/wife, children) and local governments played the most important role in recovery from flood impacts. Local governments found it hard to support households because of a lack of resources, although they were most relevant in terms of legal support for respondents (Figure 8.6).

• **Figure 8.5.** Flooding and local food security.



• **Figure 8.6.** Different sources of support for local communities after the flood.



### 8.3.2.3. Economic

The 2007 floods caused various economic damages to local communities in which damages to agricultural production (48.1%) and damages to houses (39.1%) were the most severe (Table 8.7). Total damages amounted to about 20% of the total income of the households in 2007. There was no significant difference in the total damage cost between households that acted on an early warning message and households that did not, suggesting that the conventional coping mechanism was not effective in the context of extreme disasters. Although the poor experienced significantly less absolute damage costs than richer households, the relative impact was more severe because they were more vulnerable than the wealthier households.

• Table 8.7. Damage costs from the 2007 floods.

Types of damages	Min	Max	Mean	%
Damage to Crops	0	41.000.000	983.423	25,80
Damage to Livestock	0	26.000.000	849.646	22,30
Damage To Aquaculture	0	45.000.000	160.765	4,20
Damage to family-based industry and service	0	830	6.884	0,20
Damage to House	0	81.900.000	1.492.152	39,10
Damage to family property and goods	0	8.550.000	117.625	3,10
Damage to house due to public infrastructure	0	25.130.000	207.599	5,40
Total Damage	0	83.740.000	3.816.105	100,00

There was a slight difference in terms of sources of local income in the local communities between the period before the flood and after it. Local communities tended to be involved less in agricultural production but more in non-agricultural practices such as industry, service, and others after the flood.

There was a statistically significant difference between different groups of households by income in terms of participation in a government flood prevention plan in which the poor households were less willing to participate in the government program while being the most vulnerable group with a lower adaptation capacity to floods. The most important factor involved in a willingness to contribute was that people felt their lives were in danger because of flood. Further, labour availability (more vs. less labour), type of village (flooded vs. less flooded villages), and type of household (permanent vs. non-permanent) were respectively important determinants of local willingness to contribute to a government flood prevention plan in the future. This finding suggests that it is important to raise local awareness about prevention and mitigation of floods.

#### 8.4. Conclusions

There was a lack of local community participation in the planning process for responses to annual disasters. Such plans and strategies often missed the real needs of households and sometimes ignored the potential of local resources and capacities. The local government has paid a great deal of attention to and made great efforts for prevention and mitigation of disasters. However, constraints and limitations include that prevention and mitigation activities are passive and mainly focus on addressing specific problems, and there is a lack of early warning systems from the provincial to the local levels.

The findings of the Quang Nam study are expected to make a significant contribution to both local communities and local authorities in preparing prevention, mitigation, and adaptation strategies to reduce the integrated health, social, and economic impacts of floods in particular and climate-change-related disasters in general on local communities. The project will also provide local authorities with community-based prevention measures to mitigate the impacts of climate-change-related disasters.



*Focus Group Discussion  
to map out affected areas  
in Quangnam*

## 9. SOUTHERN LEYTE, THE PHILIPPINES, FLOOD/WINDSTORM

### 9.1. Introduction

#### 9.1.1. Context

Two provinces, Albay and Southern Leyte, were chosen for the Philippines MICRODIS sites on the basis of data obtained from the NDCC. The province of Southern Leyte has 19 municipalities with a total of 502 barangays. The whole province was declared under a state of disaster with the occurrence of natural disasters in 2003 and 2006.

Southern Leyte (Figure 9.1) occupies the southern quarter of the island of Leyte. To its north lies the province of Leyte, while its eastern, southern, and western boundaries are the Surigao Strait, the Bohol Sea, and the Canigao Channel, respectively. Southern Leyte's geological features created several issues in the province after the flooding of Subangdaku River and the mudslide in Guinsaugon. The geology of Southern Leyte, according to some experts, predisposes it to being susceptible to natural disasters like landslides and floods.

Indeed, Southern Leyte, according to the MGB, is one of the 10 provinces in the country that is highly prone to natural disasters. First, it is located within the Philippine Rift Zone, a major fault line that traverses the municipalities of Sogod, Libagon, and St. Bernard, among others. Other regional geological structures that indicate its vulnerability to earthquakes are likewise found in other municipalities, including Silago, Hinunangan, and Bontoc.

The municipality of St. Bernard in Southern Leyte, one of the two focus regions in this study, is strategically situated in the southern portion of the island with a total land area of 10,000 hectares. The topography is hilly and mountainous. St. Bernard consists of 30 barangays/communities. The municipality depends largely on agriculture, and the major crops include rice and abaca. St. Bernard had a total population of 25,252 as of the 2007 census with an annual growth rate of 2.5%. Currently, the town infrastructure includes 27 schools, a rural health unit, and eight barangay health stations. Its source of water is a developed spring with a reservoir/water tank, and water is distributed through pipes. An electric service cooperative supplies the energy needs of the population.

Hinunangan, the second region of focus in Southern Leyte, had a total population of 27,712 as of the 2007 census and a land area of 156 sq km, and consists of 40 barangays. The municipality is the rice granary of the province and producer of abaca, rattan, other forest products, and vegetables. Aside from 35 elementary schools, the town has two tertiary education institutions, the Southern Leyte Institute of Agriculture and Technology and the Holy Rosary Academy.

#### 9.1.2. Disaster Background

Aside from the identified risk of earthquake-induced landslide, geographic studies have revealed eight other hydrometeorological risks present in the area. These include floods, storms, storm surge, rain-induced landslide, tsunami, ground shaking, ground rupture, and liquefaction. The impact of a disaster in Southern Leyte is far reaching. Based on the report from the MGB, some 104 barangays (21%) of the total barangays in Southern Leyte are highly susceptible to landslides that would likely affect about 36,431 hectares and around 75,633 people.

#### 9.1.3. The Disasters in Focus

This MICRODIS survey based from Xavier University was carried out in the municipalities of Hinunangan and St. Bernard. Of the two municipalities chosen, one survey team first entered St. Bernard where, on February 17, 2006, several mudslides caused by heavy rains (amounting over 200 cm) and a minor earthquake destroyed at least one town and various commercial and residential infrastructure, leaving hundreds dead. The municipality of St. Bernard was one of the worst-hit areas, and Guinsaugon, a mountain village, was almost completely levelled. Everything from trees to homes was destroyed, killing 1,800 residents.



Figure 9.1.  
Southern Leyte province in  
the Philippines.

Many rescuers from national and international teams responded to the incident. However, rescue efforts were greatly hampered by poor road conditions and a lack of heavy equipment. Survivors also reported a lack of coordination of rescue efforts. The Philippine government stated their inability to cope with the disasters. The handful of Guinsaugon citizens who escaped the landslide were put up in emergency shelters without adequate nutrition and care.



• *Negotiating a bridge during field work.*

A second survey team took the municipality of Hinunangan, the other disaster-prone area selected, which is located just a few kilometres from St. Bernard. A 2007 earthquake struck the area with a magnitude 6.0 on the Richter scale. In both of these areas, the survey teams were able to conduct quantitative and qualitative data collection.

## 9.2. Methods

### 9.2.1. Project Preliminaries

Early in the process, the study team learned that the municipality of St. Bernard had an ongoing international multi-donor funded READY project on geohazard mapping for the entire area. Although these highly technical maps were not yet made public, the study primary investigator was given access to these data. Thus, the survey area frame was produced with help from these risk assessment and geohazard maps.



• *Xavier University/MICRODIS field personnel in Guinsaugon, St. Bernard, Southern Leyte.*

Prior to the recruitment of enumerators, two manuals were developed, The Interviewer's Manual and The Field Research Guide: Qualitative Component. While the former emphasizes instructions to interviewers on administering the survey questionnaire, the latter focuses on the mechanics in the conduct of focus group discussions and in-depth interviews and provides guide questions. Once recruited, enumerators also attended a three-day training session.

Site visits and courtesy calls to local government executives were made to facilitate smooth entry of researchers into the chosen areas and in the conduct of actual data gathering. Further, preliminary data were gathered during pre-survey site visits, including demographic profiles, socioeconomic characteristics, and cultural and geographic features of the study sites. The first pre-survey site visit was done by the survey team in Southern Leyte. A pre-arranged meeting with the provincial governor together with the provincial disaster coordinating officer enabled the team to gather necessary data, including site maps and a disaster profile.

The team likewise visited and reconnoitred the selected municipalities, and the local chief executives (mayors) were also informed of the project and provided their endorsements for the eventual entry into the selected communities. Aside from securing these necessary endorsements from government executives, initial plans were made for the accommodation of the field enumerators during the actual field work.

### 9.2.2. The Study Design

The core objective of this study was to investigate the social impacts of natural disaster that cut across various aspects of people's lives. To delineate aims at different levels of analysis and to highlight the social contribution from the economic and health consequences, the project had the following specific objectives: (1) to describe the characteristics of study population; (2) to determine socio-demographic conditions and experiences of households during and after the occurrence of the natural disaster; (3) to describe the magnitude of economic and social losses and ill-effects to health; and (4) to uncover social gains that emerged out of the event in terms of social capital and protection support during and after a natural disaster. Further, at the individual level, the aims were (5) to uncover experiences during the disaster that impacted individual daily activities and social relationships; (6) to look into individual resiliency, coping behaviours, recovery, and social/emotional outlook; and (7) to probe the intersection and interaction of natural disaster impacts on the economic, health, and social aspects of people's lives.

The quantitative component of the data collection consisted of the MICRODIS integrated questionnaire. There also were two methods employed for the qualitative data gathering. First, there were focus group discussions targeting the affected communities of the two sites, two per site. The second method used was the in-depth interview.

#### 9.2.2.1. Site selection and sampling

For the study, four barangays were selected from each municipality, two of which were least affected and the other two most affected by natural disasters. A total of 500 households participated in the study.

The selection procedure followed a multi-stage cluster design. The first stage was the selection of two municipalities by probability proportional to the size of barangays (barangays as the measure of size). As noted, Hinunangan and St. Bernard were selected for the province of Southern Leyte. The second stage of selection began with the construction of frames for identifying the affected and least-affected barangays.

At the outset, this study had established a sample size of 400 households for Southern Leyte, which was predicted to yield a 5% level of accuracy on estimates derived and a 95% confidence level. The determination of the sample size was accomplished using the Cochran formula. In total, 50 sample households were selected by systematic sampling from each of the barangays.

#### 9.2.2.2. The survey

In this type of research project, the interviewer plays a crucial role. The quality of data gathered depends largely on how s/he presents the questions and can elicit accurate and relevant information from the respondents. Interviewers were carefully trained for this study in a variety of techniques, including locating the correct sample household (which in some cases proved quite difficult, as three barangays in particular were difficult to access), reporting any information about call-backs or interview refusals, carefully conducting the interview with a focus on listening, avoiding expressions of personal opinions, and representing MICRODIS at all times.

Completing all of the household interviews required 23 days. The time might have been shorter had there not been some delays because of bad weather and slight flooding in the selected communities. Accessibility and transportation to the field sites proved challenging in some cases.

### 9.3. Results

Ultimately, the response rate was 100%; there were no refusals and no "not at home" respondents. A confluence of factors was at work to obtain this high rate. These included doing callbacks, endorsement of local executives, rapport with the community, and interviewee-friendly data collectors. A total of 1,944 people were covered by the surveys with an average age of 25 years. The majority were in the labour force, and 49% were married.



● A home in an affected barangay.

### 9.3.1. Qualitative Findings

A total of 24 in-depth interviews were conducted; 12 from each province in the affected communities. To best obtain information about the impacts and a variety of experiences, three subgroups of people were interviewed, namely, mothers (2), heads of households (2), and adolescents (2) from each sample of the affected communities.

Two focus group discussions were conducted in each municipality of Southern Leyte, giving a total of four community discussions. Participants invited included community leaders, active members of religious groups, officials of local government units, officials of women's organizations, and representatives from youth groups. The in-depth interviews and focus group discussion proceedings were recorded on tapes and subsequently transcribed and collated. A response matrix for 48 interviews was prepared by province. A team of three researchers jointly processed the responses, discussing patterns observed and themes that emerged. The focus group discussion proceedings were likewise transcribed and collated. A panel of researchers who were present during the conduct of the discussion met and discussed the results, noting convergence and divergence in responses.

Building linkages with the local chief executives was also a necessary step to achieve the research objectives. Obtaining proper endorsement for entry into their respective area of jurisdiction as well as their cooperation and support facilitated much easier movement of the field enumerators. Furthermore, they provided initial data and useful insights that constituted a rich and meaningful context for the data collected.

Informal interactions most often followed the completion of an interview. Children and adult household members alike asked questions regarding the occurrence of natural disasters as they had overheard the questions of the interviewers. Other times, on their way back to the 'barracks' (where enumerators lodged), people asked them the nature of the project, thus starting an informal group discussion right in the middle of the road or under the waiting shed (while waiting for the public transport jeep).



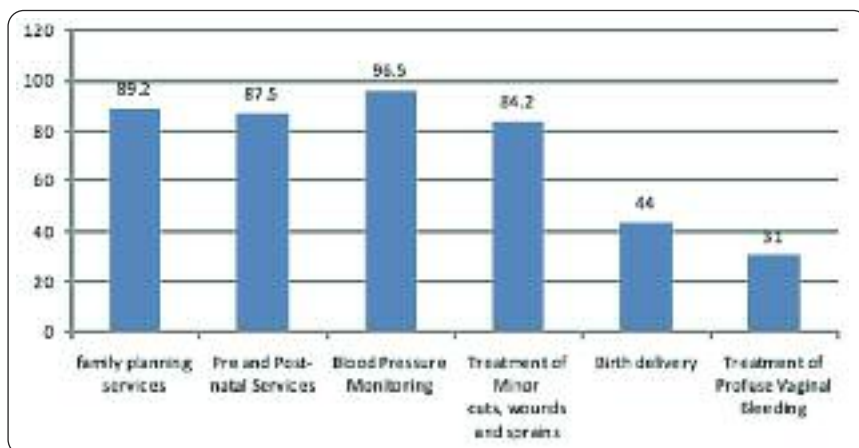
• Focus group discussion in Southern Leyte.

### 9.3.2. Quantitative Findings

#### 9.3.2.1. Health

Regarding health impacts, except for services relating to treatment of profuse vaginal bleeding and birth delivery, the majority affirmed the availability of health care services both pre- and post-disaster occurrence (Figure 9.2). Access to these services post disaster was jeopardized in some cases because of damaged roads.

• Figure 9.2. Health services availability.

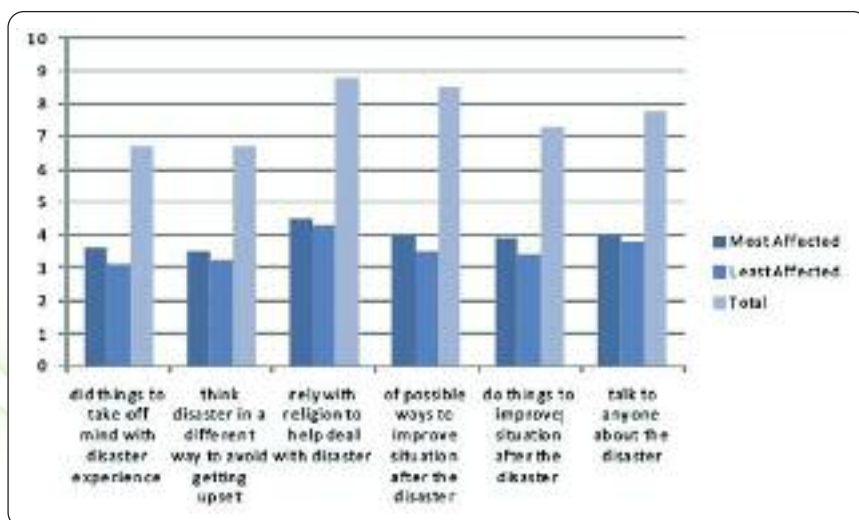


Children's health was perceived to be compromised by an increased incidence of infectious diseases (diarrhoea, acute respiratory infections, and skin infections).

### 9.3.2.2. Social

For the Southern Leyte study, the social, health, and economic impacts and their integration were all considered. In terms of social impacts, the most prevalent individual coping mechanism was to “rely on religion to help deal with disaster” (Figure 9.3). An evaluation of the levels of communal coping indicated a preference for pro-social actions such as social joining and seeking support, which underlies resilience, collective concern, and reciprocity. The number of social contacts did not change post disaster, but the quality of the social relationships did. Respondents ranked relationships as being closer with more bonding and less tension and intrigue. Additionally, the post-disaster relationship was characterized by a greater sense of volunteerism and cooperation.

• Figure 9.3. Coping mechanisms in most-affected and least-affected areas.



The health, economic, and social impacts also interacted with one another (Figure 9.4). Food sufficiency was a greater problem at some sites. Anxiety and depression correlated with sex, age, social support from different sources, number of natural disasters experienced in the last five years, perceived assessment rating of how traumatic the experience was, coping index (how many times individuals do certain things to deal with the consequence of the disaster), and the number of associations/organizations of which a respondent is a member. As might be expected, support from friends was inversely associated with anxiety. The best predictor of health, social, and economic impacts of a natural disaster in this study was the current health condition, so health had a huge influence on all aspects of impact.

### 9.3.2.3. Economics

Immediately after the disaster, the predominant coping behaviours related to economics. These included sale of assets (notably livestock), the taking of formal loans, and borrowing money from informal sources (friends and relatives). A very large majority experienced damage to their dwellings, with residents in least-affected areas reporting more damage to homes, while residents in most-affected areas reported more damage to their employment (Figure 9.5).



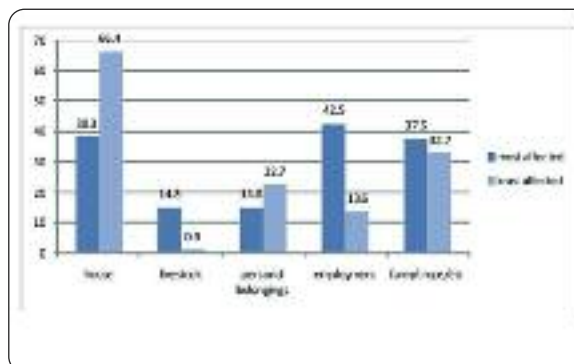
• Enumerator training takes place at XU for the MICRODIS main study.

• **Figure 9.4.** Multiple regression coefficients of composite indices of social, economic, and health costs.

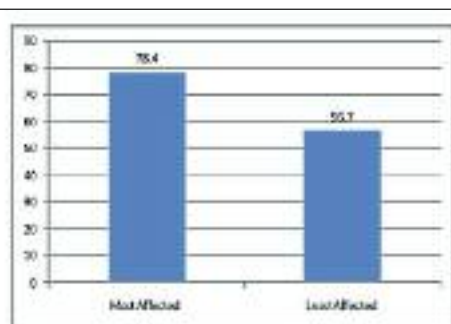
Variables	Unstandardized Coefficient		Standardized Coefficient	t	Sig
	B	Std. Error	Beta		
A. Dependent Variable: Health Cost					
Constant	1,161	0,252		4,612	0
- household size	0,023	0,01	0,05	2,337	0,02
- general health condition of respondent	0,957	0,026	0,808	37,355	0
- sense of community index	-0,179	0,067	-0,058	-2,674	0,008
R = .800 ; R <sup>2</sup> = .640 ; F-value = 471.222 ; Sig = .000					
B. Dependent Variable: Social Cost					
Constant	18,349	0,758		24,201	0
- age of respondent	-0,016	0,008	-0,113	-1,851	0,066
- household size	-0,117	0,051	-0,138	-2,281	0,024
- general health condition of respondent	-1,081	0,153	-0,423	-7,086	0
- total number of disaster experienced	-0,295	0,094	-0,187	-3,123	0,002
- total amount of damages on household goods and valuables	4,86E-05	0	0,148	2,485	0,014
R = .5220 ; R <sup>2</sup> = .273 ; F-value = 15.753 ; Sig = .000					
C. Dependent Variable: Economic Loss					
Constant	27777,638	3634,672		7,642	0
- general health condition of respondent	-3021,389	1249,485	-0,087	-2,418	0,016
- was access to usual health care compromised after the disaster	-12342,634	2901,41	-0,153	-4,254	0
- infectious diseases incidence of children during occurrence of disaster	-12013,535	4294,407	-0,1	-2,797	0,005
R = .194 ; R <sup>2</sup> = .038 ; F-value = 9.898 ; Sig = .000					

In most-affected and least-affected areas, respectively, 78.4% and 56.7% of individuals reported an effect of natural disasters on their daily routine and their main occupation (Figure 9.6).

• **Figure 9.5.** Types of economic damage.



• **Figure 9.6.** Percentage of individuals reporting disaster effects on their daily routines.



#### 9.4. Conclusions

The best predictor of each component index was the current health condition. The unravelling of the web of association of demographic, health, social, and economic variables yielded results that clarified the temporal flow of the relationship. For example, there was a temporal or cyclic connection among the demographic, health, social, and economic variables in this study. Economic loss was found to affect health by compromising access to healthcare and by reducing availability of health services. This lack, in turn, would result in an increase in infectious diseases among children under age five years.

Health emerged as a huge influence on the economic and social aspects of the disaster impacts. Current health condition was the best predictor of outcomes in all areas. Social factors also influenced health, specifically mental health, as anxiety reduced with increased social support from friends. While social contacts did not change in number relative to the disaster, the nature of social relationships did undergo a change for the better, both interpersonally and in terms of community-level factors, such as volunteerism and cooperation. The results of this study overall show that integrating these impacts for analysis and examining their interactions is a natural reflection of their interlinkage in disaster outcomes.



• Fr. Jose Villarin, SJ (XU President) presents on disasters and climate change

## 10. TEWKESBURY, UK, FLOOD

### 10.1. Introduction

#### 10.1.1. Context

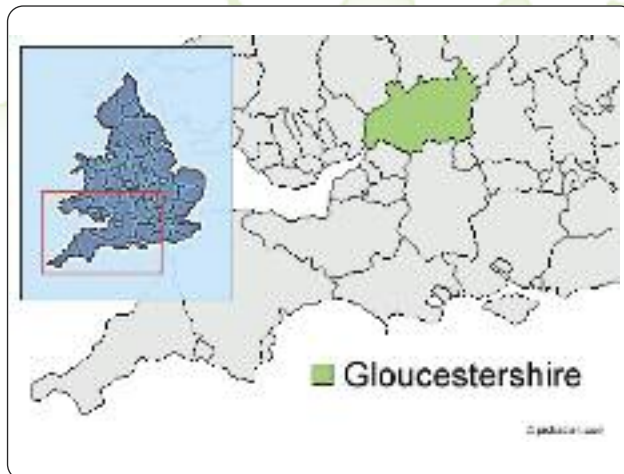
There are more than 2 million homes currently at risk from coastal or inland flooding in the UK with plans to build 3 million new homes by 2020, including a significant number in known floodplains. The average annual damage cost of flooding in England and Wales is £1 billion (about 1.6 billion US\$) per year. Likely climate change impacts mean that the level of flood risk in the UK is predicted to increase.

Tewkesbury town is part of the Severn River Basin District in the county of Gloucestershire (Figure 10.1), the third largest in England and Wales with an area of 21,590 km<sup>2</sup>. It lies at the junction of the rivers Severn and Avon and has always been prone to fluvial flooding because of its position on the main fluvial floodplain and the potential contribution of two separate river catchments to flooding events. There are 1,800 people in 800 households situated directly on the floodplain in the Tewkesbury district.

Tewkesbury has a well-preserved medieval character and is of considerable historical and conservation interest. For this reason, tourism is the major source of income and employment in Tewkesbury. It is also one of the wealthier regions in the UK. The district of Tewkesbury has a population of 76,405 while Tewkesbury town itself has a population of 10,087.

Of the people residing in Tewkesbury town, 4,997 are males (49%) and 5,117 are females (51%) living in 4,523 households. About a quarter of householders are retired or on pension, and the average annual income is over the English average. The area is popular with tourists, in part because of water recreation activities, and in many parts of the area, people live close to the river.

Most inhabitants of Tewkesbury are in good health, with 1,624 reporting suffering from a long-term illness, most of them pensioners. The Social Flood Vulnerability Index for Tewkesbury is very low, and the population is assumed to be better able to respond to and recover from flooding events than in more deprived and/or urban areas of the catchment.



• Figure 10.1.  
Gloucestershire.

#### 10.1.2. Disaster Background

Among the several UK counties affected in the historic flooding of 2007 was Gloucestershire, where 350,000 people were left without a water main supply. This loss was referred to as the “most significant loss of essential services since the second world war”. Other critical infrastructure and essential services disrupted were power supplies, transport links, and telecommunications. Tewkesbury, the site chosen for the MICRODIS UK survey, is one of the towns in the county of Gloucestershire.

The first recorded flood in Tewkesbury was in 1484, and since then, the town has experienced flooding events approximately every 30–50 years. The largest flood level of historic flooding events (records from 1862–1990) was recorded in 1947, triggered by warm rain falling on snow. Prior to the severe 2007 flood, there have been five other recent major flooding events within the catchment (February 2004, February 2002, Autumn 2000, October 1998, and Easter 1998). However, Tewkesbury town itself was affected only by the flooding in autumn 2000, which had been the largest flooding event on record in the lower Severn catchment before 2007.

#### 10.1.3. The Disaster in Focus

The County of Gloucestershire where Tewkesbury is located is largely rural. More than 6,000 properties were affected by the summer 2007 floods, many first flooded by surface water then by the River Severn a few days later. Roads and transport links were affected and seriously hampered people’s travel plans. The M5 flooded and left 10,000 vehicles and their occupants stranded on the motorway. Over 30 schools were damaged.



• The 2007 flood in Tewkesbury.  
Source: British Geological Survey.

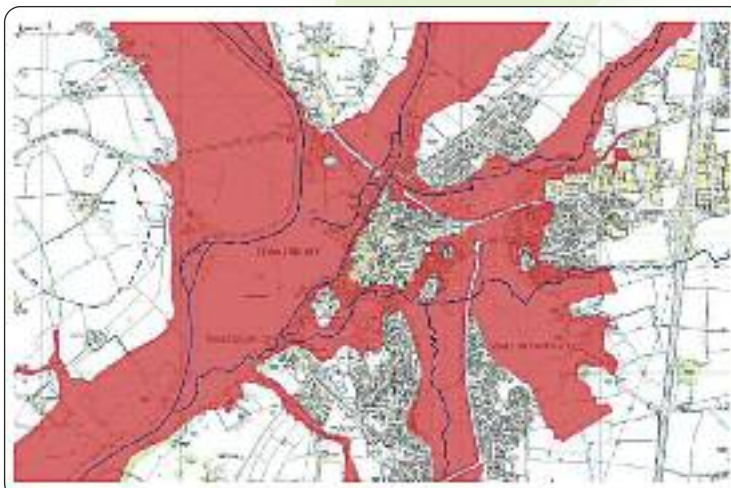
The 2007 floods were a result of the surface water but also flooding of the Severn. Flooding is the only major disaster risk in Tewkesbury, and, as indicated, the Severn catchment has a long and well-documented history of flooding. Tidal effects of the River Severn are usually confined to the stretch of river up to Gloucester and only reach Tewkesbury in unusual circumstances.

The summer 2007 floods were particularly severe and were linked to 13 deaths, even as fatalities are unusual in UK floods. The Environment Agency's warning system was the target of criticism; in particular, there was concern that warning about flooding at the Mythe water treatment works was very late.

Indeed, the Mythe water treatment works flooded and had to be shut down, leaving 350,000 people across Gloucestershire without drinking water for up to 17 days. Electricity supplies were also threatened, as the Walham switching station and Castle Meads electricity substation became vulnerable to rising floodwater. Castle Meads was shut down before it flooded, leaving over 40,000 people without electricity.

Rough estimates suggest about 1% of the road infrastructure was damaged, with a potential cost in the order of £20–30 million (31.6 million–47.3 million US\$). Tewkesbury was particularly badly affected and thus became the subject of research interest (Figure 10.2). The district of Tewkesbury received 80–90 mm of rain on July 20, 2007, which amounts to almost two months of rainfall in just one day and caused severe flooding of the town. An estimated 810 properties were affected by flooding in Tewkesbury, with the centre of town being completely cut off due to flood waters, and 1,500 buildings were flooded by both flash and fluvial flooding.

• Figure 10.2. Map of the flooded area, courtesy of the Environment Agency.



## 10.2. Methods

### 10.2.1. Project Preliminaries

The MICRODIS/University of Northumbria pilot study in Morpeth revealed the need for some changes in the language of the MICRODIS integrated questionnaire for the UK context. For example, some of the questions using colloquial language for mental health, such as “feeling blue,” were discovered to be awkward to ask, and for economics, questions about coping and loans had to be modified to include overdrafts and credit cards. With the advice from thematic experts on comments to specific questions, the questionnaire used in Tewkesbury was adapted taking the observations from the pilot study into account.

In line with the general commitment of MICRODIS to involve local stakeholders in the research process and to enable a smooth entry into the field area, the team consciously built bridges with the local stakeholders. These local stakeholders were identified before the survey began in Tewkesbury. Survey team members stayed in the centre of the town where there were many opportunities to speak informally with local people and also to carry out interviews in informal surroundings.

Tewkesbury Borough and the Town Council were contacted to share the objectives of the MICRODIS survey and to elicit their cooperation. These contacts enabled the team to get an initial understanding of the role played by these as well as other government agencies immediately after the floods.

The Severn and Avon Combined Flood Action Group is an advocacy platform of and for people affected by floods. Since their formation, they have been lobbying with various governmental agencies on issues of flood mitigation. As a local stakeholder, a representative of the group spoke at a meeting of the research team to convey their concerns about flooding and their proposed solutions.

### 10.2.2. The Study Design

The UK field surveys had the following specific objectives: to test, evaluate, and further the development of the integrated impact tools for standardized data collection in disasters; to further develop the scientific understanding of the health, social, and economic impacts of flooding in the UK context; to contribute to establishing a sound evidence base of field data on disaster impacts; to design and validate a tool- and site-specific data entry system; and to identify and describe differential social impacts of flooding in the UK.

This study incorporated both a quantitative approach, in the form of using the MICRODIS integrated questionnaire in the field survey, and a qualitative approach, in the form of in-depth interviews and other community-level activities involving respondent feedback and informal interactions.

#### 10.2.2.1. Site selection and sampling

Because of data protection laws in the UK, the team was unable to obtain property lists to do random sampling. The group therefore had to do a pathway analysis, a form of systematic sampling, to develop its sample plan. This was done as follows: Sample households were selected geographically on the basis of the flood outline map. The flood outline map was used to identify one third non-flooded and two thirds

• *Figure 10.3. An example of how a pathway was created and houses chosen for the study. Source: Laura Irvine, UCL*



flooded households in the Old Town and Newtown areas of Tewkesbury. This map was used to outline target areas with validation of households carried out through the walk-about method by the team of interviewers. Households were counted (over 1200, with a target of 600), and pathways created in a uniform manner, so that every other house was chosen with a random start of each pathway (Figure 10.3).

Determination of required sample sizes for both populations of interest (flooded and non-flooded households, i.e., the control group) was achieved by defining the variables of interest. The following primary variables were identified for the Tewkesbury survey: mental health functioning, physical health functioning, coping/recovery support, social cohesion/social capital, and willingness-to-pay. Using Cochran's formula, the team determined that the overall required minimum sample size of flooded households for the Tewkesbury survey was 428 households.

#### 10.2.2.2. The survey

A team of 13 fieldworkers from six countries conducted the main survey in Tewkesbury. Six of these interviewers had already participated in the pilot study in Morpeth, while one interviewer had participated in the MICRODIS surveys in India. Thus, most of the participating interviewers had benefited from prior training and practical experience.

The quantitative survey in Tewkesbury was carried out between January 4, 2009, and January 23, 2009. Questionnaires were to be administered with the sample population. As noted, based on the statistical calculations using Cochran's formula, it was decided that about 428 flooded households would be interviewed. Further, about 150 non-flooded households were interviewed to serve as a control group in the analysis.

The questionnaire used in Tewkesbury generally drew from the generic questionnaire developed by the MICRODIS thematic teams. To maintain the comparability between UK and other sites in Asia, the Tewkesbury questionnaire kept most of the MICRODIS core, social, health, and economic questions but adapted the content of some of them to the UK. Adaptations were made based on the piloting of the MICRODIS questionnaire in Morpeth in November 2008.

Survey team members made every attempt to get to know local people and understand their current situation and their attitudes to the flood of 2007. The team stayed in the centre of the town at one of its most popular inns (The Bell,) where there were many opportunities to speak informally with local people and also to carry out interviews in informal surroundings. Customers in the Inn were very willing to speak of the flood and flood management issues in this informal setting.



• The Bell.

While the team was based in the older part of Tewkesbury, much of the fieldwork was undertaken in the Newtown area. The Canterbury Public House was an important support for local people during the floods and very welcoming to the survey team, allowing them to use it as a base when interviewing in the vicinity. Team members also shopped locally and spoke to local people whenever possible.

During the survey itself, a pamphlet was dropped in sampled respondents' houses before an interviewer called on them, giving them the background of the MICRODIS project and requesting their participation in the survey. This enabled respondents to understand the survey and, in the team's opinion, led to more openness from respondents to participating in the survey. It is common in the UK for people to be rejected if using 'cold calling' techniques (i.e., knocking on doors unannounced) because householders are regularly contacted in this way by persons trying to sell double glazing, for example. The team noticed a more positive response once householders had been forewarned.

### 10.3. Results

A major challenge the team faced was the high refusal rate by the respondents. Although several reasons contributed to this issue, such as not wishing to relive the flood experience through talking about it, the chief reason among them was survey fatigue. Many households had participated in previous surveys, and cold calling in the first stages of the fieldwork could not overcome householders' opposition. The survey fatigue was evident as many said that they had already been interviewed by other agencies and were not keen to participate in a new survey now.

Also, the interviewer team was a mixed team in terms of gender as well as ethnic backgrounds and experience, which could have been one of the reasons for the refusal for the interviews. Female respondents, particularly if alone in the households, seemed reluctant to allow male interviewers into the house. The ethnic composition of the interviewers could have affected the response rate, although the experience as well as personality of the interviewers to engage with the community could have counted even more. In the end, 136 flooded households and 76 non-flooded completed the questionnaires among an overall sample number of 503.

#### 10.3.1. Qualitative Findings

During and following the quantitative surveys, more in-depth field work was carried out at Tewkesbury. The initial analysis of the quantitative survey interviews had revealed that the nature of support systems has an impact on the recoveries of affected people. Thus, some of the qualitative field work focused on the issues in the support system in relation to the recovery from the floods.

To that end, two in-depth interviews were conducted to explore the support systems that respondents did or did not experience. The interviews were conducted with a husband and wife as a unit, and they revealed differences in the way in which different genders experience support systems and pressures of disasters. Initial analysis revealed that perceptions around support followed certain dominant constructions of masculinity and femininity. For example, in one of the interviews, the husband, age 65 years, said, "I think it affected my wife more than me. I'm a bit old fashioned; as a man I think you have to, you know...not going to be crying on my wife's shoulders. I think it should be the other way round. Now I know that's a bit old fashioned but that's the way I am. So, I'm not trying to be a martyr here, I'm just trying to say, as a bloke, sometimes you've just got to stop whining and get on with it. And that's how I really dealt with it. It's no good me sitting around and crying on people's shoulders. It's not really a very manly thing to do".

The team built rapport with the respondents and stakeholders through meetings as described above. These meetings were occasions for the research team to understand the perspectives of the stakeholders, but also for them to understand more about the MICRODIS project, its objectives, and its research activities. For some of the respondents, the interview process was also a process of sharing their concerns about and after the floods with the research team because they perceived the team as an independent agency. The interviewers picked up several concerns in this manner that were not a part of the interview schedule itself during the interview process, and the information has formed a valuable backdrop for understanding the community during the analysis of some of the quantitative findings.



• Team members interacted with local residents as much as possible.

#### 10.3.2. Quantitative Findings

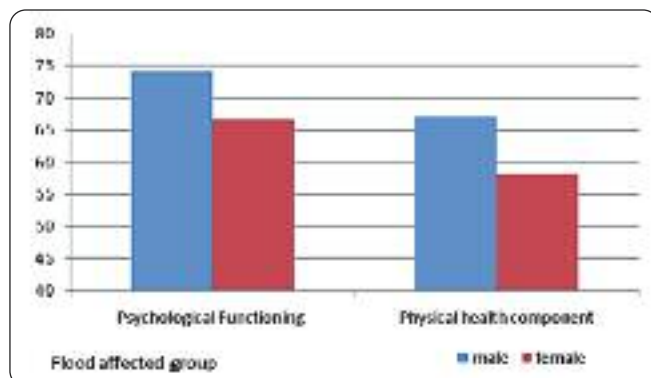
About 56% of the respondents were female, and most respondents were married. The sample population was fairly well educated with about 85% having some level of school qualifications or higher degree or professional qualification. As noted, many were retired.

### 10.3.2.1. Health

The mental health impacts did not differ significantly between males and females in the flooded groups, although predictors of mental health impacts did. The main predictor of mental health for males was their self-belief in their ability to cope. For females, it was their sense of community. In terms of physical health, 22% of respondents stated that they or their household members had experienced illness because of the floods. Among these, 30% reported depression and another 33% reported having suffered a stroke.

Analysis to identify predictors of mental health showed that individual economic position was negatively associated with mental health. With controlling for social variables such as gender and age, mental health was affected by perceived deterioration of one's economic position ( $p < 0.05$ ). Further, there were differences in the flooded group in terms of gender and physical and psychological function: women in the flood-affected group scored lower than men (Figure 10.4). Some respondents reported that they or a household member had experienced depression.

• *Figure 10.4. Psychological and physical functioning based on gender in the flood-affected population.*

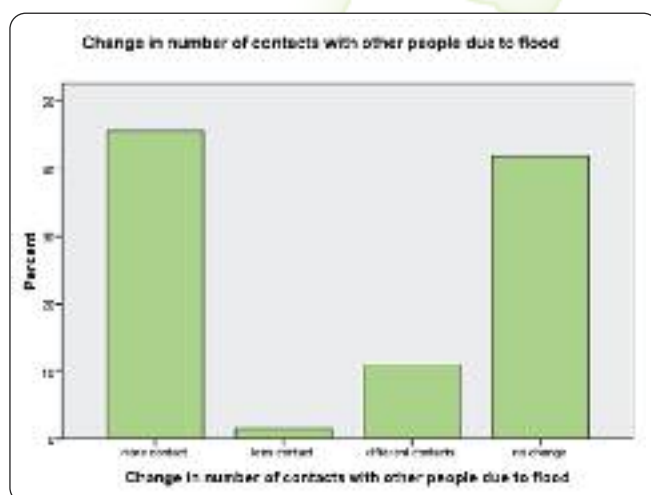


Stress levels differed based on age group, with the 25–39 group experiencing higher stress levels than older or younger people. Strategies of coping also differed significantly by age, with older people relying more on religious beliefs to cope compared to other age groups.

### 10.3.2.2. Social

Socially, almost half of respondents reported having more contact with people after the floods, while another 11% reported having different contacts after the event (Figure 10.5). Women sought help much more than men after the floods. Early observations were that community contact increased and that the flood experience brought people together. As one respondent said, “When we were in the same situation, we were struggling together in the neighbourhood, so we got to know more people”.

• *Figure 10.5. Change in number of contacts because of flood.*

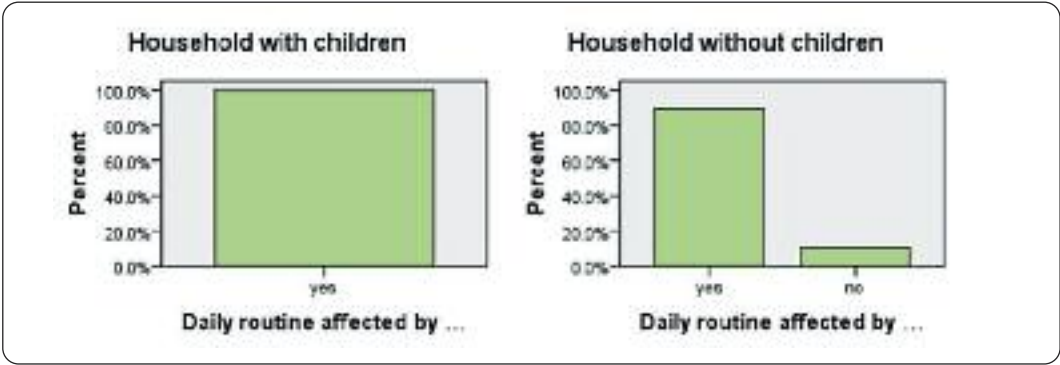


Of interest, people who experienced flooding were less willing to pay for a hypothetical flood scheme; 68.4% of flooded and 72.4% of non-flooded respondents expressed a willingness to pay for flood defences to avoid future damages to homes and their contents. The flooded respondents cited as their main reason for not wanting to pay that the government or council should be making the investment (44%); that they did not believe the scheme would work to avoid flooding (22%); and that they just could not afford it (9%). The strongest motivation among those who expressed a willingness to pay was to avoid being flooded again.

For the preliminary report, the team mainly enquired into the social impacts through the lenses of two social variables: household structure and gender. A particular focus for analysis was households with children and households without children and the differential impacts each experienced. Similarly, the research team analysed the differential effects of the flood as a result of gender differences.

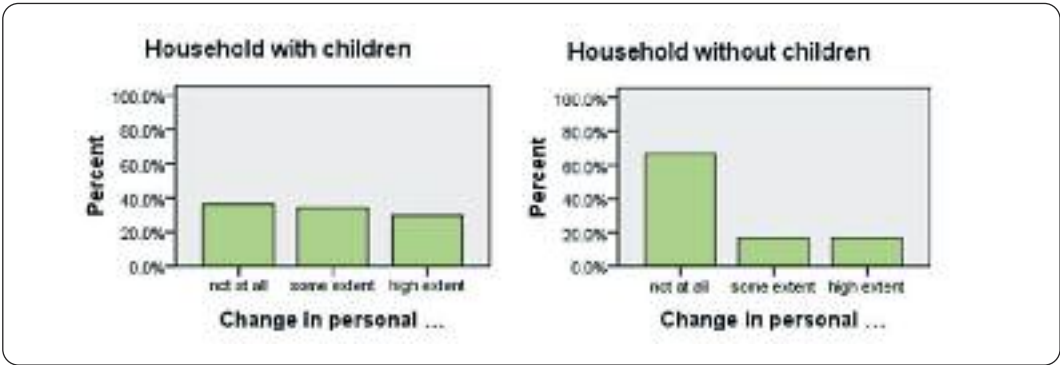
There did appear to be a relation between displacement patterns and household structure in the population in that having children exacerbated flood effects. The data suggested that households without children faced less displacement than those with children. The data also suggested that households with children were more prone to changes in daily routine than those without children (Figure 10.6). A relationship between trauma and household structure also emerged, with households having children experiencing higher trauma.

• *Figure 10.6. Effect of floods on daily routine in households with and without children.*



Furthermore, many more households without children reported no change in personal relationships due to floods than those with children (Figure 10.7). As one family with children said “[We were] affected to a high extent, more stressful, there were more family arguments, obviously as we were all staying in a caravan”.

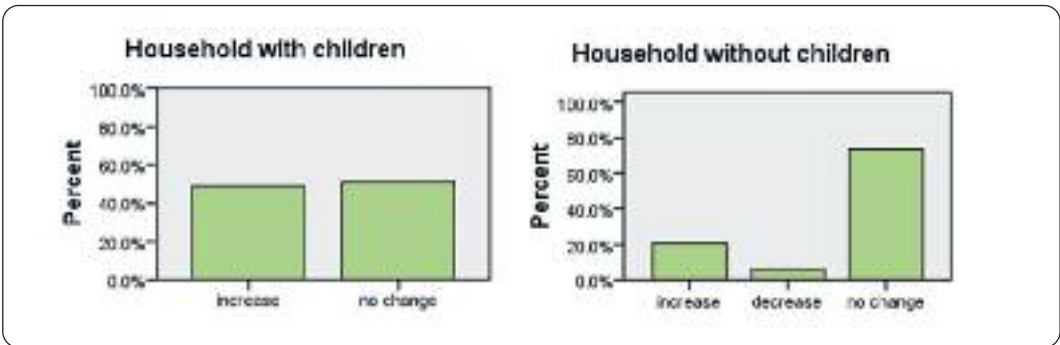
• *Figure 10.7. Change in personal relationships because of floods in households with and without children.*



### 10.3.2.3. Economic

In general, more households without children noted that there was no change in their monthly expenditure than those with children (Figure 10.8). Households with children noted an increase in their monthly expenditure. Furthermore, households with children experienced significant increases in food expenses after the flood compared to households without children. Households with children also consumed cheaper, less-nutritious, or easier to prepare foods. Indeed, the study uncovered a statistically significant relationship between household structure and food expenses after the floods.

• *Figure 10.8. Change in monthly expenditure because of floods in households with and without children.*



Retired people also experienced economic effects, undergoing the highest level of change in economic position compared to other occupational groups. Most flooded persons (67%), however, reported recovery of their occupation to a high extent, although a minority (12%) reported that their occupations had not recovered or had a very low recovery.

#### 10.4. Conclusions

The quantitative findings revealed some interesting aspects of gender-based differences in coping, with men relying more on a self-belief in their ability to cope and women turning more to the community. Also of interest was the association between the presence of children in the household and more economic and social stressors. In addition, the survey process led to some intangible achievements, including rapport building with respondents and stakeholders, providing a conduit for sharing of respondent concerns about and after the floods, and uncovering of different perceptions on flood causation and responsibility.

The field work in Tewkesbury also showed the general difficulty of reaching out to a large number of sampled respondents through the face-to-face interview technique in the UK, which yielded a relatively high non-response rate. Furthermore, in comparison with many of the surveys in Asian countries, there was a difficulty in accessing a large number of respondents in a setting that involves individualized styles of living, such as single occupants or couples, which made it difficult for the research team to contact them because many times, they were not found in their houses, even after repeated visits.

By comparison, in Asian villages where MICRODIS surveys have taken place, the lifestyle is much more open and communal with a high number of extended households and larger family size, which meant a higher degree of accessibility to the sampled household. This contrast emphasizes some specific differences between doing research in a UK/ European setting as compared to an Asian setting.



• Flooded residential streets in downtown Tewkesbury  
Source: Severn & Avon Valley Combined Flood Group

## 11. WEST BENGAL, INDIA, FLOOD

### 11.1. Introduction

#### 11.1.1. Context

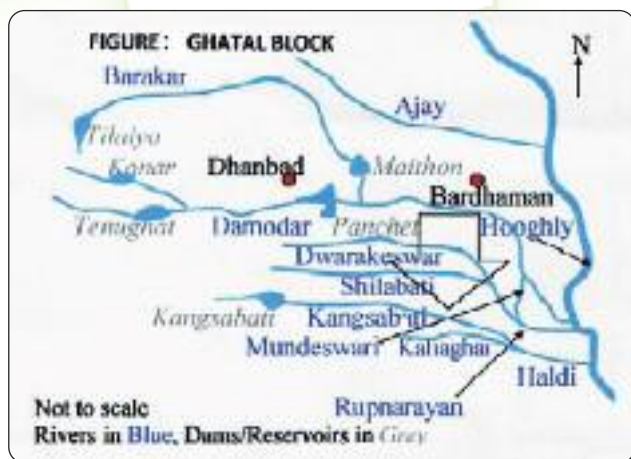
The study was carried out in the Ghatal block which is one of the five community development blocks under the Ghatal Subdivision of the West Medinipur district in the State of West Bengal in Eastern India. The Ghatal block consists of 12 Gram Panchayats, with the Ghatal town being the headquarter.

Agriculture is the predominant occupation in this area. Fishing, weaving and some cottage industries and government jobs are other occupations which can be found in the area. An important characteristic of this area is that a large number of people temporarily migrate to other states of India and/or abroad in order to work as goldsmith and silversmith. Remittances, therefore, represents an important share of the income of the households.

#### 11.1.2. Disaster Background

Ghatal is known to be a flood-prone area due to the fury of nearby rivers. It is situated on the sides of river Shilabati in the South, Darakeswar in the east. The river Shilabati and Darakeswar meet with rivers Jhumi and Dmodar in the east at a place called Bandar (see Figure 11.1).

• Figure 11.1 River flow in the Ghatal block



Initially these rivers and canals had deep valleys, but gradual deposition of silt and sand on their beds lead to flood and water logging in this subdivision.



• Aerial view of flood in Ghatal.

### 11.2. Methods

#### 11.2.1. Project Preliminaries

The study consisted of both qualitative and quantitative data collection methods. The Focus Group Discussions (FDGs) consisted of a small number of carefully selected people, divided between male and female members. The quantitative data collection included household surveys.

#### 11.2.2. The Study Design

##### 11.2.2.1. Site selection and sampling

There are 145 villages under different Panchayats in the Ghatal Bloock. The villages were stratified on the basis of their population density which is one of the most important indicators of vulnerability of floods.

For the purpose of this study the most vulnerable district, Medinipur in West Bengal was selected on the basis of the vulnerability index calculated for different districts in West Bengal. Further the Medinipur district is divided into two parts: Purba Medinipur and Paschim Medinipur. Paschim Medinipur was selected as the final study site as it is severely and regularly affected district in West Bengal.

Thirty-six villages were selected from a complete list of villages of Ghatal Block provided by the Census of India 2001. The selection of villages was done with the help of stratified random sampling using the population density as a criterion of stratification. From each of the 36 villages 5 to 10 per cent of households were then sampled at random.



• Selected village for the MICRODIS study in Ghatal Block.

#### 11.2.2.2. The survey

The FDGs were organized with the kind cooperation from villagers, NGOs, local administration (Gram Panchayat, SDO, and Information Officer) and also social workers. The FDGs consisted of a small number of carefully selected people brought together on a common platform and were divided into male and female members. The group composition was based on the age group ranging from 18 to 65 years and the number of participants was not more than 12 for each FDG. The FDGs facilitated to structure the questionnaire. In addition, information and opinion regarding floods were sought from the FDGs. After the FDGs were done the questionnaire was pre-tested in twenty randomly selected households.

Ten field investigators and two supervisors were trained at Ghatal College. The questionnaire was translated in local language (Bengali) for better understanding of the interviewed. Once the training was completed another pilot survey was conducted by the selected field investigators in order to identify potential difficulties which could be faced during the main data collection activity.



• The MICRODIS JU team during the data collection.

The main data collection activity was supervised by the MICRODIS JU Team. Supervisors rechecked one out of every twenty-five filled up questionnaire. A total of 525 households were surveyed out of which 443 households revealed their complete response. Therefore, the response rate was about 84.5%.

The information collected from the 443 field surveys was then stored into a database using MICROSOFT EXCEL. In addition to the quantitative data some information that the villagers stated qualitatively were also coded into the database, e.g.: a) displacement; b) destination of displacement; c) damage to public infrastructure; d) job opportunity; e) sources of loan; f) sources of financial and material support; g) type of help provided by the households to others; h) types of precaution taken by the households during floods; i) types of sickness; j) types of medical treatment they received; k) primary and secondary occupation etc.

## 11.3. Result

### 11.3.1 Demographics

All the households included in the study, reported to have experienced more than one flood during the last five year. They reported heavy rain fall and discharged river water as the two main causes of flood. During flood the inundated areas are submerged sometimes up to 10 ft with average level being 7.75 ft.

The average family size of surveyed households in this study was 5.59. The average number of male, female, and children was 2.02, 1.80 and 1.76 respectively. The highest variation in number of family members per household was observed in children. This variation is least for female members of households (see Table 11.2).

• Table 11.2 Average number of members per household and its variation

Statistical Measures	Number of Members per Household			
	Male	Female	Children	Total
Average	2.02	1.80	1.76	5.59
Standard deviation	1.22	1.05	1.77	3.24
Coefficient of variation	60.20	58.37	100.53	58.08

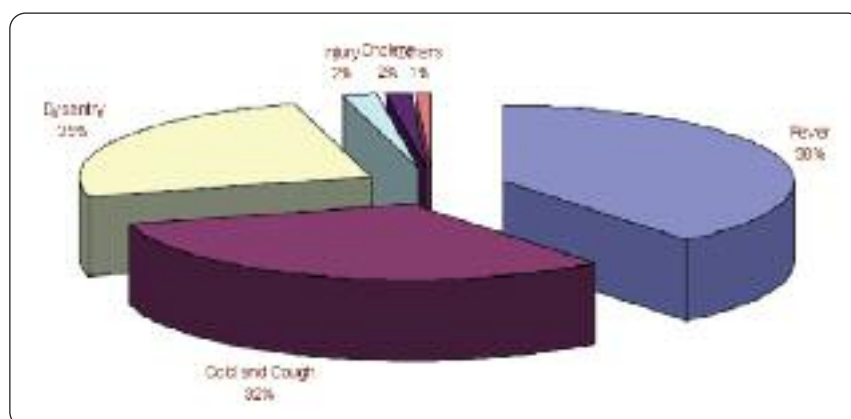
At least one member of each family was recorded to have obtained school education. In five percent of the households a graduation degree was recorded to be the highest level of education obtained by a family member.

Agriculture was reported to be the major occupation of the surveyed households. The results showed that for 51 percent of household agriculture is the primary occupation. Wage earning, service, cottage industry etc. are the primary occupation for 18,15 and 13 percent of the population respectively. Fishing was reported to be the primary occupation for a very small number of households.

### 11.3.2. Health impacts

Nearly 79 percent of family members of the 443 households reported to have fallen sick during the flood. They suffered mainly from fever, cold and cough, dysentery, cholera and injury. Fever, cold and cough and dysentery are the most common reported from of illnesses. Only 2 percent of people reported to have suffered from an injury. The incidence of cholera was not very significant (see Figure 11.3).

• Figure 11.3 Incidence of disease during the flood

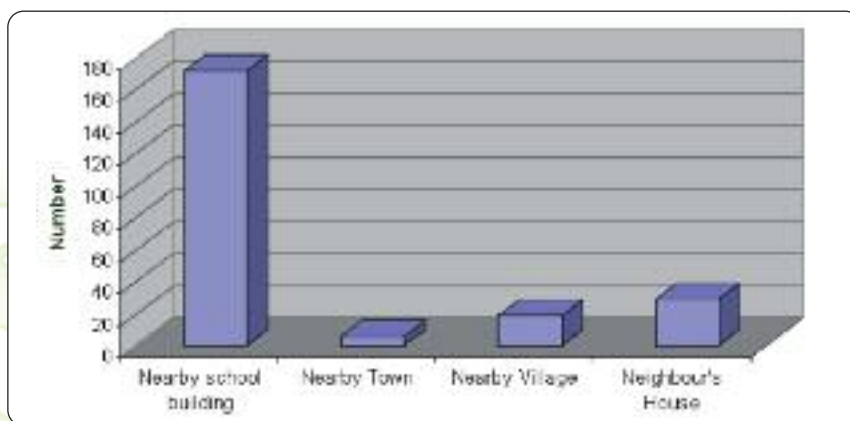


Different medical facilities are available in Ghatal Block, namely hospital, health centre, allopathic doctors, homeopathic doctors and quack. Villagers avail these facilities during and after flood if they get sick. Temporary medical camps are also set up during and after flood. However, villagers mostly go to quack for medical treatment (nearly 60 per cent). 18 per cent of the respondents prefer to go to allopathic doctors, and another 18 per cent to health centre. Medical camps take care of only 1 per cent of the respondents. The average cost of treatment due to illness during flood period was 807 Indian rupees with standard deviation 2169 Indian rupees

### 11.3.2. Social impacts

The results showed that members of some households were temporarily displaced to safer shelters during flood. Displacement occurred mostly to nearby school buildings. Duration of stay varies from one week to one month depending on severity of flood (see Figure 11.4).

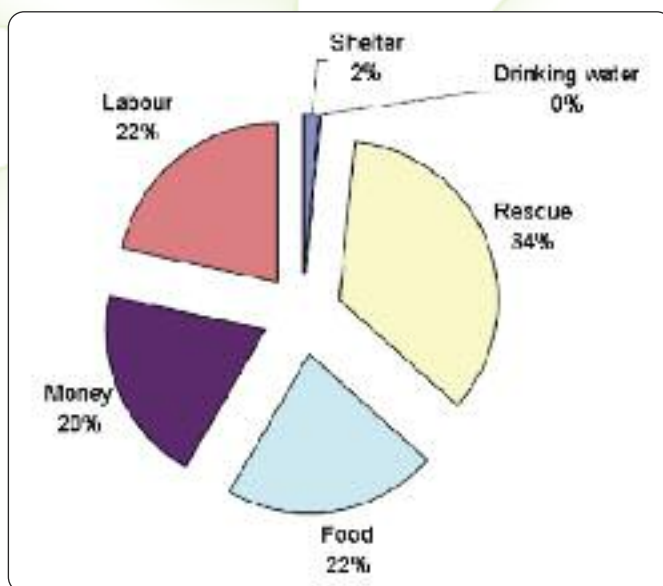
• Figure 11.4 Places of temporary displacement during flood



Flood causes damage to households. In order to restore the damages households reported to obtain different types of aid from external sources i.e. government, NGOs and religious institutions. Some household reported to receive financial support from government. However, villagers also reported to receive material support such as food, tarpaulin, water pouch, and medicines during and after flood. The role of religious institutions was shown to be very important in relief work at the survey site. Their contribution constituted of nearly 38 percent of the total relief in Ghatal block

During flood villagers reported to mutually help each other by rescuing others; offering free labour for repairing neighbour's house; lending money and offering their food. The results show that there is an income effect on help i.e. higher is the income higher is the percentage of persons offering out help and assistance (see Figure 11.5).

• Figure 11.5 Self help occurrence as reported by the surveyed households



### 11.3.3. Economics impacts

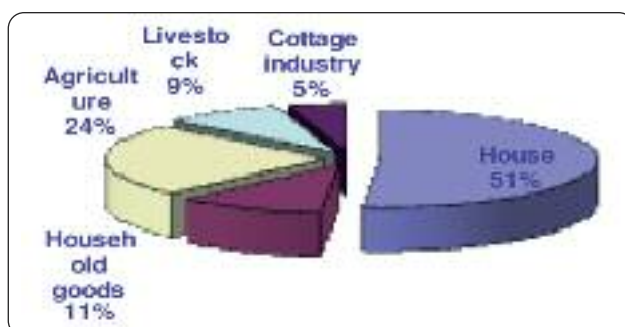
The results of the study showed that households experienced a 13.2 per cent increase in monthly expenditure during flood compared to pre-flood period. The increase in expenditure may be attributed to scarcity of essential commodities. Transport cost also increases as normal mode of transport gets disrupted. Table below shows the comparative monthly expenditure between the two periods (see Table 11.6).

• Table 11.6 Average household expenditure and its variation

Statistical measures	Before flood	After flood
Average Monthly expenditure (Indian rupees)	2869	3248
Coefficient of Variation (%)	57.74	151.42
Percentage Change	-	13.20

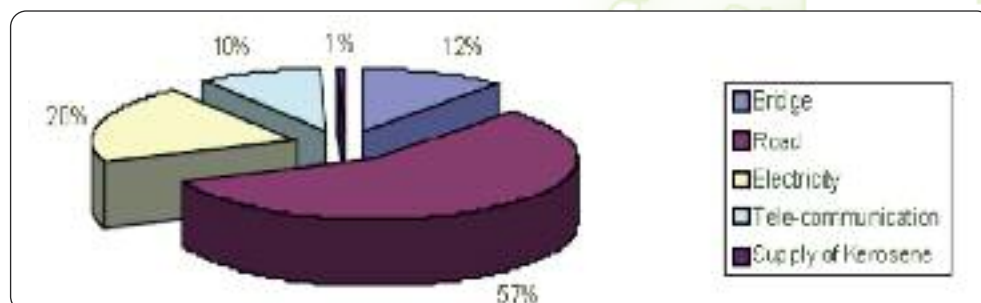
Households in the survey site suffered damage to their houses, household goods, crops, loss of livestock and cottage industries. The reported total average damage per household was 3369 Indian rupees (see Figure 11.7).

• *Figure 11.7 Distribution of damages occurred to household properties*



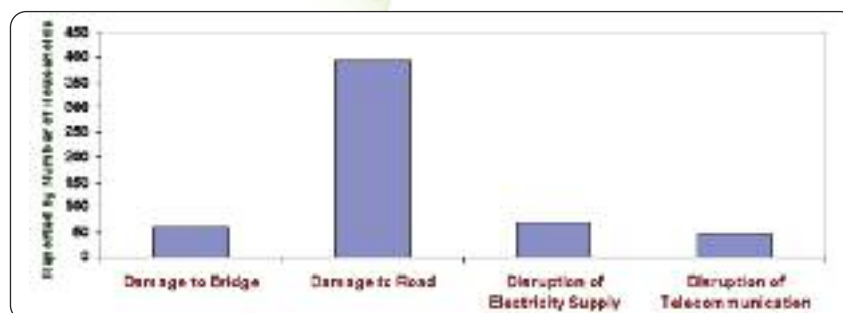
In addition, public utility services like road, electricity supply, communications etc are affected causing great hardship to the affected areas. Following damage to different public utility services were reported by surveyed households (see Figure 11.8).

• *Figure 11.8 Damages occurred to public utilities as reported by the surveyed households (%)*



The results revealed that on an average households lost 31 working days, and the average loss of income was reported to have been 3078 Indian rupees. More than 89 per cent of households blame this suffering due to damage to road (see Figure 11.9).

• *Figure 11.9 Causes for loss of income as reported by surveyed households*



## 11.4. Conclusions

The results from this study showed once again that flooding causes misery to affected households. The flood destroys houses, belongings both movable and unmovable, livestock etc. In addition it causes loss of working days and crops. This leads on one hand to increased prices of essential commodities and on the other hand to a lower price of saleable items.

Flood also adversely affects human capital. Many water borne diseases break out during and after flood. People find it extremely difficult to access modern treatment facilities and thus have to depend on locally available medical facilities. The worst affected are children and elderly people who are physically weak. In addition, the results also indicated that a sense of community and mutual help was developed due to flood. Households helped each other by rescuing, giving shelter and food irrespective of their level of income status, religion caste and creed. Although many internal and external sources rushed in to help the people with food, medicine, cloths etc, were not sufficient to make up their total loss or damages.

The overall impact of a flood is multifaceted of which only a few of them could be delineated through this study. Some aspects of floods may remain unexplored. Given the constraints of time and resources, the study tried to capture and cover problems of flood as adequate as possible.

## 11. OVERALL CONCLUSIONS

The interaction of disaster and vulnerability was clear from the results of the surveys and qualitative findings for the MICRODIS main sites. Some commonalities that many of the surveys shared were findings of increased infectious disease, especially among young populations, and economic effects that were most pronounced among the poorest groups, especially agricultural workers. As was noted in one study, the less a household had to lose, the greater the effects of any loss to damages from disasters.

Also noted among studies in Asia were the effects of a vicious cycle of poverty followed by disaster followed by the taking of high-interest loans because of difficulties recovering from the disaster, thus deepening the poverty. Another key disaster effect in some parts of Asia was the worsening of child malnutrition.

Responses to early warning systems varied from site to site, with some cultures exhibiting a casual attitude, having become so inured to repeated disasters that warnings have lost meaning. In the case of one of the UK sites, a failure of the early warning likely worsened disaster outcomes for some. Populations exposed to disaster have mixed responses to questions regarding their willingness to contribute, with some expressing wariness of the underlying intentions of such programs, while others reported a greater willingness to contribute in-kind labour rather than money.

A consistent theme among sites was the influence of disaster on social impacts. Many populations in both Asia and Europe reported increased social cohesion and involvement, with some positive changes in personal relationships. Disasters seem to draw people closer together and foster some increase in community cooperation. That said, the presence of children in the UK context seemed to exacerbate some of the disaster outcomes for families. Many respondents in Asia sites expressed that they use religion to help them cope with the outcomes of disasters.

Access to health care was variable from site to site, depending on how badly the disaster influenced transportation and the health facilities themselves. Certainly, as noted, there was an overall increase in many cases of acute infectious illness. Also, there was a notable increase in a few of the studies in hypertension following the disaster. Given the expected findings of increased stress at many sites, this enhancement of hypertension may also be anticipated and requires further investigation.

The results of these studies emphasize the vulnerability of certain populations in disasters, generally young children and the elderly. Some studies yielded specific recommendations that might be applied in many cases, including improved immunization and closer attention to child nutrition. As noted in the introduction to this report (Part I), the outcomes of a disaster can in large part depend on the resilience and vulnerability status of the affected populations, and as one study showed, health plays a central role in the outcomes related to social and economic impacts. Thus, health - including mental health, as the UK study results emphasize - remains a focus not only in the immediate aftermath of a disaster but also in preparation for disaster.

It should be recognized that health, social and economic impacts are heavily linked; some correlations being proven stronger than others depending on the disaster and the local context. Mitigating factors such as active disaster awareness or prevention programs, and sound disaster policy also play varying roles in reducing negative impacts on affected populations.





**MICRODIS**



## PART 3

### MICRODIS TEAM LEADER INTERVIEWS



This part presents interviews with the team leaders of each active MICRODIS partner with their insights into the challenges and benefits of their experiences with the MICRODIS project and consortium.

## 1. Mrs. Lourdes Louella Escandor, Citizens' Disaster Response Center, Albay Study



According to Lourdes Louella Escandor, community-based disaster preparedness is central to the Citizens' Disaster Response Center (CRDC), which led the Albay study. "Disasters, as we all know, cannot be prevented", she said, "but we can certainly prepare ourselves and be better equipped to withstand these calamities. The key task, therefore, is the goal of building resilient communities".

Typical actors in disaster preparedness in Albay include the Albay Public Safety & Emergency Management Office, which uses local governance to plan and implement disaster risk-reduction programs. Non-governmental organizations (NGOs) and the private sector also play varying and comprehensive roles. "Albay has the reputation of being the country's province that is most frequented by natural disasters such as typhoons, landslides, and volcanic eruptions", Escandor said. "However, it is also known as the country's showcase of best practices in terms of disaster management".

Escandor noted that the social impacts that stood out from the Albay study were that 93.5% and 95% of respondents, respectively, in the most-affected and least-affected areas were worried that their lives were in danger during the disaster. Economic losses in the disaster were almost uniform: except for two households in Albay, all incurred damage to their properties and sources of livelihood. Further, she said, one out of every four respondents believed that access to health services was compromised after the disaster. This difficulty was exacerbated by the destruction of health centres in Albay, especially in the most affected areas.

She also described the importance to the project of relationships with the community. "One of the main factors that facilitated the success of the field survey was the good coordination on the ground", she noted. "The proper endorsement from the governor and the mayors was important in gaining entry into the communities. The cooperation and support of the village councils on the other hand was just as important. They provided accommodation, access to their facilities, and even security to the enumerators during their stay in the communities".

Escandor said that the project outcomes were a breakthrough for CDRC. "We had always believed that we were less capable of doing this field work and better off doing community-based disaster management", she said. "This experience with MICRODIS, however, has proven us wrong. With the tools, methodologies, and other learning acquired from MICRODIS, CDRC will definitely embark on future similar projects with greater confidence".

## 2. Prof. P.C. Joshi, Department of Anthropology, University of Delhi, Bahraich Studies



Prof. P.C. Joshi, MICRODIS India partner and professor in the Department of Anthropology, University of Delhi, said that most research on disasters still comes from the government sector in India, and that “there is a need to involve universities in generating state-of-the-art and evidence-based knowledge on disasters”. With MICRODIS, Joshi said, “a good beginning has already been made in this direction”. The project team selected the Bahraich district of Uttar Pradesh in India for its MICRODIS focus because it was most affected by floods the year before project initiation, and floods are the most frequent disaster in India. “Our MICRODIS research was mainly focusing on social impacts”, Joshi said. “Historically speaking, in India the major focus has always been on hard areas of disaster impact such as food, medicine, clothes, buildings, bridges. Soft areas like social impacts are not visible but have the capacity to harm a community for a long time”.

The project results showed that the study population had a low capacity and high vulnerability. “One of the distinct results was that while floods were making people poor, the taking of loans was making them perpetually poor”, Joshi noted. Furthermore, “the psychological impact of persistent flood was clearly visible on the women, who showed a high prevalence of anxiety and depression”. Researchers shared their findings with the community and also with officials, NGOs, and others involved in disaster response. “Our interaction has definitely played a significant role in raising the issue that long-term and sustainable solutions are best for such a community”, Joshi said.

The collaborations within MICRODIS were helpful for enriching knowledge and skills, said Joshi. Further, the team had the chance to collaborate closely with many other universities and research institutions. According to Joshi, “We plan to translate this bond into enduring bilateral and multilateral research relationships”.

Joshi played a major role in the MICRODIS project as the Asia coordinator. “My main role was to facilitate the smooth functioning among MICRODIS partners in Asia”, he explained. “During the tenure of the project, whenever and wherever there was any problem in smooth functioning, I would be asked to serve as facilitator”. While Joshi did step in where necessary to facilitate smooth function of the project and served as the liaison with Asian partners to ensure that tasks were done on time, he focused on the facilitating aspects of the work. “I intervened whenever such a need arose...and performed my role as Asia coordinator as facilitator and helper rather than as controller”, he said.

### 3. Dr. Mondastrri Korib Sudaryo, University of Indonesia, Indonesian Studies



According to Dr. Mondastrri Korib Sudaryo, a MICRODIS partner from the University of Indonesia, all three MICRODIS themes (health, social, and economic) were equally important for the Indonesian study site of Bojonegoro. While the main focus was on health impacts, he said, “We did not ignore the important aspects of social and economic impact and investigated these areas using the specific instruments developed by our MICRODIS partners and experts”. The most significant health impacts they identified were possible increases in the prevalence of major acute infectious illnesses, such as fever, dermatitis, ARI (acute respiratory infection), gastroenteritis or diarrhoea, and DHF (dengue hemorrhagic fever), especially among under-five children. In that same group, flood might have also induced acute malnutrition and amplified chronic malnutrition.

Sudaryo said that the results indicate that more adequate programs are needed to anticipate and prevent such increases in diseases after floods. “Specific and focused intervention for children is needed to prevent acute and chronic malnutrition potentially occurring after a flood”, he said. “Further, communication, information, and education programs to promote disaster awareness and positive health-seeking behaviour should be strengthened, through community participation and wider stakeholder involvement”.

He noted that the Indonesian people can help achieve these aims by supporting and actively participating in various information, communication, and educational activities to increase individual and community knowledge and awareness of disaster-related health impacts and to improve the perception of disease/illness susceptibility and seriousness. This participation will help with “improving the personal hygiene and sanitation and care seeking practice”, he said. Further, the findings of poor coverage and communication via the early warning system point to a need for improvement in that area, by both government and the community.

Sudaryo noted that one of the unexpected findings of the study was that “about 33% of affected people did not immediately go to modern health facilities when they became ill within one month of the flood, even though most could have easily reached a health facility”. He said that the main reason was that they did not consider their illness to be serious enough.

With four years of working on the MICRODIS project, Sudaryo had some ideas about how to build on the knowledge and experience gained from the project. “The linkage of my centre and university with other prominent relevant institutions and organizations, government and non-government, academic and non-academic, national and international, gives us a nice opportunity to establish wide and strong networks with institutions and organizations”, he said. “(We can) thereby use the knowledge and experience to support adequate and applicable disaster policy and management”.

#### 4. Dr. Ståle Navrud, SWECO Grøner, Quangnam Studies

According to Dr. Stale Navrud of SWECO Grøner and a member of the MICRODIS Economic Working Group, measuring the economic impacts of disasters is important because it relates also to the social benefits of avoiding future floods. Indeed, Navrud indicated that it encompasses all of the impacts under the MICRODIS umbrella, saying that “It is important to document the full economic benefit of preventing floods...including not only avoiding damages to infrastructure, agriculture, housing, and small businesses but also the health impacts and overall welfare loss of affected households”.

Navrud was one of the contributors to developing the MICRODIS economic questionnaire. According to him, the greatest difficulty in designing the questionnaire was to capture enough detail regarding physical losses while not being too detailed for respondent recall. Another challenge, Navrud said, was constructing questions about willingness to pay and contribute in a way that was “realistic and...does not cause protest behaviour”. Finally, he noted, there was “the overall challenge of merging the health, social, and economic surveys into one survey without making the survey too long and avoid causing respondent fatigue”.

According to Navrud, the survey instrument was as similar as possible between Asia and Europe to allow for comparisons across countries, but there were some differences. “The main difference between Europe and Asia is the lack of insurance in Asia. For Europe, we had more questions on insurance premiums, coverage, and compensation payments they received”.

The survey questions included coverage of respondents’ willingness to pay and willingness to contribute. Navrud explained the distinction between the two: “Willingness to contribute labour to a project...is often a better way of measuring the welfare loss from flooding for the affected households. This willingness to contribute is converted to a monetary measure, comparable to willingness to pay, by looking at the income their labour would have earned”.

Navrud’s team participated in the studies in Quang Nam. He said that the most important thing they learned in these studies is that the survey they developed worked very well in the field. “The main lesson...was that welfare loss makes up a major part of the total damage costs of flooding”, he noted, “and needs to be added to avoid too little investment in measures that will avoid or reduce impacts of future natural disasters”.

The experiences with MICRODIS have yielded plenty in the way of future applications, according to Navrud. “The methods...can be extended to assess environmental, ecosystem, and culture heritage damages from disasters”, he noted. “The extensive work carried out in MICRODIS to assess the health, social, and economic damage costs from natural disasters can contribute to the assessment of overall damage costs from climate change to better inform decisions on reduction in greenhouse gas emissions and adaptive strategies”.

## 5. Dr. Kai Savolainen and Virpi Väänänen, Työterveyslaitos Finnish Institute of Occupational Health, MICRODIS Annex Studies



Two MICRODIS team members from Finland, Virpi Väänänen and Kai Savolainen of the Työterveyslaitos Finnish Institute of Occupational Health, discussed their focus on occupational health in disaster research. In their study on floods in industrial areas in Hanoi, they noted that there were many chemicals located there and that damages could be reduced if occupation (or industrial) hygiene issues were better understood. As they noted, “The amounts of used chemicals are significant, which is why in the case of disaster, there must be knowledge about dangerous chemicals in the area, awareness of how to identify and handle dangerous chemicals, and awareness of the health effects and exposure routes of chemicals and risk assessment”.

In their work in Hanoi, Väänänen and Savolainen found that identifying dangerous chemicals was a difficult task because of gaps in labelling. Further, they reported that knowledge about dangerous chemicals and their health effects was not necessarily taught in local schools. “In Asia, chemical contamination is very important because the people in Asia use floodwater for growing vegetables and they have fishing farms in the coast line and in rivers”, they noted. “The use and disposal of chemicals causes contamination of the environment and ground water”. Further, they said, industry and the use of chemicals is anticipated to grow rapidly in Asia, in contrast to the situation in Europe where the use of chemicals is decreasing and the industry follows safe practices for use and disposal of chemicals more closely.

Väänänen and Savolainen expressed the hope that through training courses and awareness of and knowledge about the use of chemicals will increase among students and public health experts in Vietnam. “Through the students, these issues will become important and hopefully enhance knowledge of chemicals and their effects, working practices, rules, and regulations”, they said. “Through the symposium, we brought these issues to the table among disaster research experts in Asia”.

Indeed, they both judged that this knowledge sharing was one of the main strengths of a collaborative project like MICRODIS. “There are always issues to be learned from each other”, they noted. “In Europe, we comply with the regulations and rules, and people in Asia have more human power and are very eager to learn and get along with the business”. The team expects their experiences in Southeast Asia to be “highly helpful” in delineating the responses of the European rescue system in cases of serious future challenges. “The challenges in Southeast Asia are of a different magnitude than we have in Finland or other European countries”, they said, “but improving systems is always important, and the improvements carried out in Asia...could be helpful in the case of Finland and throughout Europe”.

## 6. Professor Debarati Guha-Sapir, Universite catholique de Louvain, MICRODIS Project Coordinator



Dr. Debarati Guha-Sapir of the Université catholique de Louvain said that one of the main challenges she experienced in her role as MICRODIS project coordinator was managing the levels of skills and work rhythms of the different partners. “Despite being fully aware of the cultural differences, I found that trying to understand all the things that were not said, but meant or vice versa—not meant but said—took a lot of time”, she said. “Finally, it was not easy to have a common language between operational partners and scientific partners as their perspectives on what is useful differed widely”.

There were other challenges. To assess the health, social, and economic impacts of floods, every survey team used the MICRODIS assessment tool, but they made slight modifications to fit it into their country’s contextual and cultural environment. “These ‘country-specific adaptation measures’, as we call them, were absolutely necessary for a successful implementation of the questionnaires”, noted Guha-Sapir, “but they made the straightforward comparison of questions across sites and countries not as easy as anticipated”.

To tackle this problem, the group, along with colleagues from Heidelberg University, brainstormed possible solutions for creating a system to facilitate cross-country data comparison. They performed an in-depth comparison and analyses of all survey questionnaires. “Once we had a clear picture of the differences in questionnaires, we started again from the beginning allocating common codes to common questions”, Guha-Sapir said. “At the end, we came up with a 300-page document with common codes” that allowed each team to standardize data.

Thanks to clues from English back-translated questionnaires, Guha-Sapir and her team also found that it is essential to understand the extent of both the language and contextual adaptations to ensure that the same type of information is being pulled together under the common codes. “So I would recommend that in cases where data collection takes place in many countries using different languages, special attention should be given to adequate translation processes”, Guha-Sapir said.

One thing the team also learned from their experience at three survey sites, two in the UK and one in India, was to appreciate the differences among the sites and how the tools really needed to be adapted for the local context. “As well, it was interesting to see how curious the researchers from each site were about sharing experiences across Europe and Asia”, Guha-Sapir said. “For example, in Orissa, the enumerators were surprised to hear about the magnitude of the floods in the UK. They were absolutely shocked that we had a high non-response rate in the UK, as in Orissa the response rate was 100%. Researchers in the UK were very interested to hear about the strength of social networks and community organization in Orissa and could make some similarities in the UK case to their local flood action groups and increasing sense of community after the flood by those affected”.

## 7. Dr. La Ngoc Quang, Hanoi School of Public Health, Hanoi Studies



Dr. La Ngoc Quang of the Hanoi School of Public Health and a MICRODIS partner in Hanoi discussed the reasons that health impact assessment of floods is a priority for Vietnam. “Floods with a long duration cause health problems, particularly for the elderly and disabled living in poor conditions with limited food stocks, unhygienic water sources, and poor sanitation”, he said. The Hanoi floods stood out in a country with multiple disasters every year because of their historic nature, according to Quang, who described some areas as being under as much as 2.5 meters of water. In that flood from October to November 2008, 22 people died, and even a month after the rains ended, some areas of Hanoi were still deeply inundated.

Quang said that the results of the Hanoi survey were really “just a snapshot of the health situation of people in four communities within one month after the heavy rains that led to the historic flood”. The findings showed “higher proportions of cases of dengue fever, red eye diseases, and psychological problems in communes severely affected by flood as compared with that of controlled communes”.

He noted a specific need to pay special attention to the health of people in the flood-prone area not only after a flood but also in a preparation period for the health care sector before the rainy and flooding season strikes. According to Quang, access to the usual health care services and medication was compromised by 50% for people in both urban and rural flood-affected communes mostly because of road damage and a lack of available transportation.

The overall experience with the MICRODIS project “provided good opportunities for us to share and exchange expertise and experiences related to disaster management”, Quang said. “The project also provided us the chance to learn about carrying out inter-country studies”. Quang anticipates incorporating his experiences with the MICRODIS team into lectures on disaster management for students earning their bachelor’s and master’s degrees in public health in the Hanoi School of Public Health.

## 8. Dr. Michael Marx, University Hospital Heidelberg



Dr. Michael Marx of the University Hospital Heidelberg serves as the leader of the MICRODIS Health Working Group and participated in the MICRODIS study in the Jagatsinghpur district of Orissa. He explained why measuring the health impacts of disasters is important. “The impacts are more pronounced in developing countries where the infrastructural and financial resources to buffer them are limited”, he noted. “It is essential to understand the additional burden produced by natural disasters on already stressed systems. Assessing the impact of disasters is also important to better understand the causalities to better conceive preparedness and coping strategies”.

Designing the MICRODIS health questionnaire entailed a few challenges, Marx said. “The main challenge was to accommodate adequately the inter-country variances while trying to preserve a standard set of questions in order to generate comparable results”. Other challenges, according to Marx, were integrating the three thematic groups into the same questionnaire while maintaining continuity and accommodating questions pertinent to the three types of disasters along with the three thematic areas and individual country specificities in the same questionnaire.

Health systems research is key to improving the health status of a population, but health systems was, Marx said, one of the weaker parts of the project. One issue in accomplishing the “huge task” was that not all country teams had experience with the systemic approach to health. “Although a generic questionnaire was circulated, the teams did not systematically collect the information, and this was a major drawback”, Marx said. “In my opinion, strengthening health systems is the most essential step in buffering the health impacts of any kind of disaster”.

A major strength of the MICRODIS project was the integration of the three thematic areas, but this also was a major challenge, Marx noted. “I was sceptical about the process of integrating multiple countries and three thematic groups”, he said. Ultimately, though, “when we constructed the conceptual model for health, the inputs from the economic and social groups were remarkable. When we conducted the field work in the health systems survey, the participatory methods advocated by the social group helped us triangulate the quantitative findings”. In other words, Marx said, interpretation of the health impacts in light of the economic and social impacts strengthened the understanding of the health impacts.

Another main strength of the MICRODIS project, according to Marx, was the continuing learning process for its members. For future applications, he noted that “the best way to build on the knowledge generated from the MICRODIS project will be interventional studies targeted at the sites studied”. As for outcomes, Marx said, “The best learning experience was developing sound and standard methodologies for inter-country assessments keeping the socio-cultural aspects intact and arriving at scientifically robust outcomes”.

## 9. Dr. Alok Mukhopadhyay, Voluntary Health Association of India, Orissa Studies



Alok Mukhopadhyay, chief executive of the Voluntary Health Association of India (VHAI), talked a bit about his experience as part of the MICRODIS team in the Jagatsinghpur district of Orissa focusing on the health impacts of floods. According to Mukhopadhyay, VHAI has worked extensively within the community to raise awareness about disaster impact mitigation and preparedness.

The results of the study yielded some important information, Mukhopadhyay noted. Among the findings, “Converging research outcomes with real-life situations is a challenge, but a necessity”, he said. They also found that “evidence-based problem identification is very important for preparing a medium-term and long-term response plan in any post-disaster situation”. Furthermore, any communication strategy and materials for creating awareness “must consider the local needs, culture, and adaptability”. According to Mukhopadhyay, VHAI plans to share the MICRODIS experience and knowledge in an important session during its general meeting so that the representatives from various states can take the information back to their regions and member organizations for more dissemination and implementation.

As for the study findings, Mukhopadhyay said, “The overall finding of the study provides sufficient evidence that health impacts cannot be analyzed in an isolated manner independent from social and economic factors”. Indeed, he noted that a complex set of other factors appears to be involved in the susceptibility of people to the health impacts in a disaster situation. “Disasters severely challenge the public health infrastructure and behaviour of personal hygiene, and any disaster risk management should focus on reducing the health vulnerability of communities in long run”.

The Orissa/Jagatsinghpur study also involved assessing the nutritional status of children ages 6 to 59 months. “We found the prevalence of chronic malnutrition (stunting) to be higher among children living in households affected by floods, compared to those not affected”, Mukhopadhyay said. The results suggested that “living in flood-prone areas is associated with an increased risk for children of suffering from growth retardation”. Furthermore, health centres were found to be inadequate for post-disaster needs.

Part of the MICRODIS experience was discovering that the concept, collection of data, and the analysis could have been more integrated, Mukhopadhyay noted. However, he also said that the lessons from the MICRODIS study “will help in improving preparedness plans at the community, state, and national levels”. In fact, the local government is seriously considering the recommendations of the study to integrate with the state disaster preparedness plan. “The strength of our work in the project has been to involve (such entities) pro-actively right from the beginning”, Mukhopadhyay said.

## 10. Dr. Ivan Komproe, HealthNet TPO, Tewkesbury/Morpeth Studies



Dr. Ivan Komproe of HealthNet TPO answered a few questions about the MICRODIS experience in Morpeth. The focus of the Morpeth study was the mental health impact of disaster, in this particular case, flooding. According to Komproe, studies show that in post-disaster situations, the prevalence of psychiatric and psychological symptoms is higher than under normal circumstances. These mental health effects can hamper the reconstruction of society and rebuilding of lives in the wake of disasters.

Even though floods are often less traumatic in terms of mental health than disasters such as earthquakes or storms, “depression and anxiety as a result of a continuous risk of being flooded and related loss of resources remain high”, Komproe noted. “In our opinion, it is difficult to specify the specific mental health impacts of a specific type of disaster without taking into account the long term (secondary) effects of the disaster on the individual, the community, and the environment”.

Komproe listed three challenges involved in designing the questionnaire for measuring social impacts in Morpeth. First, there is the interdisciplinary nature of social impact research, requiring collaboration across disciplines. A second issue is the abstract nature of social impacts, making them difficult to measure. Finally, because of these complexities, the instruments used must be carefully validated, which is a long and thorough process.

In comparing mental health impacts in Asia and Europe, Komproe noted that “within (Asian) regions, the occurrence of a disaster is often a matter of life or death, not only due to the danger of the experience itself but also due to the already fragile economic position people lived in prior to the disaster”. Despite these differences, the HealthNet TPO team developed a model that explains mental health problems in both the Asian and European context. “To simplify matters, we postulated that the loss of personal resources (perception of the disaster, ability to cope, and employ social support) and social resources at the community level both lead to mental problems”, he said. “Yet, we argue that the strength of the relations differs across contexts”.

Komproe cited as the most interesting findings from the Morpeth study the complex interplay between individual attributes and community-level resources in determining mental health outcomes. An understanding of this model, he said, provides starting points for interventions at both levels. The team used economic loss to explain mental health outcomes. “It turned out that economic loss is mediated by personal resources loss and loss of social capital at the community level”, he said. “Thus, economic loss helped us to explain mental health outcomes”. He noted that because his group, HealthNet TPO, has an interventionist philosophy, they apply interventions at the individual and community levels, and the MICRODIS research supported this approach and expanded their knowledge to the disaster setting.

## 11. Dr. Tuan Tran, Hue College of Economics, University of Hue, Quang Nam Studies



Dr. Tuan Tran of Hue College of Economics, University of Hue, discussed why economic impacts are such an important focus for a country like Vietnam. “In many developing countries like Vietnam, governments often report total economic loss after the occurrence of disaster without a clarification of calculation methods”, he pointed out, saying that the result can be over/underestimated damage cost. There is a need, he said, for a better understanding of the full economic costs of floods and other natural disasters.

In the MICRODIS study site in Quang Nam, the results indicated that local communities suffered huge losses during the 2007 flood disaster, as much as 20% of the total income of the households. The level of preparedness varied from area to area, according to Tran. “Local communities used different preparedness methods to cope with natural disasters (mostly floods and typhoons), such as changing the crop calendar, adopting new short-term food varieties, building houses with higher foundations”, he said. However, he also noted that much of the population remains vulnerable to extreme flood events. “In the context of extreme disasters, new risks are rapidly appearing that exceed the adaptation capacity of local communities”.

A challenge of the study, according to Tran, was translating the economic assessment tools and analysis for non-economic experts in the MICRODIS consortium. Further difficulty arose with the economic aspects of the questionnaire itself, a common theme for many MICRODIS sites. “The time for conducting an economic impact assessment is often 6 months to 1 year after the occurrence of floods”, Tran explained. “Thus, local respondents found it hard to answer questions in particular that related to damaged items or income variables”. To address this problem, the team often used proxies to obtain more reliable information, such as replacement costs for goods.

Tran also said that assessing the social and health impacts enhanced the team’s insight into the economic impacts of disaster in Quang Nam. “For example, many households could not run their businesses because of infrastructure damage, power failures, and market closures”, he said, “and many families spent their savings to pay for medical treatment costs”.

Hue College of Economics will apply the MICRODIS experience in a number of ways, according to Tran. Researchers there already have contributed by reviewing the conceptual model and calibrating the protocol toward a common approach for assessing economic impacts of extreme events, he noted. “We have also conducted more research projects in the field of natural disasters and climate change”, he said. “Case studies and other information have been integrated into courses for undergraduate and graduate students of our university, particularly for majors in agricultural economics and rural development, and environmental economics and resource management”.

## 12. Dr. Wu, Sichuan, People's Hospital of Deyang City, Earthquake-related Injuries Study



Dr. Wu of the People's Hospital of Deyang City in Sichuan province talked about the situation at his hospital shortly after the large May 2008 earthquake struck the area. "After the earthquake, our medical staff assembled immediately in the hospital and evacuated over 1,200 inpatients to safe area as soon as possible, overcoming difficulties like traffic jams and communication outages", he said. "The Emergency Response Plan for emergent public health events was launched 30 minutes after the earthquake. Staffs were organized into specific teams including a coordination team, medical treatment team, logistics team, and reception team and so on to undertake all necessary medical work. After that, we set up temporary tents for diagnosis, seriously injured patients, operation, and inpatients for an increasing inflow of injured people". Wu reported that within 48 hours after the disaster, more than 1,200 patients (including 500 more seriously injured ones) had been treated in the hospital.

Given the magnitude of this disaster and the frequency of natural disasters in China, it likely comes as no surprise that research especially on the human impact of earthquakes is of great importance. Wu noted that such studies "will help a lot in establishing measures for prevention, relief, and reconstruction against natural disasters". This kind of work is needed, given the findings of Wu's team in Sichuan. "Injured people in rural areas were widely scattered and some of them migrated after the earthquake", he said. Further, there was a large floating population in Hanwang Town (which had the largest number of injured people), but most of them returned to their hometown after the earthquake so that their information was not stable.

In addition to these data collection gaps, there also are research gaps. "There is no epidemiologist on the Deyang Team", he said, "so for much of the research, we must rely on the Université catholique de Louvain team. Also, we do not have experience in earthquake research". He noted that a great benefit of the MICRODIS project was the friendly attitude, cooperation, professional dedication, and rigorous research approach of the MICRODIS project members.

Indeed, Wu anticipates mirroring some of these factors in applying some of the knowledge acquired during the MICRODIS work, including ensuring a scientific and feasible design before implementation of a study and strict implementation of the design. Further, he expects to imitate the MICRODIS focus on data integrity, enthusiastic cooperation, team stability, and cultivation of participation and cooperation from authorities.

### 13. Dr. Maria Teresa Sharon C. Linog, Research Institute for Mindanao Culture, Xavier University, the Philippines Studies



According to Dr. Sharon Linog, research associate of Xavier University and MICRODIS project coordinator/team leader in the Philippines, one of the main strengths of a project like MICRODIS is the multidisciplinary approach. “Bringing together these experts from different countries brings an add-on cultural richness to the project”, she said. “A more holistic approach to reducing disaster risks, increasing resiliency, and adaptation of communities can be achieved”.

Linog’s team worked at two sites in the Philippines, Albay and Southern Leyte. Geographically, they were similar and prone to hydrometeorological hazards, she said. Southern Leyte stands out because it lies on a geographic fault and is highly prone to landslides. Indeed, a 2006 landslide in the Southern Leyte municipality of St. Bernard, triggered by rains and possibly an earthquake, completely wiped out an entire village except for a few individuals pulled from the debris.

The team worked hard to build community links to facilitate the project. Their efforts were successful and ended in the governors of both study sites allowing dissemination of the study results in coordination with CRED. “This activity not only validates our research findings”, Linog said, “but more important, it empowers local executives and concerned communities as to utilization of research results and recommendations”.

One thing that can be done to reduce the negative social impacts of disasters, based on the MICRODIS study, is behavioural modification, particularly targeting cultural practices and beliefs that tend to support a lax attitude towards warnings and advisories, Linog noted. Indeed, she said, a significant number of respondents in one study site did affirm having received warning of an impending disaster but only a handful acted on these warnings.

Assessing the health and economic impacts widened the team’s perspective on social impacts and how these themes intertwine in people’s lives, Linog said. “When we go out into the field, we cannot simply ask respondents how were they affected by the recent natural disaster economically or socially. Compartmentalization of these impacts may not be necessarily understood by the community folks. Hence, a multidisciplinary approach affords social scientists and researchers a much wider lens, particularly on gender and vulnerability impacts”.

Linog anticipates building on the MICRODIS experiences in several ways. “The tremendous knowledge and experiences the MICRODIS project gave me are undeniable, and I will always be grateful”, she said. “I hope that I will be able to apply what I have gained in the MICRODIS project in all future endeavours”.

#### 14. Dr. Maureen Fordham, University of Northumbria, European Coordinator and Tewkesbury/Morpeth Studies



Dr. Maureen Fordham of University of Northumbria discussed her role as the MICRODIS European coordinator and the experience with the MICRODIS surveys in Morpeth and Tewkesbury. Her role, she said, included leading the UK MICRODIS team and also engaging in discussions with other MICRODIS colleagues and colleagues outside the Consortium on matters with relevance for the European studies. “It includes planning research work collaboratively, sharing our findings, and working on joint papers as some of the key tasks”, she noted.

Fordham said that the team encountered its first challenge in Tewkesbury in terms of the sampling method because of difficulties obtaining a list of flooded households as a result of data protection reasons. So the team had to select flooded properties lying within the flood outline and then ground truth the data by physically walking the streets after reaching the Tewkesbury field site. Houses were then selected and approached for an interview using systematic sampling methodology.

The second challenge the team faced was the high refusal rate by the respondents, almost 30%. “The major reason was survey fatigue”, Fordham said. “Many had already been interviewed by other agencies and were not keen to participate in a survey again”.

In comparison with many of the surveys in Asian countries, the experience in Tewkesbury points to the difficulty of accessing a large number of respondents in a setting of individualized living styles, such as single occupants or couples, Fordham noted. The research team found reaching out to them difficult, as they often simply were not at home. “By comparison, in Asian villages where MICRODIS surveys have taken place, the lifestyle is much more open and communal”, Fordham said, “with a high number of extended households and larger family size, which meant a higher degree of accessibility to the sampled household”.

Fordham noted that an interesting finding from the two UK studies in Morpeth and Tewkesbury was the difference in mental health predictors for men and women. “The main predictor for good mental health for males was a degree of sense of control they felt after the floods”, she said, “while for females, it was their sense of community and feeling of embeddedness with their neighbourhood”.

According to Fordham, future directions following the MICRODIS study include a proposal for a project on resilience. Also, she said, “We will be using the MICRODIS study as part of our teaching material for our MSc Disaster Management and Sustainable Development and fully expect several of our postgraduates to take this work further”.

## 15. Professor Tuhin Das, Jadavpur University, West Bengal Study



a MICRODIS study site. “Floods are a significant disaster in West Bengal,” he said, noting that the floods affected 2.1 million people in 1998 in the region. The economic impacts are an important focus, he said, because major flood disasters in the area are associated with short-term and long-term economic losses, including population displacement and loss of homes, possessions, and livelihoods.

“During the period from 2005 to 2009, lives lost in West Bengal account for 4.99% of total lives lost in India”, he said. Furthermore, “damage to houses in West Bengal was 17.11% of the total number of houses damaged in India during this period”.

According to Das, the government of West Bengal plays an important role in disaster preparedness, alerting people and taking defensive action. The government also coordinates among relevant agencies and sets relief such as food, drinking water, and medical facilities as top priorities during disasters. NGOs make significant contributions to providing such services in the aftermath of disasters, he said.

There were three Indian sites in the MICRODIS study assessed for flood-related disasters: West Bengal, Orissa, and Bahaich. Das said that the economic impacts of floods in the three Indian sites were similar in the sense that in all three sites, floods are the most consistently recurring events. Further, he said, “these three sites have been suffering from the aftermath of floods from the very beginning. The floods have grave consequences for the people as well as the economy of the affected regions of the three Indian sites”.

To raise community-level awareness, Jadavpur University organized a “Community Disaster Awareness Programme” to seek the opinion of various experts and to invite local people who are generally affected by flood to exchange their views in an interactive session. Experts from the meteorological department, subdivision office, information department, and NGO helped in knowledge sharing. “This programme was successful in the sense that the local people now feel the need for improving human resources through training and knowledge sharing”, Das said.

Das describes the MICRODIS study as a “win-win” experience. “Our effort of listening to the affected people and sharing the on-field experience with other responsible people was very enlightening”, he said. “We came to know the perception of the people in charge of disaster management about the needs and feelings of affected people and vice versa”.

## 16. Professor David Alexander, Università degli Studi di Firenze, L'Aquila Study



Professor David Alexander, who oversaw the L'Aquila earthquake study, discussed the importance of earthquake research in the European context. He noted that major earthquakes are possible in Italy, Greece, Turkey, and Malta and that lesser risks are present in eastern Spain and central and northern Europe. "I am particularly interested in the role of self-protective behaviour in saving lives during earthquakes," he said. "At the same time, I am interested in how behaviour may lead people into danger."

The disaster focus for Italy was the 2009 earthquake that struck L'Aquila, killing more than 300 and injuring 1,500. According to Alexander, the MICRODIS study in L'Aquila had three objectives: to understand how people were killed and injured in the earthquake; to understand health, welfare, and social conditions during the short-term aftermath (over the first six months), in which many survivors were forced to live in tents; and to analyse the same factors over the medium term of 20 months (April 2009–January 2011), during which survivors were resettled in transitional housing.

"Unfortunately, the Italian government's response to the disaster can only be understood in terms of a political logic, rather than one based on common sense," Alexander said. Thus, "in the interests of short-term political expediency, decisions were taken that effectively replicate and propagate errors made during earthquakes that occurred decades ago." Although many residents were happy to collaborate with the questionnaire surveys, Alexander noted that there was also a sense of "survey fatigue", mixed with a general air of depression, isolation, and abandonment arising "as a natural consequence of the policies" of the Italian authorities. It was difficult, he said, to obtain cooperation from various government and university sources. "There was a general reluctance of public bodies to share data and very little appreciation of the value of research," he said.

He also noted a strong sense of intimidation associated with political patronage that resulted in "political, social, and economic paralysis in which it is difficult to make progress with research, let alone with recovery from the earthquake." The upshot of these difficulties, he said, was that "our study has had the rather unusual characteristic of unearthing a series of rather negative findings. Regrettably, the current situation in Italy, and especially in Italian Civil Protection, is too heavily politicized and too open to corruption to enable our findings to be used to positive benefit there. However, they can be beneficial elsewhere in Europe and the world."

Alexander noted that a project like MICRODIS facilitates a broad approach to the epidemiology of disasters but also can have the disadvantage of constraining results via mechanisms designed to allow comparison across countries and cultures. That said, he observed that "MICRODIS has excelled at emphasizing the social and economic conditions that affect health and welfare in disaster situations, which enables causal analysis on a deeper level than would be possible by merely collecting data on physical and mental ailments."



**MICRODIS ANNEX STUDIES**



This part presents information about the MICRODIS annex studies.

## 1. MICRODIS ANNEX STUDIES IN ASIA

### 1.1. Survey Site: Fakharpur Block, Bahraich District, Uttar Pradesh, India

**Lead Partner:** University of Delhi with Université catholique de Louvain

**Research Focus:** To estimate the nutritional status of children aged 6–59 months by assessing anthropometric measurements and identifying malnutrition symptoms and immunization status of the children.

The focus of this annex study in the Bahraich district of Uttar Pradesh was the long-term impact of flood on the Fakharpur block in the district, which was the most flood-exposed area during the 2008 flood event studied in the MICRODIS survey. In that flood, about 183 villages experienced inundation. This annex study was carried out from July 5 through July 15, 2009, allowing for ascertaining of the long-term impacts.

The study was a two-stage stratified cluster survey with a sample size of 800. The focus was under-five children. Half of the sample size came from flood-exposed households, and the other half from unaffected households. Among the parameters assessed were the taking of loans, the presence of bitot's spot, an indicator of vitamin A deficiency, in the under-five group, and the prevalence of water-borne diseases in this group.



• Taking anthropometric measurements to assess nutrition after floods.

The impact of the flood was profound among families that had received loans or microcredits, i.e., the flood impacts were greater on economically vulnerable families. More than 57% of families in flood-exposed households had taken loans or microcredits, compared to under 46% in unexposed households. High dependency on loans because of indebtedness and persistent poor economic conditions was notable even when many months had passed since the flood.

Bitot's spots are a manifestation of vitamin A deficiency and are characterized by keratin accumulations in the conjunctiva of the eye. The prevalence of these spots was much higher in flood-affected children (6.4%) compared to the global prevalence (5.2%) estimated by the World Health Organization. By contrast, in unexposed children, prevalence was 4.3%.

Finally, there was a high prevalence of cough and cold and water-borne diseases like diarrhoea among the under-five children, attributable to a lack of appropriate care. Furthermore, the findings indicated that the flooding had both acute and persistent effects on the health of this most vulnerable group of children.

### 1.2. Survey Site: Gosaba Block, West Bengal, India

**Lead Partner:** University of Delhi

**Research Focus:** The impact of cyclone Aila on the livelihood of the people in Sunderbans, West Bengal

This MICRODIS annex study was conducted in the Gosaba block of the District South 24 Parganas of West Bengal state in India, which was affected by cyclone Aila on May 25, 2009. Gosaba covers a total area of 285.85 km<sup>2</sup>. It has 14 gram panchayats spread over 10 delta islands, of which one is uninhabited. According to the 2001 census, Gosaba block had a total population of 222,822 in 50 villages. A total of 46,962 families reside in this block.

A sample of 780 households was selected for this study using a cluster sampling method, and the survey was conducted in May–June, 2010. It attempted to trace the course of changes in livelihood in the post-disaster period, including changes in occupations of the people with a view to understanding the effect of resultant economic constraints on school attendance, gender relations, migration, trafficking of women and children, psychosocial health, and dependency on local organizations.

Many people had migrated because of cyclone Aila from Gosaba block to different parts of West Bengal as well as to other major cities and states of India in search of a better livelihood. The majority of the people in Gosaba were not injured during cyclone Aila. However, prevalences of different types of illness like diarrhoea, fever, cough and cold, malaria, and Japanese encephalitis during and after Aila were high among the people exposed to the disaster. Six people became disabled because of the effects of the cyclone.

The pattern of the main source of income before and after the cyclone showed significant differences based on the type of business. The major differences were evident in the area of agriculture and daily wage labour. While agriculture as a main source of income decreased, there was an increase in the daily wage labour percentage from before and after the cyclone. This result suggests that because of the land salinity caused by the cyclone in the agricultural fields, people were forced to earn their livelihoods through daily wage work. The negative impact of the Aila cyclone was also evident in aquaculture, which dropped somewhat following the event.

Regarding whether migration increased after Aila or not, 40.7% respondents agreed that it had, closely followed by 36.7% of respondents who strongly agreed that it had. The high percentage of respondents agreeing with this statement indicated that the cyclone had severely affected different dimensions of people's lives. To cope with these adversities, people have migrated to different places. Only 15.5% of the respondents somewhat agreed with the statement.

Of interest, regarding the statement about whether the financial status of families had been negatively affected because of cyclone Aila, one fourth of the respondents strongly agreed, while almost half of them agreed.

### 1.3. Survey Site: Hanoi, Vietnam

**Lead Partner:** Hanoi School of Public Health

**Research Focus:** To evaluate mosquito larva and related factors of Dengue Fever (DF), Dengue Haemorrhagic Fever (DHF) and Dengue Shock Syndrome in (DSS) four precincts of Hanoi from July 2006 to September 2010.

Objectives include describing monthly distribution of DF/DHF/DSS cases in Bach mai hospital, epidemiological characteristics of the DF/DHF/DSS cases recorded in Bach Mai hospital and clinical characteristics of the DF/DHF/DSS cases recorded in Bach Mai hospital.

The study was conducted between September and December 2010, and focused on collecting secondary data from medical records of inpatients diagnosed with dengue from 2006-2010. There were a total of 2020 confirmed cases, and all were included in the sample. Results can be found in reports on the MICRODIS website: [www.microdis-eu.be](http://www.microdis-eu.be).

### 1.4. Survey Site: Jakarta, Indonesia

**Partner:** University of Indonesia with Université catholique de Louvain

**Research Focus:** To investigate the possible impact of flood and climate on the occurrence of leptospirosis and dengue hemorrhagic fever (DHF) in Jakarta

From February 1 to 26, 2007, a major flood occurred in the Indonesian capital, Jakarta Province, inundating 60% of the city. In the aftermath of these floods, many cases of leptospirosis were reported.

Leptospirosis is a widespread zoonotic disease transmitted via *Leptospira* bacteria, and may be one of the most common zoonoses in the world. It is also known as swamp fever or mud fever. Rodents are known vectors via contamination of water, and with the occurrence of flooding, would be expected to proliferate and come into contact with humans sharing the high ground. Further, rodent-contaminated water will promote its spread. The bacteria invade through mucous membranes or abrasions in the skin.

The clinical characteristics of leptospirosis range from a mild, flu-like illness, the "anicteric" form, to a fulminant disease, also known as Weil's disease or the "icteric" form. This latter is characterized by multiple organ impairment. In the Jakarta area in particular, the clinical characteristics of this disease have not been well described.

A combination of case series and ecological investigation was carried out to analyse the 195 leptospirosis cases reported from five major general hospitals in five municipalities in Jakarta province. About 56% of the cases came from West Jakarta. Most reported cases (68%) were young adults ages 18 to 49 years, and male cases were predominant (77%).

The flooding from February 1 through 26, 2007, followed heavy rains in the area, as did a sharp increase in leptospirosis cases. The case number peaked abruptly and then fell, suggesting a point-source outbreak, or that the population was exposed from a common source—i.e., the flood—at a common point in time. The data indicated that most of the leptospirosis cases were concentrated in flooded areas, especially in the northwest part of the province. Especially of interest, the mapping showed that clusters of leptospirosis occurred in certain areas alongside city drains, canals, and rivers.

Another mapping result indicated that most of the cases were distributed in areas within the radius of 500 m from the point of disposal. The findings suggested that certain environmental factors, like flows of rivers, drains/canals, and possibly waste-disposal sites and slum environments, may have induced the spread of leptospirosis after the February floods.

Disease length did not differ between those who survived and those who died of leptospirosis, indicating that death did not come early in the disease course. The overall fatality rate was 6.25%, and the overall median disease duration was 11 days (3–53) days in survivors, while it was 9 (3–28) days in those who died. Because dengue fever or DHF is common in Indonesia and may have some similar clinical presentations, DHF was also diagnosed in 27.1% of the leptospirosis patients at the time of admission.

### 1.5. Survey Site: Jagatsinghpur District, Orissa, India

**Lead Partner:** Voluntary Health Association of India with Université catholique de Louvain

**Research Focus:** To estimate the nutritional status of children aged 6–59 months by assessing the anthropometric measurements

The effects of floods, the most commonly reported natural disaster worldwide, are especially dramatic in developing countries of south and Southeast Asia. A review of the literature indicates little research on the association between floods and children's nutritional health. VHAJ conducted a survey on the 2008 September flood that affected the Jagatsinghpur district of Orissa, India, to study the prevalence of malnutrition in children living in exposed and non-exposed villages. In the first sampling stage, 29 villages (30 clusters) were selected. The lists of children ages 6 to 59 months were obtained, and a random sample of 30 children was derived from each cluster for a total of 900 children surveyed. Twenty-one children were excluded because they were not available or had died. The study was conducted in September 2009.



• *Focus Group Discussion in Orissa during the qualitative part of the study on child nutrition.*

Based on the findings, wasting and underweight showed the largest differences in prevalence between affected and non-affected areas, whereas the prevalence of stunting (chronic malnutrition) presented quite similar results between affected and non-affected areas. No systematic or large differences in these indicators were evident between boys and girls in the sample, although none of these results should be considered definitive and further study and analysis are warranted.

### 1.6. Survey Site: Padang, West Sumatra, Indonesia

**Lead Partner:** University of Indonesia

**Research Focus:** To investigate the effect of injury on the occurrence of disability and decrease in quality of life among adults and also of extreme events; to identify evidence, methods, and tools to understand the individual coping mechanisms of injured adult survivors of 2009 earthquake in West Sumatra, Indonesia

After experiencing an earthquake in 2007, regions in West Sumatra, especially in the coast of Padang, were struck by a strong earthquake on September 30, 2009, with a magnitude of 7.6 on the Richter scale. The initial shock was followed by a 6.8 aftershock on October 1, 2009. As of October 28, 2009, an estimated 1,117 people had been reported dead and another 3,515 people injured. Padang City and Padang Pariaman district were the most affected.

The objective of this cohort and longitudinal study was to measure the effect of injury on the disability and quality of life of the injured survivors after the Padang earthquake. A total of 275 respondents consisting of 182 injured survivors and 93 non-injured survivors were interviewed. Concerning demographic characteristics, there were more injured older respondents as compared to non-injured (e.g., of 60+ year-old respondents, 17.4% were injured, while there were 8.6% non-injured respondents).



• A UoI researcher administers a household questionnaire in Padang after the earthquake.

The majority of both injured and non-injured respondents were inside their houses when the earthquake struck. Around 13% of injured survivors and 20.4% of non-injured respondents were outside a building, for instance, in the backyard. Types of injuries suffered were mainly mild injuries, such as bruises (41%). The three top moderate/severe injuries were broken bones, open wounds, and sprained ankles/wrists. More than half of the injured respondents reported that a leg/foot was the dominant part injured. About one out of five respondents had experienced injuries on their arm/hand, head/neck, or backbone.

A total of 71.2% of injured survivors reported that they had been struck down by falling objects (concrete, rocks, wood, etc.) as a major cause of injury, followed by being thrown, punctured by sharp material, wedged, falling down, being bumped, and burns. Regarding the health status of respondents, hypertension was the main chronic disease, followed by heart and lung diseases. The same pattern was observed among both injured and non-injured respondents.

Almost half of injured survivors reported joint pain as the main acute sign and symptoms they experienced after the earthquake, while only about one fifth of non-injured respondents reported the same complaint. Interestingly, non-injured survivors experienced more fever and flu/cough, as compared to injured survivors.

Quality of life (QoL) scores of non-injured survivors were significantly higher than scores of the injured survivors. Furthermore, the injured survivors were significantly more disabled than non-injured survivors. The significant differences in disabilities and QoL between the injured and non-injured populations did not depend on the socioeconomics or level of house damage because the characteristics of these variables were similar between injured and non-injured people.

### 1.7. Survey Site: Sichuan, China

**Lead Partner:** Université catholique de Louvain with People's Hospital of Deyang City and Sichuan Hospital

**Research Focus:** To estimate the direct health impact in Sichuan Province immediately and two years after the earthquake: focusing on injuries, trauma, and death derived from hospital-based secondary data and a small-scale patient follow-up study in the most-affected areas

On May 12, 2008, an earthquake of magnitude 8.0 on the Richter scale shook Sichuan Province in China, injuring almost 375,000 and killing more than 69,000. The earthquake damaged or destroyed many clinics, thus affecting access to health care.

To study the health impacts of the Sichuan earthquake, the Université catholique de Louvain (UCL) and Chinese stakeholders (the People's Hospital of Deyang City and the Sichuan Academy of Medical Sciences and Sichuan Provincial People's Hospital) collaborated on this annex study. The team decided on an analysis of hospital data focusing on injuries, death, and trauma caused by the earthquake, and then a follow-up study on about 200 patients in two of the most-affected areas to ascertain current health status, prognosis, and treatment.

The primary aim was to document injury causes and patterns as well as treatment following the earthquake to formulate recommendations to improve future earthquake relief efforts. The objective was to create a database with information on earthquake-related injuries from patients admitted to the People's Hospital of Deyang City between May 12 and 31, 2008. For the follow-up study, the objectives

were to estimate quality of life and disability status among the injured adult earthquake survivors at approximately two years after they were admitted to the Deyang hospital, and to assess differences in self-reported quality of life and or disability among these patients according to severity of injury, accounting for demographic variables (e.g., age, sex), post-disaster housing, and economic situation. The population of this study consisted of injured adult patients (18 years or older) admitted to Deyang hospital who survived the earthquake and were discharged from the hospital.

Data collection was done retrospectively using hospital records. The team recorded patient demographic information, cause of injury, date and time of hospital admission and discharge, diagnosis (ICD-10 codes), diagnostic tools, and any treatment or procedures undertaken (ICD-9-CM-3). A relational database model was used.



• The UCL research team and the Deyang medical staff from the People's Hospital of Deyang City in February 2010.

The technology used for the development of the database was PostgreSQL, an open-source database system that allows creation of security policies and consistent data management. PostgreSQL, available freely under the General Public License, is a robust, secure, and free system for handling sensitive data.

UCL and the Deyang team piloted the system during the last day of the mission, and UCL modified it according to the results of the pilot. All of the objectives of the mission were achieved during the one-week visit to Deyang Hospital and a debriefing session with the UCL team was held in March 2010.

### 1.8. Survey Site: Quang Nam Province, Vietnam

**Lead Partner:** Hue College of Economics with SWECO Grøner

**Research Focus:** To conduct an analysis of flood risk (i.e., flood exposure) and an in-depth study of the socioeconomic vulnerability of flooded communities and adaptation measures to extreme flooding events in Quang Nam

The Economic Annex Study was conducted in Quang Nam province where a 2007 flood event inundated homes. For this study, three districts were randomly selected that were representative of three ecosystems in Quang Nam province. These included Hoi An (coastal), Dien Ban (delta), and Dai Loc (upland).

This MICRODIS Annex study focused on local vulnerability, adaptation, and local willingness to pay for prevention measures. In achieving the above research objectives, a questionnaire survey, qualitative data collection, and secondary data were important activities. The total number of interviewed households was 510. The surveyed samples were equally distributed among the three districts.

The average age of the respondents was 47.1 years. It is worth noting the low level of educational attainment found among the interviewees: about 6.3 years of schooling. All interviewees had been living in the study site for over 27 years, and the size of households was relatively high with about 4.6 persons, of whom more than two thirds were of labour age. The study also found that household income was much lower, about 18.4 million/household (4.6 persons) in comparison with the national GDP of about 500 US\$/year.

More than 60% of affected households were inundated up to the waist inside the house.

There was a strong positive association between the level of floods and the cost of damages caused by floods in 2007 in the three districts. Furthermore, local villages had been dealing with ongoing difficulties of flooding over a period of time—more than 55% of respondents confirmed difficulties caused by annual floods, about evenly distributed across the three ecosystem types. Other issues were poverty and unemployment, both of which were felt more in the upland area than in the delta or coastal regions. A lack of fresh water was also a difficulty to the local people, most so for those living in the coastal areas.

## 1.9. Survey Site: Hanoi, Vietnam

**Lead Partner:** Työterveyslaitos Finnish Institute of Occupational Health (FIOH) and Hanoi School of Public Health (HSPH)

**Research Focus:** Assessment of chemical contamination due to floods in trade village near Hanoi

The aims of the empirical study were (1) to sort out how the small or medium size enterprises (SMEs) are prepared for the floods in Vietnam, and (2) to make a workplace risk assessment of the chemical contamination of the workers and people living in trade villages.

Workplace risk assessment study was done in a trade village located in a flooded area near Hanoi in Vietnam on August 20 and 22, 2010. Heavy rains led up to 10 days of flooding in the last days of October and first week of November in 2008 in Hanoi. The high intensity and large magnitude of rain resulted in a historic flood in Hanoi. The trade village was selected so that there were small or medium size enterprises with about 20-50 workers. In the selected trade village they produced handicraft products made from rattan or bamboo.

The study was done by following international guidance and recommendations for the work environment risk assessment. The focus was on chemicals and the impact of floods to the enterprise. Three workplace surveillances were made with the concept of walk-through survey. There were twelve in-depth interviews of family size enterprises, three interviews of the owners, three interviews workers in the SMEs, and two interviews at the governmental level made by six trained data collectors.

Chemical losses because of floods and rain were low in the studied trade village. One reason for that was that the chemical storage amounts in the trade village were low. The used chemicals were bought from the market place as small amounts. Another reason was that the chemicals were transferred higher places when the flood was coming. So the floodwater did not reach the chemicals. The people in trade village were aware of the danger of floods by listening weather forecasting. In the studied trade village, the chemicals and fumigation kilns/canvases were located at the garden or at home. The sulphur was normally burnt at night, but anyway it was impossible to avoid the exposure of the toxic emissions of burning sulphur or other work processes at home. The used chemicals were released to the sewer systems that lead to the fields and ponds. The waste water was not treated. Most of the used chemicals were bases, but also unknown chemicals and dying chemicals were used and released into environment.

Chemical contamination because of floods was low in this trade village near Hanoi. However, some people were having symptoms like skin irritation and red eyes symptoms after the flood. The amount and the diverse of chemicals were not large in the trade village. The chemicals were often without proper labelling and workers did not have proper personal protection equipments. So the hazards of the chemicals were not always known and the safe use was not always available. The common way using chemicals and the disposal of the chemicals caused air pollution and pollution of environment in the trade village. The burning of sulphur, which was the main used chemical, caused at least moderate sulphur dioxide emissions which exposed both people and the environment in the trade village. In one trade village the amount of burnt sulphur was about 70 kg per day. There were no waste water treatment in use and all the chemicals (known and unknown) were discharged into the sewer system that led into the near fields and ponds.



• FIOH and HSPH researchers discuss chemical contamination and floods at a workplace in Hanoi.

## 1.10. Survey Site: Southern Leyte and the Autonomous Region of Muslim Mindanao

**Lead Partner:** Xavier University

**Research Focus:** Emergency assistance and rehabilitation efforts, an assessment of disaster management policies, procedures, and practices

The initial MICRODIS effort in Southern Leyte yielded insights that indicated two conflicting stances regarding the effectiveness of assistance and rehabilitation projects. One view was that such efforts usher in changes in the local landscape and people's behaviour, while the opposing view was that such programs are not beneficial and ultimately worsen economic conditions, fostering a reliant mindset that is counter to self-sufficiency.

Thus, the Southern Leyte annex study examined how various stakeholders assess either the benefits or the deleterious effects of development programs/projects designed for disaster emergency assistance and rehabilitation. Furthermore, the study proposed to uncover policies, procedures, and practices that need to be enhanced, modified, or fine-tuned so that the assistance and rehabilitation programs and projects yield maximum return.

The core objective of the study was to determine how various stakeholders assess emergency assistance and rehabilitation programs and projects, which refers to any efforts and supports given to a community and its residents, including livelihood, housing, education, training, and disaster preparedness. The assessment relied on three types of stakeholders: beneficiaries, program implementers, and local executives. This qualitative approach used as its basis and context the quantitative findings from the MICRODIS main site survey in Southern Leyte.

Three types of data collection methods were employed: case study, focus group interviews (FGIs), and in-depth interviews of key informants, with participants identified based on selection criteria that included residency at the time of the disaster occurrence, age, and giving voluntary consent. The study focused on sample sites in Southern Leyte and communities from the Autonomous Region of Muslim Mindanao. FGI participants were selected from each of the selected sites.

The first stage of data processing involved transcription of the FGIs and in-depth interviews. Team analysis was employed to minimize subjective interpretation, with each team consisting of the principal investigator, a research specialist, and two selected data collectors/interviewers. Members that are independent from each other familiarized themselves with the transcription content and noted key words and phrases. The final analysis involved team interpretation of information and its implications, and identification of patterns of similarities and differences to highlight relationships among themes that emerged.

## 1.11. Survey Site: Jagatsingphur, Orissa, India – 2nd Study

**Lead Partner:** Voluntary Health Association of India

**Research Focus:** The main objective of the research was to assess the long-term social, health and economic impact of disasters on an affected community. In addition other objectives were formulated such as to validate and strengthen the relationship between extreme events and their social, health and economic impacts on an affected community; to refine and develop an impact assessment model; to establish scientific and empirical tools as well as to assess the nutritional status of children.

This research was organized in Jagatsingpur district of Orissa, India during August 2010. The study implemented a stratified sampling method in order to select 34 villages. Within each village 12 households were then randomly selected. The final sample consisted of 408 households. Prior to the survey implementation the questionnaire was translated from English to Oriya (local language) as well as back translated into English for quality control purposes. The survey team consisted of 10 enumerators and 3 supervisors who were trained prior to the field activities.

A pilot study took place on August 10, 2010 in both an exposed and a non exposed village. The pilot study comprised six randomly selected households in each village (Kanaguli- non-exposed; KunjaKothi-exposed). The main data collection was organized from August 12-19, 2010. Each enumerator was given the names of 4 households, randomly selected, in a selected village

The study highlighted the long term impact of the flood on affected community. It showed that flood has an impact on psychosocial, socio demographic, socio economic and livelihood of the vulnerable communities in long run. For instance, it was shown that due to massive loss to the standing crop and inundation of agricultural land, both agriculture and manual labour work were affected. Though for most

the primary occupation remained the same but there was change in intensity of the work and decrease in income from the respective sources. In addition the study indicated that the property damage due to the flood caused direct economic losses which are not replaced and therefore causes a even further reduction in consumption and a decrease in the quality of life. In addition to direct economic losses, there are indirect losses that arise from the interdependence on community networks.



• Enumerators from VHAJ and UCL take the mid-upper arm circumference (MUAC) of a child as an indicator for malnutrition

The study also suggests a public health approach to disaster risk management focusing on decreasing the vulnerability of communities through prevention and mitigation measures and increasing the coping capacity and preparedness

## 2. MICRODIS ANNEX STUDIES IN EUROPE

### 2.1. Survey Site: Morpeth, UK

**Lead Partner:** University of Northumbria

**Research Focus:** (i) The impact on displaced persons due to the Morpeth flood; (ii) the role of flood insurance in disasters, a review of the flood insurance experiences of the residents of Morpeth; and (iii) educating children about disasters: the use of play

The first annex study was a study investigating the health and social impacts of displacement on flood-affected Morpeth residents with particular reference to the differences between impacts on people staying with family and people staying in rented accommodation or hotels. The study was carried out by Laura Irvine, MICRODIS Technical Officer from the Centre for Research on the Epidemiology of Disasters (CRED) at the Université catholique de Louvain, Brussels. Laura carried out 11 in-depth interviews from August 19 to 25, 2009.

Also in Morpeth was an investigation of the mental health impacts of the flood, conducted by Tim Wind from the MICRODIS partner HealthNet TPO, the Netherlands. Tim carried out interviews with Morpeth residents, health professionals, and the British Red Cross Operations Director for the North East and Cumbria from September 14 through 18, 2009. He has summarized his findings and is conducting further analysis. Nick Grainger, a postgraduate student from the masters course in Disaster Management and Sustainable Development at Northumbria University, chose the role of flood insurance in Morpeth as his dissertation subject. He carried out interviews for this second aspect of the Morpeth annex studies with affected residents and insurance providers and has since completed and submitted his dissertation.

A third aspect of the Morpeth studies was educating children. Joelle Yap, a postgraduate student from the masters course in Disaster Management and Sustainable Development at Northumbria University, completed and submitted her dissertation on the subject of “educating children about disasters: the role of play”. The project was implemented at Morpeth Goosehill Primary School and included a general discussion and quiz, a puppet film on floods, and a learning activity (putting together an ‘emergency go-bag’) with a quiz for the students. There was evidence of individual learning and increased disaster risk awareness among the pupils as a result of the study.

Further investigations in Morpeth included a comprehensive annex study into the role of social capital in the Morpeth flood response and recovery by Manuela Scharf, PhD student and MICRODIS UK researcher, and a study of self-help and actual and perceived responsibilities for flood mitigation measures, conducted by Heather Taylor, a postgraduate student from the masters course in Disaster Management and Sustainable Development at Northumbria University,

## 2.2. Survey Site: Helsinki, Finland

**Lead Partner:** Työterveyslaitos Finnish Institute of Occupational Health (FIOH)

**Research Focus:** to describe the health and safety risks and their management in different international disasters from the perspectives of rescue workers, military officers and police officers. The exact study aims were to describe: main health and safety threats in different international disasters, management of health and safety threats in different international disasters, and training and its effects to manage different threats.

All these professions face a risk of death, injury and ill-health resulting from the various hazards at disaster scenes. These range from environmental conditions, managerial issues, inadequate preparation and training, a lack of information, inappropriate personal protective equipment, stress and fatigue to physical, chemical and biological risks. Thereby death and injuries may occur owing to fatal and non-fatal accidents.

Data for this study were collected between October and November 2010, using key informant interviews of a sample of 17 people. The data were analysed using qualitative content analysis (Krippendorff 1986). After categorization, the contents of the categories were checked several times until each expression was placed in one category without overlapping. Detailed results are available from FIOH and will be available on the project website. One example of threats and their management linked to different natural disasters and rescue tasks is found in Table 2.2.1.

This study provides information which teachers can use in their work when training helpers to meet different crisis disasters in the world. Also volunteer helpers can benefit it when working in international missions.

Table 2.2.1.

SITUATION	Health and safety threats in different situations	Management of health and safety threats in different situations	Development needs of the training
Natural disasters: <ul style="list-style-type: none"> <li>floods,</li> <li>windstorms,</li> <li>tsunamis,</li> <li>earthquakes,</li> <li>volcanic eruptions,</li> <li>dryness,</li> <li>rock falls etc.</li> </ul>	Death Diseases Accidents Stress Safety and security threats Agitations Thefts Traffic and logistic problems Coordination problems Lack of food and clean water	Management of threats Group discipline Working as a group Preventing of threats Good equipments and tools High hygiene Safe routes Collaboration with local authorities Following of the security level situation continuously Training Informing of threats and local circumstances Using action models Evacuation system Using personal consideration	Training has met the threat management well.  Development needs: <ul style="list-style-type: none"> <li>to guarantee informing for all</li> <li>improvement of safety and security attitudes</li> <li>keeping record of stand by staff</li> </ul>





**MICRODIS**



## PART 5

### OTHER DISASTER-RELATED EUROPEAN COMMISSION PROJECTS



## 1. CAPHAZ-NET

CapHaz-Net is particularly concerned with people's capacities in a disaster and how contextual conditions influence them. CapHaz-Net does not consider the physical conditions of a hazard but rather regards the occurrence of a disaster as a result of lacking the capacities to anticipate, cope with, and recover from the impact of a natural hazard. A particular interest is concrete case studies from across Europe, from any spatial scale or cultural context. Main research topics include social capacity building, risk governance, risk perception, social vulnerability, risk communication, risk education, and social resilience. Natural hazards considered include heat-related hazards, forest fires, alpine hazards, and riverine floods. Anticipated outcomes include a state-of-the-art overview of natural hazard research in the social sciences.

Supported by the European Commission, FP7. Project coordinators: Dr. Annett Steinführer and Dr. Christian Kuhlicke, Jochen Luther Helmholtz Centre for Environmental Research, Department of Urban and Environmental Sociology, Permoserstraße 15, 04318 Leipzig, Germany; e-mail: caphaz-net@ufz.de. More information available at <http://www.caphaz-net.org/>.

## 2. MOVE

The overall objective of MOVE is to provide policy makers, public administrators, researchers, educators, and other stakeholders with an improved generic framework and methodology for the measurement and assessment of vulnerability to natural hazards in Europe. MOVE will develop and test a multi-dimensional vulnerability framework that takes into account various hazards as well as different social settings and that can support practical users, e.g., in urban and regional planning. Hazard-dependent and hazard-independent aspects and indicators will be identified and analysed to improve the estimation of vulnerability. Finally, MOVE will test the usefulness of the framework in seven case studies in Europe by integrating stakeholders and end-users at an early stage of the research.

Supported by the European Commission, FP7. Project coordinators: Univ. Prof. Sergio Boncinelli; email: [boncinelli@unifi.it](mailto:boncinelli@unifi.it), and Univ. Prof. David Alexander; email: [david.alexander@unifi.it](mailto:david.alexander@unifi.it). More information available at <http://www.move-fp7.eu/>.

## 3. EDEN

The main aims of EDEN are to characterize the ecosystems most exposed to local changes and to risks of introducing and spreading vector-borne emerging diseases; cover a wide enough range of diseases to gain an overall picture of emergent risks in European ecosystems; and lay the foundations of a surveillance and early warning policy for vector-borne diseases in Europe. EDEN is organized into six sub-projects: tick- and rodent-borne diseases, leishmaniasis, West Nile fever, malaria, and the African platform (West Nile fever and Rift Valley fever). To strengthen the integrative approach, each sub-project works with the same set of additional teams specialized in information and data management systems, low- and high-resolution remote sensing, and change indicators (including biodiversity), or in statistical and mathematical modelling of vector population dynamics and disease transmission.

Supported by the European Commission, FP6. Project coordinator, Renaud Lancelot, CIRAD-Département Systèmes Biologiques, EDEN Secrétariat, TA A-DIR/B Campus de Baillarguet, 34398 Montpellier Cedex 5, France. More information available at <http://www.eden-fp6project.net/>.

## 4. SCENARIO

The main goals of SCENARIO are to develop a European roadmap on sustainable mitigation of natural and induced technological hazards and risks; to integrate fragmented research approaches, concepts, and results; and to assess and reorganize the Logic Value Chain of natural disasters through updating knowledge and the state of the art on natural disaster prevention and mitigation in the context of modified societal and environmental features. To achieve these objectives, SCENARIO is setting up a networking process among existing projects and activities dealing with natural disasters with several workshops and meetings for knowledge sharing and dissemination.

Financially supported by the European Commission, FP6. Project coordinator, Dr Scira Menoni, EC Officer, Bjorn Vangelsten; email: [bjorn-vidar.vangelsten@ec.europa.eu](mailto:bjorn-vidar.vangelsten@ec.europa.eu).

## 5. ARMONIA

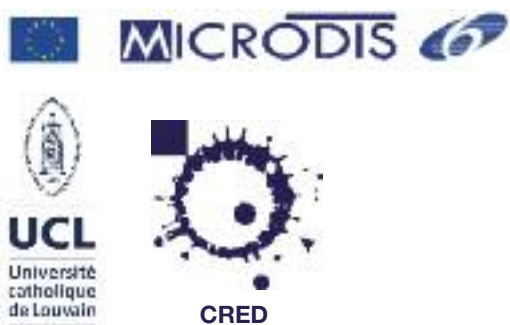
The overall aim of ARMONIA is to provide the EU with a new harmonized methodology for producing integrated risk maps to achieve more effective spatial planning procedures in areas prone to natural disasters in Europe. ARMONIA seeks to achieve outcomes that can mitigate the adverse effects of natural phenomena through the joint effort of the scientific community, technology experts, and end-users. The target is therefore not solely scientific output but also a measurable impact on policies and practices for disaster mitigation initiated within the period of the project.

Financially supported by the European Commission, FP6. Project coordinator, Ms. Katja Firus; email: [k.firus@t-6.it](mailto:k.firus@t-6.it). European Commission officer, Denis Peter; email: [denis.peter@ec.europa.eu](mailto:denis.peter@ec.europa.eu). More information available at <http://www.t-6.it>.

## 6. PREPARED

This project aims at preparedness for earthquake hazards and mitigation of seismic risk. Among its goals are identifying technology to assess which earthquake effects may occur and where, and observation of earthquake forerunners and crustal changes to develop methods for earthquake warning on a long-term and short-term basis. Rapid evaluation of earthquake impacts before or after onset helps in preparing necessary and effective rescue actions. Tools created in PREPARED for alerting, evaluating, and visualizing earthquake and pre-earthquake processes have been produced and are gradually being applied by scientists in their hazard watching and installed for testing and practical use in the EWIS system.

Supported by the European Commission, FP5. Project coordinator, Dr Bardi Thorkelsson; email: [bardi@vedur.is](mailto:bardi@vedur.is). More information available at <http://hraun.vedur.is/ja/prepared/>.



Unless otherwise indicated, each of the photos was taken by MICRODIS consortium members from the relevant survey site or meeting host.



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