

WORKING P A P E R

Models of Relief

Learning from Exemplary Practices in International Disaster Management

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WR-514

August 2007

Prepared for RAND Center for Domestic and International Health Security

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PREFACE

Natural disasters are an unfortunately common occurrence in the United States and countries around the world. In the United States, Hurricane Katrina's devastation of the Gulf Coast in 2005 spurred a renewed interest in improving U.S. disaster management practices. As such, government entities—from the White House and U.S. Senate to state and local emergency preparedness agencies have been considering how to address the deficiencies in the U.S. system exposed by the Katrina experience. Most of this inquiry has drawn upon the United States' experience with disasters and the traditional United States principles for disaster management, including preparedness, response and recovery.

This study looks to contribute to this inquiry by tapping into the rich body of disaster-related experiences from the broader international community. Collection and analysis of information about the management of disasters around the world provides a new and potentially fruitful avenue to improve disaster management in the United States. This study identifies examples of good practice in disaster management from throughout the world. After motivating this discussion through a case study of Hurricane Katrina to identify problematic areas in the U.S. response, the study presents a series of selected case studies of exemplary disaster management experiences in other countries, and highlights from interviews with international disaster management experts, to identify lessons that could be considered by U.S. policymakers.

This report should be of direct and practical interest to agencies across a range of sectors at the U.S. federal, state and local levels responsible for U.S. disaster planning and response. It should also spur consideration of ways to bridge the experiences of U.S. agencies charged with domestic disaster response, such as the Department of Homeland Security, and those charged with international disaster response, such as the U.S. Agency for International Development's Office of Foreign Disaster Assistance. At a broader level, the report should interest the U.S. Congress for learning lessons for U.S. policy by drawing on international achievements, the Department of State for the guidance it suggests for engaging with other countries to identify policy lessons to bring home to the United States, and

those multilateral agencies, international organizations and individuals that are interested in sharing with U.S. policymakers their experiences and wisdom from international disasters.

This study was funded by RAND's Center for Domestic and International Health Security, through support from Kaiser Permanente. The Center is a multidisciplinary research collaboration within RAND whose mission is to improve domestic and global health and emergency preparedness. Center staff include behavioral scientists, economists, medical sociologists, organizational analysts, physicians, policy analysts, political scientists, and statisticians. They are focusing their efforts in three broad areas: Public health and preparedness, Mental health, and Global health.

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SUMMARY

Hurricane Katrina, which struck the U.S. Gulf Coast in August 2005, was the most destructive and costly natural disaster in U.S. history. While shortcomings in disaster preparedness and response associated with Hurricane Katrina were numerous and have been reported extensively, they more broadly illustrate areas needing improvement in this country's overall disaster management system.

Natural disasters are a common occurrence in the United States. Between 1974 and 2004, an average of 38 federally declared major disasters occurred annually. While the number of such disasters has been relatively stable and the number of disaster-related deaths has decreased in recent decades, the associated economic losses have increased exponentially, from less than \$25 billion over earlier five-year periods going back to the 1950s, to nearly \$100 billion over the five-year period from 1992-1996. In contrast, the occurrence of natural disasters worldwide has been increasing: from an average of 100 per year in 1975-1980 to more than 400 per year in 2000-2005. In parallel, the number of persons affected by disasters has increased from approximately 160 million per year from 1985-1995 to an average of nearly 260 million per year in 1995-2005, and economic losses due to natural disasters have increased as well, from \$38 billion during the 1950s to \$660 billion during the 1990s. Thus, the sheer volume and human and economic impact of natural disasters worldwide offered a substantial body of experience warranting further examination.

This study sought information not traditionally considered by U.S. policymakers: disaster experiences from the international community. It began with examination of the U.S. response to Hurricane Katrina to identify areas that were problematic. These areas in turn served as a basis for identifying and analyzing exemplary practices from disaster management in other countries. Without purporting to provide exhaustive documentation of all events related to Hurricane Katrina, the case study presented in this report details the circumstances and activities, with a focus on New Orleans. The following areas were identified as problematic:

Prevention and preparedness

- *Coordination/management:* Lack of coordination between state and local emergency plans posed challenges.
- *Planning and exercises:* Despite annual exercises, Louisiana's planning for a massive storm had not been completed, and communities were not sufficiently prepared.
- *Early warning:* Advance warnings from the National Weather Service of a severe advancing storm did not prompt commensurate action by local populations.
- *Evacuation:* Evacuation plans were not consistent with the realities of the local population, e.g., a high proportion of the population did not have access to personal vehicles for evacuation, as called for in the plans.
- *Shelters:* Planning included community registers of evacuation shelters, but no corresponding state or national registers; also, New Orleans did not release information on local shelters to the public in advance of hurricane landfall.
- *Health:* Poor health planning ultimately led to critical delays, shortages in resources and flawed emergency protocols in the health and medical response.

Response

- *Coordination/management:* The FEMA response was delayed for administrative and logistical reasons and to allow for completion of worker training; FEMA administrative procedures delayed or even precluded a good deal of external assistance.
- *Communications:* Among the communications problems experienced during the Hurricane Katrina response, the generator for the New Orleans emergency communications system was damaged and rendered dysfunctional by the storm, and the batteries of radios used by emergency responders became depleted.
- *Evacuation:* Despite severe storm warnings, New Orleans residents were only *encouraged* to prepare for evacuation rather than actually to evacuate; voluntary evacuation orders came too late, and many residents were unable to respond for numerous reasons including lack of personal or public transportation. Also, despite individual organizations' efforts, evacuee registration

through a central database of displaced persons was delayed for several days.

- *Shelters:* Excessive numbers of persons unable to evacuate safely had to seek refuge in two large “shelters of last resort”, which were unable to meet the needs of vulnerable populations and experienced violence that posed a further security threat.
- *Health:* Healthcare facilities were damaged and became inaccessible and inoperable; some external medical assistance went unused.
- *Emergency supplies:* Emergency shelters were not adequately stocked in advance of the storm, and the storm precluded delivery of some supplies afterward.
- *Security and law enforcement:* Local police and National Guard troops were quickly overwhelmed, and external assistance was delayed; detainment facilities for offenders were inadequate or unavailable.
- *Search and rescue:* Coast Guard and National Guard conducted successful efforts, but additional active duty military personnel were not used because their commanders did not approve the rescue missions.

This report is based largely on detailed case studies of thirteen natural disasters in eleven countries around the world. In particular we sought to identify exemplary practices in areas there were problematic in the response to Hurricane Katrina. However, finding instances of exemplary practice proved difficult. Most written reports tend to document negative rather than positive experiences, and virtually none reflect rigorous evaluations that link response actions to outcomes or impact, we developed our own criteria for selecting the exemplary practices reported here. These positive experiences were selected because of potential applications to U.S. preparedness for future disasters. In evaluating cases to include as examples of exemplary practice, we sought disaster management activities, at any phase of the disaster management cycle (which includes prevention and preparedness, response, recovery and redevelopment):

- related to particular weaknesses identified in the Hurricane Katrina response;

- that were innovative - new or creative in some way - whether in relation to the affected country's previous policies or in relation to commonly accepted international practices;
- for which there was evidence that these practices resulted in a reduction in the losses that would have been expected from similar disasters; and/or
- that reflected general practices or principles subsequently validated by recognized disaster management experts and considered to be potentially replicable in other settings.

The thirteen international case studies reflect disasters that caused considerable economic and human loss across a broad range of countries. Some of them provided a robust range of exemplary practices, e.g., Cuba, Mozambique and the Philippines, while others provided fewer or only a single relevant exemplary practice, e.g., Mexico and Vietnam (see table S.1). Though each disaster is unique and country contexts vary considerably, systematic examination of positive experiences, principles and insights from international disaster management offers a fresh avenue to help enrich the body of information from which U.S. policymakers can draw as they seek to improve this country's disaster management.

Table S.1 Summary of Exemplary Practices Identified, by Country

Location	Type	Year/s	Prevention/Preparedness	Response	Recovery and Redevelopment
Cuba	Hurricane	2001	Early warning; planning; exercising; community preparedness	Coordination/management; evacuation; shelter; security; health	Community involvement
Mozambique	Floods	2000, 2001	Early warning; regional coordination; planning; exercising; community preparedness	Evacuation; search and rescue; coordination	Development orientation
Philippines	Volcanic eruption	1991	Early warning; early evacuation; regular public warnings and public awareness building	Health (surveillance and disease control)	
Iran	Earthquake	2003		International and local response coordination; health (surveillance and needs assessment); search and rescue	Community involvement (local liaisons, communications)
Bangladesh	Flood	1998	Orientation; social and economic development	Coordination/management	Development orientation; private sector
Indian Ocean countries	Tsunami	2004	Local disaster management capacity building	Private sector involvement in logistics	
Honduras	Hurricane	1998	Local risk management capacity		Decentralization, simplification, and acceleration of project implementation; community involvement; development orientation
India	Earthquake	2001			Coordination/management; integrated information systems; disaster impact mapping; community empowerment; housing; community training
Vietnam	Floods	1998, 1999			Housing
Mexico	Earthquake	1985			Infrastructure; community involvement; rent payment assistance; rapid completion
Czech Republic	Floods	1997, 2002	Early warning; emergency medical care	Coordination	
Indonesia	Landslides	2002-2003	Early warning		
Vietnam	Typhoon	2005	Prevention/protection		

To supplement the case studies, which were largely drawn from a review of the literature, the research team interviewed a number of international disaster management experts. These experts validated the literature-based observations and preliminary RAND analyses, and offered some important additional insights.

Drawing from both our international case studies and interviews with experts, we derived seven lessons contributing to effective disaster management:

(1) Different models, but common principles, underlie effective disaster management coordination, at all phases of the disaster management cycle.

A number of the case studies illustrate the importance of appropriately strong and inclusive coordination of the various entities that are involved in disaster management, and especially in urgent post-disaster response and recovery efforts. While effective coordination is critical in all phases of the disaster management cycle, there is no single model for achieving good response coordination. The case studies we examined and experts we interviewed suggest a number of principles to guide effective coordination, and the case studies illustrate a number of different coordination models. Key common principles within these include: an effective coordinating body, experienced professional leadership, active information exchange, and appropriate level of coordination.

(2) Community participation is critical, also at all phases of the disaster management cycle.

Training local community members in high-risk areas and then engaging them in preparedness, early detection and warning activities, immediate post-disaster emergency response and longer term recovery and redevelopment activities is another important lesson learned from the international case studies and discussions with experts. Community participation complements the efforts of government and other

institutions. The roles and responsibilities of communities and individuals members must be clearly defined and understood so that they are both trained and empowered to act when disaster strikes. The engagement of community members in the identification of disaster risks, potential challenges to disaster response efforts, and potential means of mitigating these problems, has led to a deeper public awareness of disaster management practices and a national "culture of preparedness" in such countries as Cuba and Mozambique.

(3) Both technology and public awareness contribute to effective early warning.

An early warning system is more than purely a technology issue. The international disasters we examined indicate that an effective system combines technology with creative and effective means of conveying the information to local citizens in a format they can understand and use. As such, effective early warning includes not just the timely release of emergency information, but also ongoing dissemination of the information, efforts to assist the public in interpreting it, and clear identification of the actions that should be taken in response to early warnings.

(4) Disaster management should be evidence-based when possible.

Another prominent theme in successful international disaster management is the importance of utilizing an evidence-based approach for planning and managing disaster response activities. While not a new insight, it is worth underscoring based on the findings from our study. Various experts we interviewed characterized the desired approach to disaster response as the public health approach. This approach systematically analyzes the health status of populations in the wake of disasters to help guide appropriate response efforts.

(5) An early orientation to long-term recovery can be important.

Effective disaster management systems are often characterized by an early emphasis on promoting the long-term recovery of disaster-stricken

communities rather than simply relief from the immediate impacts of such disasters.

(6) Countries can and should learn from previous disaster experience.

Countries must actually act upon what is learned during past disaster experience to improve preparation for future disasters, including catastrophic disasters. It can be difficult to convince budget authorities and the public of the importance of preparing in advance for disasters. Perception by a community of its vulnerability to natural disasters, often based on past disaster experience, can be an important motivator for concrete actions to prepare for future disasters. Populations that accept their vulnerability may thus be more ready to take actions to prepare and respond more appropriately and effectively to disasters.

(7) *Disaster management solutions must be appropriate to the local setting.*

A final lesson from our series of international case studies is the importance of locally appropriate solutions. Specific solutions from such countries as Vietnam, Iran and the Czech Republic were relevant to their local contexts, but similar approaches may not be applicable to disaster preparedness and response in other countries, including the United States.

This research was conceptualized to offer a potential fresh avenue to U.S. policymakers by exploring the value of learning from exemplary practices in international disaster management. A major observation and lesson from our case studies (e.g., Cuba, Mozambique, Czech Republic) and validated elsewhere (e.g., United Nations) is that systematic effort to learn from past disasters can improve management of future ones. The numerous examples provided in this report demonstrate that this is occurring: concrete activities following one disaster yield beneficial effects on reducing losses in subsequent disasters. The United States would do well to consider such examples and identify and implement additional activities to mitigate future U.S. disaster losses.

Our analyses lead to three recommendations:

1. Institutionalize the process of learning from international disaster management.

U.S. policymakers should glean lessons from exemplary international practices on a continual basis. One good way to do that is to consult with international disaster management experts in United Nations agencies, nongovernmental organizations, and countries that have demonstrated exemplary practices in specific areas of interest. Another way would be to strengthen systematic linkages between federal institutions responsible for domestic disaster management, e.g., within DHS, and those responsible for international disaster response, e.g., USAID/OFDA. The knowledge and capabilities of disaster management experts can be used to inform all phases of the disaster management cycle, including disaster preparedness, response, recovery and redevelopment.

2. Apply relevant practices from international experience.

U.S. policymakers should review the principles, exemplary practices and lessons described in this report and adopt or adapt relevant ones to help improve domestic disaster management.

3. Systematically identify, document, and archive exemplary practices.

The literature and databases we consulted tended to focus on negative or incomplete information related to disasters and disaster management. What is needed is a clear definition of what constitutes exemplary practice in disaster management and then systematic documentation and archiving of such practices, especially those that reflect more rigorous evaluation to link disaster management practices to measurable outcomes.

Establishment of such an archive could also facilitate a new line of inquiry in the field of international disaster management, consistent with the principles underlying the emerging field of "positive organizational scholarship." This is a growing

interdisciplinary field that examines factors contributing to organizational success as a way to replicate future success. We believe that this study suggests the value of this approach as applied to disaster management. The United States and all countries can benefit from creating a well-known and readily accessible global library of exemplary practices in international disaster management. This would become an important resource that experts can use to adapt or replicate past successes in future disaster situations anywhere in the world.

The United States has recently experienced significant natural disasters, and now is the time to learn from its past experiences, draw on the world of experience across borders, and prepare for the future. This study provides a systematic and comprehensive review of exemplary international disaster management practices and broader lessons learned which can usefully inform U.S. disaster management. The opportunity for the United States to learn from successful international experiences has probably always been available, but that opportunity should now be seized and acted upon, to improve preparedness and response and mitigate the impact of future disasters.

ACKNOWLEDGMENTS

We are grateful for the encouragement and financial support from Drs. Nicole Lurie and Ross Anthony, co-directors of RAND's Center for Domestic and International Health Security, who provided the inspiration and opportunity to undertake this project and thoughtful review of the draft report. We are further indebted to Kaiser Permanente for the funding support to RAND that made this study possible. We also wish to thank Di Valentine for her help in preparing the final manuscript, and Maggie Wu and John Zambrano for their research assistance. We are especially grateful to the following disaster management experts, who generously shared their experiences and insights with us, both validating and adding richness to our findings: Mark Bartelini of International Rescue Committee, Jim Bishop of InterAction, Nimmi Gowrinathan and Sothida Tan of Operation USA, Ryan Larrance of the International Medical Corps, Dr. Xavier Leus of the World Health Organization, Ian Ridley and Randy Strash of World Vision, Geoffrey Loane of the International Federation of the Red Cross, and Dr. Claude de Ville de Goyet.

ABBREVIATIONS

ADAB	Association of Development Agencies of Bangladesh
AET	Airport Emergency Team (Disaster Response Network)
BRAC	Bangladesh Rural Advancement Committee
BMG	Meteorological and Geophysical Institute (Indonesia)
CDC	Centers for Disease Control and Prevention
CEUDIP	Central European Disaster Prevention Forum
CFO	Central Forecasting Office (Czech Republic)
CHMI	Czech Hydro-Meteorological Institute
CVM	Mozambique Red Cross
DCO	Defense Coordinating Officer
DEG	Directorate of Environmental Geology (Indonesia)
DHS	Department of Homeland Security
DPCCN	Department for Prevention and Combat of Natural Calamities (Mozambique)
DRM	Disaster Risk Management
DRN	Disaster Response Network
DOD	Department of Defense
EM-DAT	Emergency Disasters Database
EOC	Emergency Operations Center
ERT-A	Emergency Response Team-Advanced
EMAC	Emergency Management Assistance Compact
ESF	Emergency Support Functions
FAO	Food and Agriculture Organization (United Nations)
FEMA	Federal Emergency Management Agency
FMIS	Fund for Social Investment (Honduras)
GDP	Gross Domestic Product
GIS	Geographic Information System
HHS	Department of Health and Human Services
HSOC	Homeland Security Operations Center
HSPD	Homeland Security Presidential Directive
IDNDR	International Decade for Natural Disaster Reduction
IFRC	International Federation of Red Cross and Red Crescent Societies
IIMG	Interagency Incident Management Group
INGC	National Disaster Management Institute (Mozambique)
INSMET	National Meteorological Institute (Cuba)
IRCS	Iranian Red Crescent Society
JFO	Joint Field Office
JLOC	Joint Logistics Operations Center (Mozambique)
LAPAN	National Aerospace Institute (Indonesia)
MSCA	Military Support to Civil Authorities
NDMS	National Disaster Medical System
NHC/TPC	National Hurricane Center - Tropical Prediction Center
NIMS	National Incident Management System
NIPP	National Infrastructure Protection Plan
NOAA	National Oceanic and Atmospheric Administration
NRCC	National Response Coordination Center
NPG	National Preparedness Goal
NRP	National Response Plan
NWS	National Weather Service
OCHA	Office for the Coordination of Humanitarian Affairs (United Nations)

OFDA	Office of Foreign Disaster Assistance
OHSEP	Office of Homeland Security and Emergency Preparedness (State of Louisiana)
PHIVOLCS	Philippines Institute of Volcanology and Seismology
PVO	Pinatubo Volcano Observatory (Philippines)
RFO	Regional Forecasting Office (Czech Republic)
RHP	Popular Housing Reconstruction (Mexico)
RIMS	Rehabilitation Information Management System (India)
RRCC	Regional Response Coordinating Center
SADC	Southern African Development Community
SCMS	State Crisis Management System (Czech Republic)
UNDAC	United Nations Disaster Assessment and Coordination
UNDP	United Nations Development Program
UNJLC	United Nations Joint Logistics Center
USAID	United States Agency for International Development
VDAP	Volcano Disaster Assistance Program (Philippines)
VNRC	Vietnam Red Cross

1. INTRODUCTION AND BACKGROUND

On August 29, 2005, Hurricane Katrina hit the Gulf Coast of the United States with Category Four winds and torrential rains. The states of Louisiana, Mississippi and Alabama bore the brunt of Katrina's impact, with the city of New Orleans hardest hit after its levees failed and left three-fourths of the city flooded under as much as 20 feet of water. An estimated 1,300 people perished as a result of the flood, and more than one million were displaced from their homes - ultimately to areas throughout the United States. With estimated damage of \$125 billion, Hurricane Katrina was this country's most destructive and costly natural disaster.

News reports at the time and more systematic studies over ensuing months faulted several aspects of disaster response at the federal, state and local level. Could any of the damage suffered have been lessened by better planning and better response? Is there precedent in this country for responding to disasters of this magnitude? Are there other experiences that could offer insights and lessons to inform future disaster response in the United States?

The objective of this study was to examine experiences from international disasters to identify approaches and experiences of potential value to U.S. policymakers. While there are clearly differences across disasters and disaster responses in different parts of the world, we hypothesized that systematic investigation of international disaster responses could enrich the body of knowledge from which U.S. policymakers draw to help improve domestic disaster management in the future.

We set the context for the study first by providing a background on the occurrence of natural disasters in the United States and worldwide and then by highlighting the problems identified during Hurricane Katrina, which served as an illustrative example of the state of the U.S. disaster management system and the basis for our examination of global exemplary practices.

Natural disasters in the United States

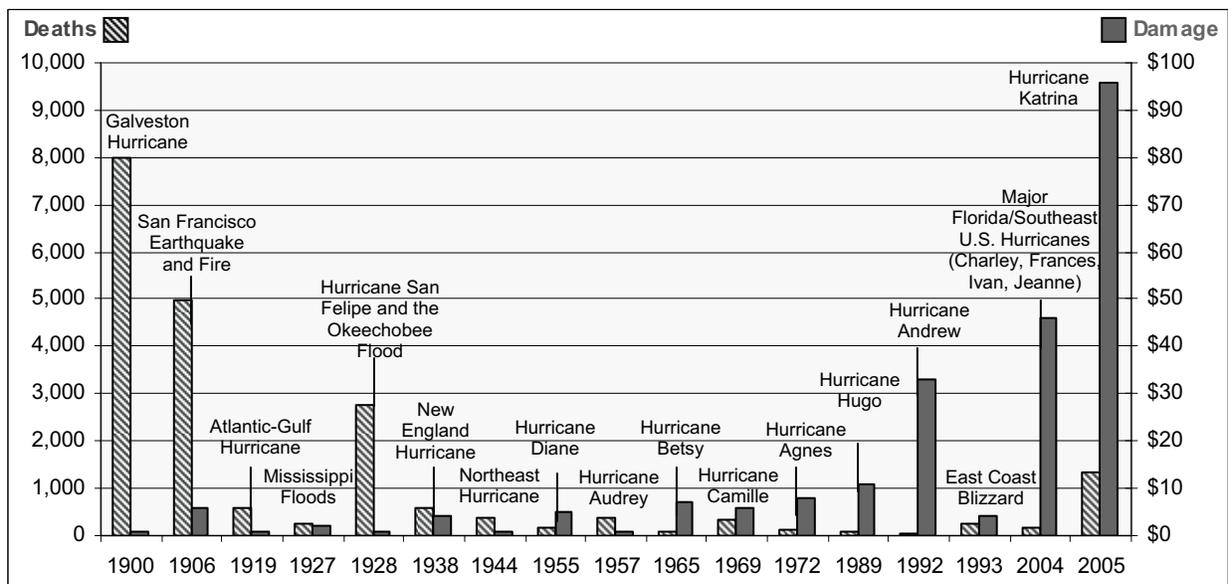
Natural disasters have occurred commonly but at a stable frequency in the United States over recent decades (van der Vink, Allen, et al., 1998, p. 533). During the past 30 years, from 1974 to 2004, an average of 38 federally declared major disasters occurred each year, as well as countless others that fall below the threshold for a federal disaster declaration (The White House, 2006). In some years, there are many more disasters. In 2004, for example, there were more than 75 federal disaster declarations - seven emergencies with focused federal response needs and 68 major disasters with more comprehensive federal response needs (The White House, 2006a, p.12).¹ Appendix 1 provides a more detailed description of this distinction, describing incidents requiring federal response as well as further description the structure and policies of the U.S. disaster management system.

The economic costs of disasters have increased consistently in real terms in recent decades (Cutter and Emrich, 2005, p.388, van der Vink et al., 1998, p. 533; The White House, 2006a, p.6). Estimates of the average annual economic loss from natural disasters between 1960 and 2003 range from \$6 to \$10 billion; however, this average masks the overall exponential growth in economic losses since 1960 (Cutter and Emrich, 2005, p.388). For the period 1992-96, the total five-year economic loss was nearly \$100 billion, more than three times greater than the previous five-year period, 1987-1991, and more than four times greater than any previous five-year period going back to the 1950s (van der Vink et al., 1998, p.533). Annual direct losses alone - averaged by decade - reached \$14.4 billion in the 1990s (Cutter and Emrich, 2005, p.388), and total economic losses during the decade were estimated at \$54 billion per year (van der Vink, et al., 1998). As of 2005, the pace of economic losses in the first decade of the twenty-first century were well on track to surpass the record level set in the 1990s (Cutter and Emrich, 2005, p.388).

¹ As defined in the Disaster Relief Act of 1974, an emergency declaration provides a state with limited federal assistance to meet a specific need, such as search and rescue or debris removal, while a major disaster declaration triggers more assistance to a state, such as the ability of individuals to receive unemployment compensation, food, and cash grants.

In contrast to the trend of increasing economic costs, there has been a general tendency for natural disasters in the United States to result in fewer deaths (The White House, 2006a, p.6). In 2005, Hurricane Katrina became the deadliest U.S. natural disaster since Hurricane San Felipe killed 2,700 people in 1928 (The White House, 2006a, p.6). Figure 1.1 depicts the trends in the human and economic costs of natural disasters in the United States over the past century.

Figure 1.1: Deaths and Economic Costs from Most Destructive U.S. Natural Disasters in Each Decade, 1900-2005²



Source: White House (2006, p.6)

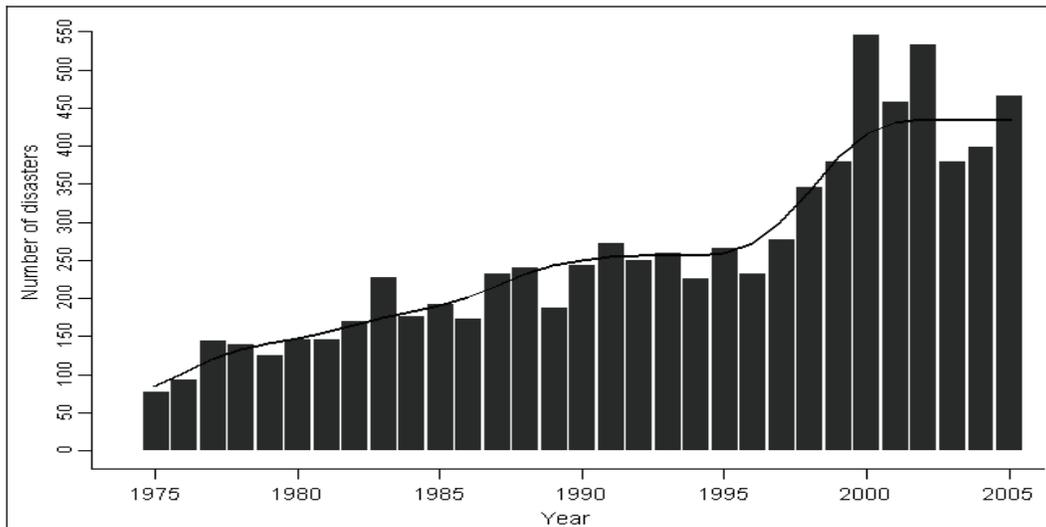
Natural Disasters Worldwide

In contrast to the relatively stable frequency of natural disasters in the United States over the past several decades, the incidence of disasters worldwide has trended upwards since 1975. As depicted in Figure 1.2, the average number of disasters reported each year grew more than fourfold from fewer than 100 per year in 1975-1980 to more than 400 per year in 2000-2005 (Universite Catholique de Louvain, 2006). As a result of both this increasing incidence and various human factors, such as patterns of settlement and economic development, the number of persons affected by disasters has also increased, from an average of 160 million each year in

² Damage in Third Quarter 2005 Dollars, see Appendix 1 for data used in graph

1985-1995 to an average of nearly 260 million each year in 1995-2005 (Parker & Hurlbut, 2006).

Figure 1.2: Number of Natural Disasters Reported Worldwide, 1975-2005



Source: EM-DAT: The OFDA/CRED International Disaster Database

In total, over the twenty-year period 1980-2000, an estimated 4.5 billion persons were affected by natural disasters (including an unspecified number among these who were affected by more than one disaster), with an additional 1.5 million persons losing their lives to these events (UNDP-BCPR, 2004). Today, roughly 75 percent of all persons in the world live in areas that were affected at least once by an earthquake, tropical cyclone, flood or drought between 1980 and 2000 (UNDP-BCPR, 2004, p.1).

Disaster impact is expressed in terms of both human and economic toll, and the two are related. The human impact of natural disasters varies inversely with the level of economic development of the affected nations. According to the United Nations Development Programme, only 11 percent of all persons exposed to natural hazards live in countries classified as low human development, but more than 53 percent of total recorded deaths from natural disasters occurred in these countries (UNDP-BCPR, 2004, p.1). In contrast, countries classified as having high levels of human development represent 15 percent of the total population exposed to natural disasters, but less than two percent of all deaths (UNDP-BCPR, 2004, p.3).

The increase in economic losses in recent years has been even more dramatic, with average annual losses by decade increasing nearly five-fold from \$138 billion in the 1970s, nearly \$12 billion per year, to \$660 billion in the 1990s, roughly \$55 billion per year. These loss estimates by decade are listed in Table 1.1. Moreover, these economic losses have continued to increase into the early twenty-first century, with total losses in the most recent ten-year period, 1995-2004, growing to \$800 billion, or an average of \$80 billion annually (UN World Conference on Disaster Reduction, 2006, p.5; UNDP-BCPR, 2004, pp. 12-13).³ In 2004 alone, economic losses due to disaster are estimated to have been over \$120 billion (Christian Aid, 2005).

Table 1.1: Worldwide Economic Losses due to Natural Disasters, by Decade, 1950-2000

Decade	\$ Billions (Year 2000 Constant Dollars, except 1950s data in 1998 constant dollars)
1950s	38
1960s	76
1970s	138
1980s	214
1990s	660

Source: UNDP-BCPR, 2004, p.13; Parker & Hurlbut, 2006, p. xix

Geographically, economic losses tend to be concentrated predominantly in Asia and the Americas, reflecting both the frequency of natural disasters and the value of infrastructure and assets at risk, as detailed in Table 1.2.⁴

³ According to the Yokohama Strategy there were more than 7,100 reported natural disasters and 300,000 deaths from natural disasters and in the 1995-2004 period.

⁴ In general, data on economic losses is considered to be less reliable than data on human mortality for international comparison of disaster consequences. This is due in large part to the fact that economic losses from disasters are often estimated from insured losses reported by reinsurance agencies, which will reflect a relatively lower level of infrastructure and economic asset accumulation in developing countries and are unlikely to provide a clear picture of the cumulative effect on livelihoods, especially in developing countries. For example, given the lack of data on small-scale and slow-onset disasters, which are more acute in developing countries, it is likely that the various estimates of economic losses underestimate the full costs of natural disasters. Moreover, most of the data on economic losses also fails to reflect how government-sponsored and private insurance programs protect certain regions, particularly more developed regions, from the full economic impact of disasters. Finally, even a relatively small economic loss may hamper development more in the case of poorer regions, such as Africa, than larger losses in more developed regions.

Table 1.2: Economic Losses from Natural Disasters by Region, 1991-2000
(UNDP-BCPR, 2004, p.13)

Region	\$ Billions (Year 2000 Constant Dollars)
Asia	401
Americas	204
Europe	165
Oceania	12
Africa	2

Worldwide, four types of natural disasters -tropical cyclone, earthquake, flood and drought - are responsible for 94 percent of all deaths due to natural disaster (UNDP-BCPR, 2004, p.3) and pose hazards to the largest number of persons worldwide:

- Tropical cyclone: 119 million persons exposed each year
- Earthquake: 130 million persons exposed each year
- Flood: 196 million persons in more than 90 countries affected each year by catastrophic flooding; many more are exposed to minor or localized flooding
- Drought: 220 million persons affected each year

Globally, disaster management is the responsibility of individual countries, but international and nongovernmental organizations often play a major role. Appendix 2 describes in greater detail internationally recognized disaster response principles and practices and those of the U.S. government's international disaster management agency, the U.S. Agency for International Development Office of Foreign Disaster Assistance (USAID/OFDA). The occurrence of natural disasters in the United States and worldwide and the disaster management policies and actors to address them provide the broad context for this study. The disaster management experience during Hurricane Katrina provides more specific and timely context.

Hurricane Katrina

We developed a case study of the U.S. response to Hurricane Katrina to identify problematic areas that in turn became the basis for our examination of international disaster management practices. As described in detail in Appendix 3, the U.S. response to Hurricane Katrina uncovered a number of problems where opportunities remain to learn and improve U.S. disaster management. These span the full disaster management cycle - prevention and

preparedness, response, and recovery and redevelopment⁵, catalogued as follows:

Prevention and preparedness

- *Coordination/management*: Lack of coordination between state and local emergency plans posed challenges.
- *Planning and exercises*: Despite annual exercises, Louisiana's planning for a massive storm had not been completed, and communities were not sufficiently prepared.
- *Early warning*: Advance warnings from the National Weather Service of a severe advancing storm did not prompt commensurate action by local populations.
- *Evacuation*: Evacuation plans were not consistent with the realities of the local population, e.g., a high proportion of the population did not have access to personal vehicles for evacuation, as called for in the plans.
- *Shelters*: Planning included community registers of evacuation shelters, but no corresponding state or national registers; also, New Orleans did not release information on local shelters to the public in advance of hurricane landfall.
- *Health*: Poor health planning ultimately led to critical delays, shortages in resources and flawed emergency protocols in the health and medical response.

Response

- *Coordination/management*: The FEMA response was delayed for administrative and logistical reasons and to allow for completion of worker training; FEMA administrative procedures delayed or even precluded a good deal of external assistance.
- *Communications*: Among the communications problems experienced during the Hurricane Katrina response, the generator for the New Orleans emergency communications system was damaged and rendered

⁵ Given the timeframe for this report, the Hurricane Katrina case study focuses primarily on disaster planning/preparedness and response, and does not include a detailed analysis of recovery/redevelopment. Several of the international case studies, however, do identify good practices in recovery/redevelopment, particularly in instances in which these efforts are closely integrated with response efforts and/or efforts to enhance preparedness for future threats.

dysfunctional by the storm, and the batteries of radios used by emergency responders became depleted.

- *Evacuation:* Despite severe storm warnings, New Orleans residents were only *encouraged* to prepare for evacuation rather than actually to evacuate; voluntary evacuation orders came too late, and many residents were unable to respond for numerous reasons including lack of personal or public transportation. Also, despite individual organizations' efforts, evacuee registration through a central database of displaced persons was delayed for several days.
- *Shelters:* Excessive numbers of persons unable to evacuate safely had to seek refuge in two large "shelters of last resort", which were unable to meet the needs of vulnerable populations and experienced violence that posed a further security threat.
- *Health:* Healthcare facilities were damaged and became inaccessible and inoperable; some external medical assistance went unused.
- *Emergency supplies:* Emergency shelters were not adequately stocked in advance of the storm, and the storm precluded delivery of some supplies afterward.
- *Security and law enforcement:* Local police and National Guard troops were quickly overwhelmed, and external assistance was delayed; detainment facilities for offenders were inadequate or unavailable.
- *Search and rescue:* Coast Guard and National Guard conducted successful efforts, but additional active duty military personnel were not used because their commanders did not approve the rescue missions.

These problems reflect the current state of disaster management in the United States and therefore oriented our search for exemplary practices in international disaster management.

Organization of this report

This report is organized as follows. Chapter 2 describes the methods we used in this study, including criteria for selecting exemplary practices and methods for obtaining complementary information from other sources. Chapter 3 first highlights exemplary practices identified in each of the thirteen international case studies - Bangladesh, Cuba, the Czech Republic, Honduras, India, the Indian Ocean countries affected by the 2004 tsunami, Indonesia, Iran, Mexico, Mozambique, Philippines and Vietnam (two case studies)- and then compiles them into a summary based on each major phase of the disaster management cycle. Chapter 4 presents observations and insights from the U.S.-based international disaster management experts we interviewed. Chapter 5 discusses the lessons derived from analysis of the case studies and interviews. Chapter 6 presents our conclusions and recommendations. Appendices 1 and 2 provide details of disaster management policies and actors in the United States and internationally, respectively. Appendices 3 and 4 present the case study of Hurricane Katrina and the thirteen international case studies, respectively, in their entirety. Appendix 5 presents a list of selected online resources for data on natural disasters.

We believe that the new perspective reflected in this study provides a fresh avenue of inquiry and a useful set of exemplary disaster management practices and lessons learned. We hope it will be considered by U.S. policymakers and ultimately inform much-needed improvements in U.S. disaster management.

2. METHODS

Disaster management requires an ongoing cycle of activities that includes pre-disaster prevention and preparedness, emergency response, and post-disaster recovery and redevelopment. Although the exact terminology for the different phases of and activities included in the disaster management cycle varies among sources, we used the following typology to organize the information in our report:

- prevention and preparedness, including planning and mitigation efforts;
- post-disaster emergency response and relief efforts; and
- recovery and redevelopment, including rehabilitation and reconstruction of infrastructure.

The motivation of this work was Hurricane Katrina's devastation of the Gulf Coast of the United States; therefore we began by developing a case study of Hurricane Katrina. The main purpose was to identify areas reported as problematic in the U.S. response and in turn focus our search for exemplary practices in international disaster management. While no disaster response is perfect, we expected that responses to disasters in other countries exhibited strengths and weaknesses distinct from our own, giving the United States the opportunity to learn from the exemplary practices of others. We also examined information from the literature on the occurrence of disasters and the policies, practices, and actors involved in responding to them both in the United States and globally.

The identification of exemplary practices in international disaster management proved difficult for two reasons - first, because failures are more likely to be documented than successes, and second, because available documentation generally does not include rigorous evaluation that links disaster management practices to measurable outcomes. After-action reports of disaster management experiences along with media coverage tend to focus on institutional failures rather than successes. Further, no central database yet maintains a comprehensive library of assessments of disaster management experiences or similar information. Several databases keep records of natural

disasters and their economic and human impacts, but these are generally not linked to specific disaster response actions:

- OFDA/CRED International Disasters Database includes human and economic losses for disasters worldwide, including relatively small disasters (10 deaths or less).
- EM-DAT, (Université Catholique de Louvain, 2006) also includes human and economic losses for disasters worldwide, as well as data for some disasters on the amount of relief money provided; however, the coverage is limited and the quality of the data is - as documented by EM-DAT itself - inconsistent.
- The National Catastrophe (NatCat) database includes calculations of economic losses from disasters worldwide.
- Sigma captures both economic and human losses from large natural and technological disasters worldwide.
- DesInventar is a disaster inventory system for Latin America.

In addition to these databases, ReliefWeb is a United Nations website that acts as a clearinghouse for documentation on natural disasters and complex emergencies, and the Prevention Consortium is a coalition of international organizations, governments, and private actors dedicated to reducing disaster risk in developing countries. While these two maintain a number of documents on international disaster response, including evaluations of such efforts, none of the sources above keep systematic information of institutional responses.⁶ Some of these sources were useful but not sufficient for our purposes, so we also reviewed academic papers and institutional reports examining disaster responses from various perspectives. We searched this literature extensively and used the sources in one report or article to find others of value, akin to snowball sampling in survey research.

Because exemplary practices in international disaster management are not clearly labeled in the literature or systematically archived in existing databases, we established our own criteria for selection of the exemplary practices described in this report. In evaluating cases to include as

⁶ Descriptions of each database are included in the Red Cross *World Disasters Report 2005*, Chapter 8.

examples of good practice, we sought disaster management practices, across all phases of the disaster management cycle:

- related to particular problem areas identified in the Hurricane Katrina response (see chapter 1);
- that were innovative - new or creative in some way - whether in relation to the affected country's previous policies or in relation to commonly accepted international practices;
- for which there was evidence that these practices resulted in a reduction in the losses that would have been expected from similar disasters; and/or
- that reflected general practices or principles subsequently validated by recognized disaster management experts and considered to be potentially replicable in other settings.

The thirteen case studies described in this report summarize the disaster event, describe one or more specific areas of exemplary practice according to the relevant disaster management phase/s (prevention and preparedness, response, recovery, and redevelopment), and then extract key findings that could potentially inform U.S. disaster management. Some of these case studies had an array of exemplary practices to offer, e.g., Cuba's response to several hurricanes in the past decade, Mozambique's response to repeated flooding in 2000 and 2001, and the extensive activities that mitigated the damage caused by the eruption of Mount Pinatubo in the Philippines in 1991 and the 1993 earthquake in Bam, Iran. In other cases, the good practices were fewer in number or narrower in focus, such as the housing reconstruction in Mexico City after the 1985 earthquake or the planting of mangrove forests along the coasts of Vietnam which effectively sheltered coastal areas against typhoons in 2005. We tried to capture the full range of practices that met the criteria above and could therefore potentially inform U.S. disaster management.

Notwithstanding the documentation that we were able to locate, much of the knowledge of what went well and what went poorly in various emergencies lies with the people who coordinated the response. Many of these individuals are staff members of relief agencies involved in response and recovery. Thus, to supplement our literature review, we interviewed key actors at

various agencies (such as the Red Cross and the International Medical Corps) about the essential elements for successes in the field. The insights from the experts we interviewed provide an important voice of experience that supplements and complements the written record.

3. INTERNATIONAL CASE STUDIES

This chapter presents highlights from each of the thirteen international case studies and then summarizes the exemplary practices we identified across all of them. The thirteen case studies can be found in their entirety in Appendix 4. The highlights presented here include a brief description of each disaster and the exemplary practices identified.

In seeking out relevant lessons for the United States, we examined a broad array of international disasters from Latin America, the Middle East, Asia, Africa and Europe. We selected for case study those disasters for which one or more practices met the criteria described in Chapter 2. Table 3.1 summarizes the nature and impact of these disasters.

Table 3.1 Disasters Reviewed in this Report, by Economic Impact Level

Location	Type	Year(s)	Deaths	Persons Affected (1,000s)	Economic losses (US \$Millions)
United States	Hurricane (Katrina)	2005	1300	> 1,000 (displaced)	\$125,000
Indian Ocean countries	Tsunami	2004	240,000	1,768	\$9,900
Mexico	Earthquake	1985	9,500	100 (displaced)	\$4,000
Honduras	Hurricane	1998	5,757	441 (displaced)	\$3,600
India	Earthquake	2001	>20,000	Unknown	\$3,500
Czech Republic	Floods	1997	50	Unknown	\$2,000
		2002	18	Unknown	\$3,000
Bangladesh	Flood	1998	918	31,000	\$2,000
Iran	Earthquake	2003	30,000	75-90 (displaced)	\$1,500
Mozambique	Floods	2000	700	550 (displaced)	\$450
		2001	113	223 (displaced)	\$30
Philippines	Volcanic eruption	1991	200-800	100	\$374
Vietnam	Floods	1998	397	Unknown	\$188
		1999	800	1,700; 55 (displaced)	\$290
Vietnam	Typhoon	2005	68	>10 (displaced)	\$209
Indonesia	Landslides	2002-3	108	Unknown	Unknown
Cuba	Hurricanes	1998	6	818 (evacuated)	Unknown
		2001	5	712 (evacuated)	\$87
		2004	0	1,300 (evacuated)	Unknown
		2005	16	1,500 (evacuated)	\$1,400
		2005	4	760 (evacuated)	\$704

The death toll for some far exceeded that for Hurricane Katrina (such as the tsunami in the Indian Ocean in 2004 or the Mexico City earthquake of 1985), whereas others had a smaller impact in terms of human casualties, sometimes due to excellent elements of disaster management. Some disasters showed extensive property damage despite limited casualties (such as the 1997

and 2002 floods in the Czech Republic). Two case studies address hurricane disasters like Katrina (Cuba in 1998-2005 and Honduras in 1998), whereas others included floods, landslides, earthquakes, a tsunami, a volcanic eruption, and a typhoon.

Highlights from individual case studies

Following are highlights of the thirteen international case studies, including a statistical summary, brief description of the event, and the exemplary practices identified.

Bangladesh

Bangladesh flood 1998: Summary Statistics	
Date:	July - September 1998
Human Consequences:	918 deaths, 31 million affected
Economic Losses:	\$2 billion (Beck, 2005)

Floods are a normal part of the natural and human ecology of Bangladesh. Unlike the normal floods, which typically cover 30 percent of the country for several days or weeks during July and August, the 1998 "flood of the century" lasted ten weeks, through mid-September, and covered up to 68 percent of the total area of the country at times (Beck, 2005, p.iv). In addition to the deaths of hundreds of people and destruction of roads, houses, and other assets that resulted from the initial flooding, the floods had considerable secondary impacts as well, including scarcity of food, firewood, and safe drinking water, and extensive damage to rural homes and the rice crops.

Exemplary practices identified

Prevention/Preparedness

- *Disaster risk management orientation:* Shift from focus on disaster relief to disaster risk management, e.g., from flood control to flood proofing.
- *Social and economic development:* Broader economic development reduced the country's susceptibility to disaster, e.g., through diversifying crops to year-round production and hence reducing economic vulnerability to seasonal disasters.

Response

- *Response coordination by NGOs:* It was not the government, but rather, a coalition of NGOs already established in the country that successfully coordinated the flood response.

Recovery/Redevelopment

- *Relief-to-recovery orientation:* Development staff were redirected to disaster relief efforts, but brought a longer-term development perspective to these efforts.
- *Private sector involvement:* The government incorporated the capabilities of the private sector into disaster relief efforts.

Cuba

Cuba severe hurricanes 1998-2005: Summary Statistics	
Date:	July 23, 1998
Human Consequences:	6 deaths, 818,000 evacuated
Economic Losses:	Not available
Date:	November 4, 2001
Human Consequences:	5 deaths, 712,000 evacuated
Economic Losses:	\$87 million
Date:	September 13, 2004
Human Consequences:	0 deaths, 1.3 million evacuated
Economic Losses:	Not available
Date:	July 8, 2005
Human Consequences:	16 deaths, 1.5 million evacuated
Economic Losses:	\$1.4 billion
Date:	October 17, 2005
Human Consequences:	4 deaths, 760,000 evacuated
Economic Losses:	\$704 million

Located in the hurricane-prone Atlantic Basin, the small island state of Cuba is hit by a hurricane almost annually. Hurricanes are, in fact, such a constant presence in the life of Cuba, that historian Louis Ferez has suggested that hurricanes have been a critical factor in shaping the economic and social development of Cuban society (Ferez, 2001). In the most recent decade, from 1996 to 2005, ten hurricanes struck Cuba - resulting on average in more than 600,000 persons evacuated and nearly one million directly affected; and almost 5,000 homes destroyed and 37,000 damaged per hurricane event (Ferez, 2001). Between 1996 and 2005, five hurricanes of Category Four or Five hit Cuba: Georges (1998), Michelle (2001), Ivan (2004), Dennis (2005), and Wilma (2005). These severe hurricanes are the subject of this case study.

Exemplary practices identified

Prevention/Preparedness

- *Community participation and a culture of preparedness:* Cuban citizens are involved at virtually all stages of hurricane planning and response.

- *Detailed plan developed at all levels of governance:* Community plans are compiled into county plans and in turn into a coherent national plan.
- *Annual updating of plans:* The national plan is reviewed and updated annually, taking into account what did and did not work well during the previous hurricane season.
- *Annual nationwide drill:* Such drills operationalize hurricane plans and heighten public awareness.

Response

- *Centralized decision-making and decentralized implementation:* The central National Civil Defense issues disaster policy but relies on provinces and municipalities for implementation; this facilitates a coordinated response while avoiding central bureaucratic delays.
- *Timely and coordinated evacuation:* Vulnerable communities are systematically evacuated 72 hours in advance of anticipated hurricane landfall; the government not only calls for but also coordinates evacuations.
- *Advance shelter preparations:* Pre-designated shelters are adequately stocked with water, food, medical and emergency supplies 48 hours prior to anticipated landfall.
- *Utilization of local police:* Local police help enforce evacuation orders and are posted at evacuation shelters to help maintain security.
- *Trained medical brigade for national emergencies:* These brigades provide not only a pool of trained medical personnel but also a structure and coordinating mechanism for the medical response.

Czech Republic

Czech Republic floods 1997 & 2002: Summary Statistics	
Date:	July 1997
Human Consequences:	50 deaths, 60,000 evacuated
Economic Losses:	\$2 billion
Date:	August 2002
Human Consequences:	18 deaths, 50,000 evacuated, 230,000 displaced
Economic Losses:	\$3 billion

The Czech Republic experiences regular flooding which cause an average of nearly \$30 million in damages each year. In July 1997, countries in Central and Eastern Europe (CEE) were hit by heavy rains, hailstorms and high winds that led to what was at the time the worst flooding in a century. Over one million people were directly affected, as buildings, roads, agricultural land, and infrastructure was destroyed. The Czech Republic was one of the worst hit areas. Only five years later, in August 2002, the CEE region suffered an even larger flood, with the Czech Republic again severely impacted. However, interventions instituted after the 1997 flood to improve early warning, emergency medical care and response coordination resulted in fewer deaths in 2002 despite the large magnitude of the disaster itself.

Exemplary practices identified

Prevention/Preparedness

- *Early warning:* After the 1997 floods, the government restructured its forecasting and warning service to both improve forecasting and better offer actionable information to the public.
- *Emergency medical care:* After the 1997 flood and to create a larger cadre of physicians to deliver emergency medical care, emergency medicine was designated an official medical subspecialty; also, all Czech physicians were required to pass a First Aid training course before being allowed to complete their specialty training.

Response

- *Coordination:* By 2000, the country had enacted three general laws to improve disaster preparedness - related to an integrated rescue system, crisis management and economic measures for states in crisis; these are credited with facilitating successful flood evacuations in 2002.

Honduras

Honduras hurricane 1998: Summary Statistics	
Date:	October 25 – November 1, 1998
Human Consequences:	5,757 deaths; 441,150 displaced
Economic Losses:	\$3.6 billion

Honduras is the third poorest country in the Americas. Tropical storms and hurricanes are the most important disaster events in the country, experiencing six hurricanes and four tropical storms during the period from 1969 to 2001. The most damaging of these was Hurricane Mitch, which devastated the country in late 1998. The numbers of deaths and displaced persons were the largest on record for any natural disaster in the country.

Exemplary practices identified

Prevention/Preparedness

- *Local risk management capacity:* Such local capacity, coupled with a good early warning system, allowed for implementation of a community's pre-developed flood mitigation plan and the loss of no lives to the hurricane (compared to other villages in the country without such a plan).

Recovery/Redevelopment

- *Decentralization, simplification and acceleration of project implementation:* The World Bank has recognized that these approaches to implementation of the National Fund for Social Investment greatly enhanced implementation and coordination of recovery efforts following Hurricane Mitch.
- *Community participation in recovery:* The World Bank credits involvement of affected communities in decision-making as well as a longer-term development orientation in the notably successful physical reconstruction of infrastructure and housing in the Honduran recovery from the hurricane.

India

India earthquake 2001: Summary Statistics	
Date:	January 26, 2001
Human Consequences:	20,000+ deaths, 300,000 injuries
Economic Losses:	\$3.5 billion ⁷

Natural disasters are common to the 50 million residents of Gujarat, a prosperous, industrialized state in western India. Gujarat experiences regular cyclones and flash floods, droughts on average every three years, and an earthquake every thirty years. On January 26, 2001, the worst earthquake to strike India in nearly three centuries struck Gujarat. The quake measured 6.9 to 7.9 on the Richter scale and affected 21 of the 25 districts in the state. The devastation in the state was concentrated in the district of Kutch, which suffered 90 percent of all deaths and about 85 percent of all economic losses.

Exemplary practices identified

Response

- *Response coordination:* Gujarat requested that UNDP coordinate between the government and national and international NGOs the massive earthquake relief efforts.
- *Integrated information collection and distribution:* The Rehabilitation Information Management System, an electronic data network, was established within one month of the earthquake to collect compiled village level information from sub-centers and hence facilitate village level relief efforts.
- *Disaster impact mapping:* The UNDP initiated GIS-based mapping of health and education sector needs in the affected district.

Recovery/Redevelopment

- *Housing redevelopment:* Communities were empowered to help rebuild their own homes at their original sites and using local materials (thus stimulating the local economy); standardized house sizes facilitated efficient large-scale home rebuilding, and the government supported the development of demonstration houses to further facilitate reconstruction by affected villagers.

⁷ *From Relief to Recovery: The Gujarat Experience* (Sadasivam, 2001).

Indian Ocean countries

Indian Ocean countries tsunami 2004: Summary Statistics	
Date:	December 26, 2004
Human Consequences:	240,000 deaths, 1.768 million displaced
Economic Losses:	\$ 9.9 billion

Tsunamis are considered among the most destructive natural disasters because of their broad impact on human, economic and social sectors. They occur on average eight times a year in the Pacific Ocean region and only once every three years in the Indian Ocean region (Rastogi & Jaiswal, 2006). In the Indian Ocean region, eighty percent of tsunamis originate in the volcanic area beneath Sumatra and Java in Indonesia. On 26 December 2004, a magnitude 9.0 earthquake shook the Indian Ocean floor about 60 miles off the west coast of Sumatra, Indonesia, generating a chain of tsunamis rushing east and west and causing losses of lives or livelihoods in fourteen countries spread over two continents.

Exemplary practices identified

Prevention/Preparedness

- *Local disaster management capacity:* UNDP training of Indian villagers in search and rescue and disaster first aid techniques is credited with saving lives following the tsunami (compared to nearby villages that had not yet received this training).

Response

- *Private sector involvement in logistics:* Following the 1993 earthquake in Iran, the Disaster Response Network had organized an Airport Emergency Team of trained private sector volunteers who took charge of airport logistics in Colombo, Sri Lanka and effectively increased the flow of relief supplies into areas of the country impacted by the tsunami.

Indonesia

Indonesia landslides 2002-2003 Summary Statistics	
Date:	October 2002 – April 2003
Human Consequences:	108 deaths
Economic Losses:	Unknown ⁸

Indonesia, the world's largest archipelago nation, is subject to many natural and man-made disasters. Droughts, tsunamis, earthquakes, volcanic eruptions, landslides, and forest fires have all taken a significant human and economic toll on the country and its people. As many as 800 landslides occurred in Indonesia during the 1990s, killing at least 735 people. The landslides are frequently caused by monsoon rain in areas where land has been weakened by deforestation (Harvard School of Public Health Program on Humanitarian Policy and Conflict Resolution (HPCR), 2002). During the period of October 2002 to April 2003, there were 44 landslides on Java and the Flores Islands as a result of heavy rains.

Exemplary practice identified

Prevention/Preparedness

- *Early warning:* The Indonesian government redoubled efforts to better inform the public and make them more aware of how to implement recommended prevention and mitigation strategies.

⁸ Except where otherwise noted, the material for this case is drawn from "Early Warning on Landslide Affecting Rainy Season of October 2002 - April 2003 in Indonesia (Lesson to Learn)," (Effendi,).

Iran

**Iran earthquake 2003:
Summary Statistics**

Date:	December 26, 2003
Human Consequences:	30,000 deaths, 30,000 injuries, 75,000 to 90,000 displaced
Economic Losses:	\$1.5 billion ⁹

Because of its size, geographical location and climactic diversity, Iran suffers from tropical storms, floods, droughts and earthquakes. Earthquakes (more than 950 between 1993 and 2003) have caused the greatest devastation in both human and economic terms. Before the 2003 earthquake in Bam, the city's population was estimated at 120,000 (IFRC, 2004). The 6.7-magnitude earthquake in 2003 lasted just 20 seconds but caused the collapse of roughly 85 percent of the city's buildings. It is estimated that only 10 percent of the population remained in the city in the months after the earthquake.

Exemplary practices identified

Response

- *International response coordination:* The efforts of provincial and national government officials and the UN Disaster Assessment and Coordination team to decentralize response, provide political leadership, waive visa requirements for foreign relief personnel, and organize responsibilities of coordinating parties are widely cited as a model for swift and effective disaster response.
- *Local response coordination:* The Iranian Red Crescent Society divided Bam into 13 sectors and organized volunteer medical assistance from other provinces in the country to "sponsor" each sector.
- *Emergency medical care:* Massive medical airlifts by the Iran government and international relief agencies led to the safe evacuation of more than 12,000 seriously injured persons; active

⁹ Except where otherwise noted, the material for this case study draws on International Federation of Red Cross and Red Crescent Societies, "Chapter 4: Bam sends warning to reduce future earthquake risks," (IFRC, 2004); *Report of the Workshop of Lessons Learnt on the National and International Response to the Bam Earthquake, Kerman, Islamic Republic of Iran*, (Calvi-Pariseti, 2004); *Health Sector Response to the Bam Earthquake: Lessons Learnt*, (WHO, 2005); and, "WHO praises Bam response but warns of Disease," (Zaracostas, 2004).

tent-by-tent disease surveillance helped document the health needs of displaced victims.

Recovery/Redevelopment

- *Communications:* The UNDP established a bi-weekly newsletter to keep volunteers and community members apprised of recovery activities.

Mexico

Mexico earthquake 1985: Summary Statistics	
Date:	September 19, 1985
Human Consequences:	9,500 deaths, 30,000 injuries, 100,000 displaced
Economic Losses:	\$4 billion ¹⁰

While the country of Mexico and its capital, Mexico City, are vulnerable to a variety of natural disasters, Mexico City is particularly vulnerable to earthquakes. The expansion of the Mexico City and the gradual draining of Lake Texcoco upon which it is built have left the city located largely on unconsolidated lake-bed sediments that amplify seismic waves. In the early morning of September 19, 1985, Mexico City was struck by one of the most destructive earthquake events in the hemisphere's history. The initial earthquake, measuring 8.1 on the Richter scale and lasting 50 seconds, was followed by a number of aftershocks through the following day, the largest having a magnitude of 7.8. The earthquake damaged or destroyed more than 2000 poorly-built and overcrowded tenements housing low-income families, 340 office buildings, 1,200 small industrial workshops, and 1,200 schools. Additionally, more than 2,000 hospital beds and 1,700 hotel rooms were lost.

Exemplary practices identified

Recovery/Redevelopment

- *Community involvement:* Overall, the building reconstruction focused on the physical, socio-cultural and psychological needs of the earthquake victims and involved them meaningfully in the reconstruction efforts.
- *Designation of lead recovery institution:* The Mexican government created a time-limited institution and set a deadline to complete the recovery efforts (which completed its mission before the deadline and was then dismantled as planned).
- *Beneficiary census and identification:* The agency responsible for recovery matched updated information on the number and socioeconomic characteristics of the persons affected with data on the physical

¹⁰ Except where otherwise noted, the material for this case study draws on "Case Study: Housing Reconstruction in Mexico City," (Kreimer and Echeverria, 2006).

conditions of damaged dwellings and used this to award certificates of eligibility for housing assistance.

- *Community preservation and empowerment:* The recovery agency organized neighborhoods in the affected area into "renovation councils" to help maintain social support systems and input into the recovery process. The agency also provide rent payment assistance to affected families.
- *Rapid completion:* In less than two years, the recovery agency had rebuilt more than 45,000 homes and restored many displaced families into homes, thereby helping victims recover their lives and improve their psychological well-being.

Mozambique

Mozambique floods 2000: Summary Statistics

Date:	January – March 2000
Human Consequences:	700 deaths and 550,000 displaced
Economic Losses:	\$450 million (UNDP, 2004)
Date:	February – May 2001
Human Consequences:	113 deaths and 223,000 displaced
Economic Losses:	\$30 million (Republic of Mozambique, 2001)

Mozambique is characterized by great irregularity in rainfall. The country may suffer either excessive rains that cause floods in the river basins or insufficient rainfall, leading to prolonged droughts. From 1965 to 1998, there were twelve major floods, nine major droughts, and four major cyclone disasters in Mozambique (Wiles, Selvester, et al. 2005). In 2000, southern Mozambique suffered from heavy rains and a series of tropical storms that simultaneously flooded several rivers for the first time in recorded history. Even though Mozambique is one of the poorest countries in the world, it had made significant investments in disaster preparedness plans and showed great capacity to coordinate not only its own response, but also that of the many international countries and agencies that sent response teams into Mozambique.

Exemplary practices identified

Prevention/Preparedness

- *Planning and exercises:* The country conducts annual multi-sector and multi-level national contingency planning that includes disaster training and simulation exercises.
- *Community involvement:* Communities are involved in carrying out the national contingency plan, including local volunteers trained in simple disaster relief tasks and risk management measures.
- *Early prevention measures:* Early warnings of upcoming severe rains led to mobilization of government and NGOs to (re)train community volunteers and pre-position food, water and health supplies in areas likely to be affected.

Response

- *Evacuations by group and maintenance of local government:* People were evacuated by groups led by local leaders who knew them, thereby reducing the stress of relocation and facilitating administration of temporary accommodations by these local leaders.
- *Local response before the arrival of external assistance:* The government and Mozambique Red Cross anticipated the late arrival of external assistance and began rescue operations early.
- *Strong response-coordination institution:* The government's foreign minister led the Joint Logistics Operation Center, where all requests for supplies and staff were effectively received and processed.

Recovery/Redevelopment

- *Recovery as development:* The reconstruction of more flood-proof infrastructure was used to improve the level of development of the affected areas, as well as mitigating damage from future floods.

Philippines

Philippines volcanic eruption 1991: Summary Statistics	
Date:	June 1991
Human Consequences:	200-800 deaths; 100,000 displaced
Economic Losses:	\$374 million (estimated) (Mercado, Bertram, et al., 1996)

Before 1991, Mount Pinatubo was a relatively unknown volcano located 55 miles northwest of Manila on the island of Luzon. As many as one million persons lived on or around Pinatubo, including 20,000 indigenous Aeta, who lived in dense forests found on the volcano's slopes, and 20,000 American military personnel and their dependents, who lived at two nearby U.S. military bases. On the morning of June 15, 1991, Pinatubo exploded in the second largest volcanic eruption of the twentieth century.¹¹ The most powerful phase of the eruption lasted more than ten hours, generating an enormous cloud of volcanic ash that grew to 22 miles high and more than 300 miles across. Coinciding with the eruption, Tropical Storm Yunya passed within 47 miles to the northeast of Mount Pinatubo, causing a large amount of rainfall in the region. The airborne ash from the eruption mixed with the rain from Yunya and fell to the ground, covering most of Luzon. Most of the human and economic losses from the eruption were attributed to the debris, as the weight of the material caused buildings to collapse, killing persons inside and nearby the buildings (Rosenberg, 2001; and Wright and Pierson, 1992).

Exemplary practices identified

Prevention/Preparedness

- *Local early detection:* The local Aeta population living on the slopes of Mount Pinatubo first noticed abnormal activity and reported it to the government, who then established seismic monitoring.
- *Regular public warnings:* The Pinatubo Volcano Observatory developed a clear and understandable public warning system and mobilized both

¹¹ The largest volcanic eruption of the 20th century was the 1912 eruption of Katmai-Novarupta (Alaska) (Rosenberg, 2001).

public officials and private citizens to take seriously these warnings and calls for evacuation.

- *Early evacuation:* When seismic monitoring detected an imminent threat, the government safely evacuated 75,000 residents before the June 15 eruption, saving an estimated 5,000-20,000 lives.

Response

- *Health surveillance and disease control:* Health officials prepared in advance for disease surveillance among displaced persons, using pre-prepared forms, and used the resulting information monitor health safety and guide relief and rehabilitation assistance.

Vietnam

Vietnam floods 1998 and 1999: Summary Statistics	
Date:	November-December 1998
Human Consequences:	397 deaths
Economic Losses:	\$188 million
Date:	November – December 1999
Human Consequences:	800 deaths, 55,000 displaced, 1.7 million affected
Economic Losses:	\$290 million ¹²

The physical and human geography of Vietnam make it one of the most disaster-prone countries in the Asia-Pacific region. Vietnam's long coastline is hit each year by an average of four typhoons and several other storms that can breach sea dykes and cause damage to houses, crops and aquaculture (IFRC, 2002). As Vietnam's population grows, more and more of the country's residents are moving into exposed coastal areas. From November to December 1998, a series of tropical storms struck the central and central highlands provinces of Vietnam. The storms combined with a cold front from the north to produce heavy rain in coastal provinces and in the Central Highlands. Water levels on rivers from Quang Tri Province to Khanh Hoa Province rose above Alarm Level Three, the highest Vietnamese flood-disaster Alarm Level designation, with water levels on some rivers rising 0.8 to 2.8 m above Alarm Level Three. The flooding was the worst in the country in over two decades. One year later, from November to December 1999, tropical storms dumped the equivalent of two years of rain on Vietnam's central provinces, causing all of the country's rivers to overflow their banks, some rising as fast as one meter per hour, and resulting in the worst flooding of the century.

Exemplary practices identified

Recovery/Redevelopment

- *Disaster-resistant housing:* In a country such as Vietnam that experiences recurrent natural disasters, public involvement in the reconstruction of disaster-resistant housing following the 1998 floods helped reduce vulnerability to future floods and is credited with saving lives and livelihoods in the 1999 flood.

¹² Except where otherwise noted, the material for this case study is drawn from "Chapter 5: Post-flood recovery in Vietnam" (IFRC, 2001).

Vietnam

Vietnam typhoon 2005: Summary Statistics	
Date:	September 27, 2005
Human Consequences:	68 deaths, 22 injured, 10,000+ displaced
Economic Losses:	\$209 million

On September 27 and 28, 2005, Typhoon Damrey, which means “elephant” in Khmer, hit Vietnam’s coastline from Quang Ninh into Da Nang, sending heavy rain and high winds over large parts of the country. The rains and wind caused mudslides and flooding in the northern provinces of Yen Bai, Lao Cai and Phu Tho as well as the collapse of a sea dyke.

Exemplary practice identified

Prevention/Preparedness

- *Increasing protection of sea dykes:* Submerged mangrove forests planted along 110 km of the country’s east coast by the Vietnam Red Cross beginning in 1994 served as a natural barrier to dampen the storm waves that threatened sea dykes protecting coastal residents and thereby mitigated damage from 2005’s Typhoon Damrey.

Summary of exemplary practices

Here we extract and summarize exemplary practices from our thirteen international case studies and describe them as they relate to each phase of the disaster management cycle - prevention and preparedness, response, and recovery and redevelopment. These include several “all-hazards” practices that are applicable to more than one type of disaster, i.e., not limited to hurricanes such as Katrina. Table 3.2 captures the areas for which exemplary practices were identified from each of the international case studies, categorized by phase of the disaster management cycle.

Table 3.2 Summary of Areas for which Exemplary Practices were Identified, by Country

Location	Type	Year/s	Prevention/Preparedness	Response	Recovery and Redevelopment
Bangladesh	Flood	1998	Mitigation; social and economic development	Coordination/management	Development orientation; private sector
Cuba	Hurricane	2001	Early warning; planning; exercising; community preparedness	Coordination/management; evacuation; shelter; security; health	Community involvement
Czech Republic	Floods	1997, 2002	Early warning; emergency medical care	Coordination	
Honduras	Hurricane	1998	Local risk management capacity		Decentralization, simplification, and acceleration of project implementation; community involvement; development orientation
India	Earthquake	2001		Coordination/management; integrated information systems; disaster impact mapping	Community empowerment; housing; community training
Indian Ocean countries	Tsunami	2004	Local disaster management capacity building	Private sector involvement in logistics	
Indonesia	Landslides	2002-2003	Early warning		
Iran	Earthquake	2003		International and local response coordination; health (surveillance and needs assessment); search and rescue	Community involvement (local liaisons, communications)
Mexico	Earthquake	1985			Infrastructure; community involvement; rent payment assistance; rapid completion
Mozambique	Floods	2000, 2001	Early warning; regional coordination; planning; exercising; community preparedness	Evacuation; search and rescue; coordination	Development orientation
Philippines	Volcanic eruption	1991	Early warning; early evacuation; regular public warnings and public awareness building;	Health: disease surveillance and control	
Vietnam	Floods	1998, 1999			Housing
Vietnam	Typhoon	2005	Mitigation		

Exemplary Practices in Prevention and Preparedness

The international case studies suggest a number of exemplary practices related to disaster prevention and preparedness, as presented in table 3.3 below. By design, these are in areas identified as problematic in Hurricane Katrina, e.g., coordination, planning and exercising, early warning, and evacuation planning. Common to these are a "culture of preparedness" and community involvement, including frequent updating and exercising of disaster response plans. Also, as the United States continues to rebuild in the wake of Katrina, Bangladesh's shift from a "flood control" to a "flood proofing" approach is instructive, using recovery as an opportunity to enhance mitigation and preparedness.

Exemplary Practices in Response

Likewise, the international case studies revealed a number of exemplary practices related to disaster response, as shown in table 3.4. Again, these are largely in areas identified as problematic during Hurricane Katrina, including response coordination, search and rescue, shelters, health, and security. We highlight two additional response practices - making use of local capacity and advance preparation of shelters. As disaster neared, Mozambique's system of predetermined evacuation groups headed by local leaders (thus leading people from the same neighborhood to evacuate to the same place) suggests how one might take advantage of existing social capital in enforcing civil order in a disaster context. The Cuban government established certain homes as "hurricane-safe," which accounted for 80 percent of evacuees' lodging during Hurricane Wilma; while that may not be sufficient in a disaster with the intensity of Katrina, in lesser events such a practice could be valuable, and the principle itself is worth considering. Financial incentives for improving physical infrastructure potentially could include lower insurance premiums for more flood-proof construction. With regard to health care, government can stock pre-designated shelters with sufficient food, water, medicines, and other supplies in advance of the storm, as the Cuban government did two days before Hurricane Michelle reached land. After the Philippine volcanic eruption in 1991, health teams were positioned at

evacuation centers and gathered basic disease surveillance information to guide resource allocation.

Exemplary Practices in Recovery and Redevelopment

Finally, in table 3.5 we list exemplary practices extracted from our international case studies regarding recovery and redevelopment. We note the general orientation of all response efforts to promote development, whether referred to as "developmental relief" or "relief-to-recovery," as well as lessons in housing reconstruction from India, Mexico and Vietnam. Both Mexico's and India's post-earthquake experiences recall the value of involving the local community in feedback and even rebuilding efforts, and the experiences from all three countries indicate the orientation toward disaster-proofing rebuilt structures as an approach to future mitigation. Also, Bangladesh's post-flood experience with letting markets determine food prices and supplies proved far more effective than government intervention.

Table 3.3 Exemplary Practices Identified: Prevention and Preparedness

PREVENTION/PREPAREDNESS	
Planning	National emergency plan updated annually from bottom up, local to national and with precise details (Cuba)
	Annual contingency planning across sectors, regions and levels of government and society (Mozambique)
Early warning	Disaster alert system with advanced technology, timely public warnings (Cuba)
	Medium-term weather forecasting, volunteer training and retraining, disaster management institute preparation and warning of vulnerable communities, early mobilization of human and physical resources (Mozambique)
	Local community first alerted authorities of pending seismic action; national Quick Response Teams investigated threat and intensified monitoring; daily bulletins/alerts including identification of danger zones; involvement of top political leadership (Philippines)
	Advanced technological system, coupled with understandable and actionable public communications, provides robust meteorological data to national, regional authorities (Czech Republic)
	Multi-institution weather forecasting team, country mapped by classified vulnerability level and used to educate and prepare communities (Indonesia)
Evacuation	Precautionary evacuation of at-risk communities facilitated by effective early warning and proactive public awareness efforts were felt to have saved 5-20 thousand lives (Philippines)
Exercising	Annual two-day drills nationwide for preparation and response (Cuba)
	Training exercises with full range of response partners (Mozambique)
Community preparedness	Culture of preparedness, involvement of citizens in all stages of planning and response (Cuba)
	Broad community-based preparedness with trained volunteers; participatory risk analysis and risk management planning facilitate understanding and effective disaster response; proactive contacts with local authorities (Mozambique)
	Effective risk communications materials were used to educate and prepare political leaders and the public; these efforts also included proactive engagement of local and national media (Philippines)
Local capacity building	Training and capacity building of local communities in high risk areas (UNDP-sponsored Disaster Risk Management programs in India, Sri Lanka) facilitated local relief efforts and were credited with saving lives (Indian Ocean countries)
	Local leaders received training that allowed them to recognize risk and implement flood-mitigation measures in advance of central government authorities (Honduras)
Coordination	Revamping institutional structures and roles/responsibilities, establishment of central National Disaster Management Institute and inter-ministerial coordinating council (Mozambique)
Disaster medical care	Emergency Medicine designated as official medical subspecialty, resulting in increased number of specifically trained medical providers (Czech Republic)
Laws/regulations	Integrated Rescue System, Law on Crisis Management, Law on Economic Measures for Crisis States (Czech Republic)
Mitigation	Disaster preparedness and management linked to economic development, e.g., "flood control" approach replaced by "flood proofing"; also, macro level social and economic development led to improvements in preparedness (Bangladesh)
	Mangrove forests planted effectively dampened wave impact on land (Vietnam)

Table 3.4 Exemplary Practices Identified: Response

RESPONSE	
Evacuation	Timely (beginning 72 hours) before disaster strikes, coordinated by government with strong collaboration from local authorities and civil society; includes all forms of transportation and door-to-door volunteer assistance (Cuba)
	Predetermined groups evacuated by local leaders, temporary shelters on high ground, evacuees from given communities living together (Mozambique)
Search and rescue	Multiple transportation modes – particularly boats – used from civilian and military sectors, major proportion of rescues carried out by national and regional sources (Mozambique)
	Rescue dogs used by Iranian Red Crescent Society saved more lives than international rescue teams (Iran)
Shelter	Houses of relatives/neighbors designated as hurricane safe are included in emergency planning, e.g., accounted for 80 percent of evacuees' lodging for Hurricane Wilma (Cuba)
Logistics	UN-sponsored Disaster Response Network Airport Emergency Team managed air cargo operations in Sri Lanka and Indonesia, resulting in enhanced throughput and dissemination of humanitarian relief (Indian Ocean countries)
Health	Government shelters stocked with food, water, medicines, emergency supplies two days before hurricane landfall (Cuba)
	Pre-established medical brigade specifically trained for disaster response and provide immediate medical assistance; local medical providers staff government shelters and know medical needs of population served (Cuba)
	Health teams pre-positioned at evacuation centers and ready with simple forms addressing key outbreak-prone conditions; information used to guide resource allocation (Philippines)
	Active disease surveillance and health needs assessments based on tent-to-tent visits (Iran)
Coordination	Legal decree defines incident command, role of all responders and centralized decision-making structure (Cuba)
	Early local coordination, e.g., for emergency health posts, distribution of tents and supplies, constructing water tanks and latrines (Mozambique)
	National flood committee activated two days pre-flood, joint logistics operations center within national government structure (not UN) strong institution for coordination, civilian and military resources well coordinated (Mozambique)
	Good coordination government and NGOs and across NGOs, involvement of local authorities and communities in defining areas for NGO work, frequent meetings and situation reports from NGO umbrella Disaster Forum, long-term presence in country and number of NGOs responding facilitated optimal NGO response (Bangladesh)
	Rapid government responses, e.g., search and rescue, visa waivers for foreign aid personnel; Iranian Red Crescent Society's "sponsorship" system circumscribed administrative areas in affected regions to facilitate aid distribution (Iran)
	NGO network organization facilitated information flow to guide relief and recovery efforts (India)
	Passed several laws specifically clarifying relationship between various groups (police, firefighters, etc.) (Czech Republic)
Security	Local police actively and effectively used, enforced evacuation orders and security at government shelters (Cuba)

Table 3.5 Exemplary Practices Identified: Recovery and Redevelopment

RECOVERY AND REDEVELOPMENT	
Orientation	Recovery linked to economic development, e.g., resettlement and reconstruction on less vulnerable land (esp. Bangladesh, Honduras, India, Mozambique)
	Recovery and redevelopment linked to economic development, e.g., major development NGO played leading role in post-flood redevelopment including in-kind rather than cash assistance facilitated recovery of livelihoods (Bangladesh)
	Existing economic development infrastructure was combined with accelerated approval process to facilitate development-oriented recovery (Honduras)
Community involvement	Municipal authorities and community members initiated housing and infrastructure reconstruction immediately and worked together effectively (Cuba)
	Local influential persons served as liaisons between relief personnel and the community to minimize alienation between them; broad access communication materials used to inform affected communities of recovery efforts (Iran)
	Agency charged with recovery organized neighborhoods of victims into councils to promote social support and provide feedback on recovery process (Mexico)
Private sector	Following trade liberalization, private sector more nimble than government in maintaining imported food supply and price stability post-disaster (Bangladesh)
Housing	Redevelopment oriented toward prompt rebuilding of sustainable housing and people empowered to rebuild their own homes and/or use local labor; government regulation that NGOs rebuild houses all of equal size saved administrative time; reconstruction based on demonstration houses in each community following World Bank aide memoire compensated for lack of sufficient local engineers and masons and provided basis for educating communities about seismically safe construction techniques (India)
	Rapid and robust federal response: Autonomous term-limited housing agency established to oversee urban redevelopment, including extensive and highly organized temporary housing, disaster-proof reconstruction mostly on previous sites, i.e., minimal relocation, and financing aimed at minimizing corruption; achieved average of 3220 dwellings constructed per month, over 45,000 total in slightly under two years; agency closed down on time (Mexico)
	Inexpensive (\$500 each) disaster-resistant housing, e.g. concrete foundations, strong roof bracing, fixed steel frame connecting roof to house – proven effective in 1998 floods; proactive effort to involve community in design facilitated acceptance and more widespread use thereafter (Vietnam)

4. INSIGHTS FROM GLOBAL DISASTER DOCTRINE AND INTERVIEWS WITH EXPERTS

This chapter highlights key comparisons between U.S. and global disaster management principles and observations from U.S.-based international disaster management experts interviewed by the research team. This information complements the findings from the international case studies; the interviews also offer insights not found in the literature.

REVIEW OF GLOBAL DISASTER MANAGEMENT DOCTRINE

In addition to examining specific international disasters, we reviewed key documents that set the framework for disaster management in the United States and commonly accepted international guidelines for disaster management (described in Appendices 1 and 2, respectively). This review allowed us to identify a number of valuable insights. First, U.S. disaster management focuses largely on assigning responsibility for specific disaster response functions and providing guidance to various federal and state/local agencies on issues of interoperability. In contrast, global disaster management doctrine includes important focus on general principles regarding such issues as long-term disaster prevention, mitigation and preparation; the necessity of integrating immediate disaster response and less-immediate recovery efforts with long-term development efforts; and integration of non-governmental assistance and foreign assistance. The scant attention to these principles in U.S. domestic disaster management policies is particularly notable – even surprising – because of their prominence within the policies of the United States' own Office of Foreign Disaster Assistance (OFDA), a division of the U.S. Agency for International Development. Among the principles that OFDA emphasizes in its guidelines on "developmental relief" and "livelihoods strategy" are several that could enhance the national domestic disaster management framework of the United States, including enlisting community participation, enhancing local capacity, and minimizing migration-caused stress. In particular, OFDA's policies stress and several of the international cases that we examined demonstrate the principle of viewing a community's recovery from a devastating disaster as an opportunity to promote the overall level of development of the community and decrease its

vulnerability to future disasters rather than simply helping the community to survive or return to its previous, vulnerable condition.

The United States might benefit from more effectively incorporating into its domestic disaster management policies greater attention to principles that are emphasized in international disaster management frameworks and illustrated by several of our international case studies.

INTERVIEWS WITH INTERNATIONAL DISASTER MANAGEMENT EXPERTS

The experts we interviewed were senior representatives from the international disaster relief field.¹³ They offered their own perspectives on the lessons to be learned from the international experience with disaster relief. In order of importance as suggested by the respondents, key elements of effective disaster management relate to the following areas, which are then described in further detail:

- coordination
- prevention/preparedness
- evidence-based planning
- local capacity
- relief-to-recovery orientation
- emergency health and medical care
- capacity to respond to catastrophic disasters.¹⁴

Coordination

The factor that these experts most consistently identified as contributing to the successful implementation of international disaster relief efforts is effective and appropriate coordination. They described four specific hallmarks of effective coordination:

- Experienced professional leadership,
- "Coordination without control,"

¹³ Experts interviewed currently work with or previously worked with from the following organizations were interviewed: Interaction, International Federation of Red Cross and Red Crescent Societies, International Medical Corps, Operation USA, World Health Organization, and World Vision.

¹⁴ Some of the lessons examples identified by these experts interviews pertain to the case studies in this report; however, in some cases experts referred to cases that were not developed into full case studies for this report.

- Humanitarian orientation, and
- Unity of doctrine.

While all of the experts we interviewed found room for criticism of the coordination effort for virtually every disaster, they also saw the very relevant lessons to be learned from the coordination of international disaster response operations as they might be applied to U.S. domestic response efforts.

Experienced Professional Leadership

Experienced high-level professional leadership is critical to effective coordination of disaster response. The need for experience is particularly acute in the context of a disaster where personnel, and especially leaders, must respond quickly and be able to adapt to unpredicted and continuously changing circumstances. Unlike most other fields, however, meaningful experience in disaster management, particularly actual experience in managing response situations, takes time and thus is not easy to accumulate. Because of the sporadic occurrence of disasters in some locations, disaster response personnel in these locations may lack experience, including personnel in government disaster management agencies and established international relief organizations. Unlike in other fields, personnel in disaster management cannot as readily gain practical experience in managing disasters in the daily routine of their jobs, particularly if disasters are relatively rare in the regions in which they work. As a result, a rate of personnel turnover that is normal in any other field can leave disaster response agencies without experienced staff, including in key leadership positions. Effective national disaster response systems are able to retain experienced professional staff and insulate them from political influence. The experts we interviewed cited the examples of Costa Rica, in which a change in government will bring about a change in the Director of Civil Defense but not affect the professional staff, and Colombia, which maintains the same director of Civil Defense even when government administrations change.

Countries may also seek experienced leadership from external partners, such as the United Nations Office for the Coordination of Humanitarian

Affairs (OCHA).¹⁵ OCHA has been a key player in many of the more effective disaster response efforts, either in support of the national government or, as requested, on behalf of the national government. OCHA coordination has enabled agencies to work together in a unified response in various disaster settings. As one respondent noted, "OCHA is oil that makes it work together." OCHA was involved in the response to several of our case study disasters. Notably, some of the experts interviewed suggested that it may actually be easier for international relief institutions, including multilateral agencies such as OCHA, to work in developing countries rather than more advanced, industrialized countries. One reason cited was the barriers created by legal, regulatory, and jurisdictional considerations that are more prominent in more developed countries. In addition, experts suggested that developing countries may be more open to recognizing and welcoming the expertise of the international disaster response community.

Coordination without Control

Effective disaster response efforts are also characterized by coordination that is effective without being overly intrusive in the activities of organizations responding to a disaster. While it might seem counter-intuitive, a number of the experts we interviewed identified governments' attempts to maintain control over disaster response activities as more counterproductive than helpful. They suggested that government attempts to "approve, filter, screen, and otherwise control" response efforts may actually impede more than they facilitate the ability of nongovernmental organizations to intervene effectively.

The experts we interviewed suggested that effective disaster response coordination recognizes the capabilities of organizations with particular expertise, including international humanitarian relief organizations and especially international disaster response agencies, and allows these agencies to operate without unnecessary constraints to reach and assist populations in need in the disaster-affected area. In catastrophic disasters in particular, experts noted that a free flow of assistance is needed and

¹⁵ OCHA is the United Nations agency responsible for coordinating the humanitarian response efforts undertaken by the various agencies of the United Nations as well as coordinating these agencies' efforts with those of non-UN institutions.

governments adapt to this reality, as Iran did in response to the Bam earthquake and India did in response to the Gujarat earthquake. Effective disaster response efforts are characterized, thus, not by exclusive control but by inclusive coordination.¹⁶

In particular, several experts identified the need for the coordinating agency to allow government agencies and NGOs that have specific experience in a certain sector, such as health, to assume responsibility for response efforts in these sectors. Otherwise, these relief efforts can become mired in unnecessary levels of review that can delay time-sensitive relief efforts or potentially diminish the effectiveness of interventions in these sectors. Moreover, effective response cannot be achieved by only allowing these expert agencies to participate in the response or the coordination, but must rest on the authority of these expert agencies. U.S. government entities, such as the Department of Health and Human Services or the Coast Guard, and international relief organizations, such as the IFRC and UN OCHA, need to be recognized for their expertise and allowed to play a meaningful role in directing response, particularly at the level of direct provision of relief services to affected populations.

Governments can facilitate the effective response of relief organizations by ensuring an adequate flow of information on disaster needs and relief activities among all responding agencies. This involves a two-way information flow: with the coordinating agency providing comprehensive and up-to-date information on the condition and needs of the affected population, current response activities being undertaken by all responding agencies, and relief agencies regularly reporting back to the coordinating agency on their

¹⁶ Cuba represents an interesting converse example identified by more than one expert interviewed. These experts were agreed that Cuba's disaster response has been as effective as it has been in part because of its unitary political system, which can make government-controlled planning easier. Similarly, Cuba's "command and control" approach to disaster management also allows it to mandate preparedness/response activities, such as evacuation, which is a key element of the Cuba model and has been a significant component of its ability to be effective at avoiding major losses and perpetuating a culture of preparedness. However, it was also said that the Cuban approach, which is highly dependent upon local participation and national planning built on input from successively local levels, is facilitated by the population's high level of trust in the government. Finally, while acknowledging the success to date of the Cuban system, one expert questioned how this system, which is characterized by a considerable reliance on control and has thus far fared well in the face of disasters of a "manageable size," might fare in a catastrophic disaster that overwhelms the government's ability to control the situation, similar to how Katrina overwhelmed the U.S. system.

activities. In many disasters, a key information exchange mechanism is a regular coordinating meeting, which all relief organizations active in the disaster response are expected to attend. Other mechanisms include centralized information centers and electronic information networks that can be accessed remotely by response agency personnel, both of which can serve as central repositories for information and analysis related to the relief efforts. Sectoral response coordinating committees that facilitate relief activities in a particular sector such as health or education are another mechanism.

Notably, some of the experts interviewed suggested that it may actually be easier for international relief institutions, including multilateral agencies such as OCHA and the IFRC, to work in developing countries rather than more advanced, industrialized countries. One reason cited was the barriers created by legal, regulatory, and jurisdictional considerations that are more prominent in more developed countries. In addition, experts suggested that developing countries may be more open to recognizing the expertise of the international disaster response community, such as the IFRC and especially OCHA.

Some groups identifying themselves as relief agencies may not be appropriate to enter into a disaster response setting. Realistically, not all groups are properly qualified. For example, it was suggested that in response to the Indian Ocean Tsunami of 2004, a number of agencies attempted to play roles for which they were not appropriately qualified. Instead, there may be a role for accrediting response agencies before disasters occur so that they can respond immediately in the event of an emergency. This would require organizations to take responsibility to explain their missions and justify their capabilities. An added benefit of this accreditation process would be that agencies would establish relationships before disasters happen, which can be essential; as one of the experts put it in words, "coordination during an emergency is a function of coordination before the emergency."

Such pre-emergency screening and accreditation would likely need to be done on a country-by-country basis, either directly with countries or through an international "broker" organization. For example, disaster-prone nations could establish contingency protocols with international response

agencies; international and national NGOs could also participate on countries' emergency committees responsible for developing national response policies and plans, and through doing so, develop explicit agreements with the national government establishing the range of activities they are expected to engage in the case of an emergency. There may, however, also be a role for an international body, such as the United Nations Bureau for Conflict Prevention and Recovery to screen and accredit disaster relief organizations that intend to work internationally as to their appropriateness and capacity for undertaking specific response actions. Such an accreditation system at the global level would help alleviate the difficulty and duplication that both NGOs and countries face in arranging singular contingency agreements.¹⁷

Humanitarian Orientation

Some of the respondents associated the tendency toward control rather than coordination with a "military mindset" or a "security orientation" as it was often related to countries' reliance on civil defense forces or other military forces to respond to and manage disasters. These experts described this approach as characterized by a chain of command that assumes that directions for the execution of specific tasks in the response can flow from the top down. Several respondents suggested that while a top-down chain of command assumes that there is a certain order to catastrophic disasters, there is actually more ambiguity than order and thus a need for greater balance between centralized and decentralized self-organizing activities when responding to disasters. "Control" might be a reasonable approach to the response of an emergency that affects a limited area, such as a building, but not an entire city. As the scale of a disaster gets larger, experts felt that there is a need for an acceptance of less host government control of the situation and greater flexibility to improve responsiveness.

In particular, a primary reliance on civil defense forces can often lead to a security-oriented response (focused on maintaining law and order) rather than a humanitarian-oriented response (focused on ensuring the safety and

¹⁷ One expert interviewed suggested that accreditation may prevent smaller NGOs, particularly local community-based organizations, from being able to participate in response efforts, including accessing funds for programs. While this issue is separate from the accreditation of international relief organizations, any consideration of options for the accreditation of domestic organizations would likely want to take this concern into account.

well-being/welfare of the affected population). An example of this is the challenge that civil defense-led responses pose to the adoption of a public health approach to the disaster response. A public health approach - characterized by the various respondents as population-based problem-assessment and problem-solving - looks to introduce an element of rationality to such unordered situations. This approach may be a challenge a "security-oriented" approach as characterized above. Moreover, according to the experts, this difference in perspective illustrated in the characterizations of the order-oriented civil defense approach and the more problem-solving public health approach, can pose a particular challenge to the communication between "those who know" - i.e. the public health, technical disaster response experts - and "those in charge" - i.e. the civil defense forces, which can lead to less effective overall interventions.

Unity of Doctrine

Respondents also identified the importance of unity of doctrine, not just unity of command, as critical to effective coordination of disaster response. Unity of doctrine - or working from the same technical dogma or philosophical approach to response - is a challenge to effective response efforts particularly in situations in which the management of the response is shared among more than one level of government. When response agencies share a cohesive response philosophy, such as the European Union's response to floods or the efforts of the Association of Southeast Asian Nations (ASEAN) and the Asia Pacific Economic Cooperation (APEC) on SARS and avian influenza, the response can be much more cohesive. Even in circumstances in which such unity of doctrine is not formally institutionalized, one expert suggested that if appropriate mechanisms can be put in place to establish the necessary solidarity of philosophy on an ad-hoc basis, response efforts can still be more effective.

Prevention and Preparedness

A second major theme emerging from our interviews relates to factors that contribute to successful prevention and preparedness. At a fundamental level, for any community to be adequately prepared and capable of responding effectively to disasters, it is first necessary for the community to accept

that it is vulnerable and then take concrete actions to prepare. Countries, or other political jurisdictions that accept their vulnerability tend to be more prepared and to respond more appropriately and effectively to disasters. However, coming to accept one's own vulnerability is not as straightforward as it might seem, and societies must make their way up a considerable learning curve, most often driven by recurrent exposure to disasters, before they reach a level of appreciation of this vulnerability that will enable them to prepare and respond effectively to disasters. In some societies, especially those that are more disaster-prone than others, the acceptance of their vulnerability to disasters can engender a sense of pride in being prepared. Conversely, those communities that are more developed and are less prone to disasters can be characterized more by a sentiment of invulnerability, which can lead to a lack of preparedness and capacity for effective response when an unexpected disaster strikes.

Another fundamental point made by respondents is that even preparedness is dependent both on being able to demonstrate a cost-effective return on investment and also mustering sufficient political will and popular support. Even though it is relatively easy to demonstrate that prevention and preparedness efforts contribute considerably to more cost-effective response efforts, it may be years or decades before the next disaster that justifies high levels of investment in preparedness actually strikes. This means that decision makers, who may want to be recognized and credited with the effectiveness of spending under their watch, might forego such prevention and preparation efforts for some less cost-effective but more politically visible project. As one respondent noted, "It is unfortunately easier to raise money after a disaster than before one." Political will is needed to help assure disaster prevention and preparedness.

It is also critical to capture the imagination and trust of the public at large to "sell" prevention and preparedness efforts both in concept and in concrete actions. This is particularly critical in areas in which persons do not experience disasters regularly and as such may be less likely to understand or trust warnings and calls for preparation and evacuation. In areas where disasters are occasional but massive and the value of widespread preparedness is not recognized, there may be a disproportionate reliance on response versus prevention and preparedness. In such areas, it may be

advisable to provide recurrent training of the public in appropriate disaster response efforts.

Evidenced-Based Planning and Management

A third major theme emerging from our interviews relates to the importance of utilizing an evidence-based approach for planning and managing disaster response activities. Such an approach was characterized by one of the experts we interviewed, a pioneer in the modern field of disaster response, as an antidote to the problem that "most disaster response interventions are mostly irrational." Various respondents advocated for a public health approach to disaster response, which carefully considers the epidemiology of disasters - what happens to populations in the wake of disasters (in terms of morbidity/mortality), why, what activities are most effective at mitigating or addressing these consequences - and develops preparedness and intervention measures for communities based on these analyses.

As an example of this process, when WHO responds to a natural disaster, one of its first actions is to brief the Minister of Health of the affected country on the likely pattern of humanitarian challenges that will result. Following this, WHO personnel immediately develop a population assessment form, often derived from previous or pre-prepared forms, for collecting initial population statistics in order to prepare recommendations for appropriate response activities. From the experience of the WHO, which has used this approach in complex emergencies and natural disasters, the "public health approach" of defining population-level problems, their causes and solutions, is broadly relevant and applicable to most emergencies in general.

U.S. and other national disaster management agencies have the opportunity to benefit from the experiences of international disaster relief organizations in the area of evidence-based disaster management. The experts we interviewed identified three specific sources for such learning:,

- First, the Active Learning Network for Accountability and Performance (ALNAP) in Humanitarian Assistance documents "good practices" in complex emergency response efforts through its Evaluative Reports Database (ERD) and publishes various documents

on "lessons learned" for responding to a fresh disaster based on similar previous disasters, such as, "Lessons Learned for the Response to the SE Asian Tsunami" or "Lessons Learned for the Pakistan Earthquake".

- Second, the Interagency Working Group on Emergency Capacity (IWG) is a consultative group of seven large nongovernmental organizations focusing on international relief and development – CARE, Catholic Relief Services, International Rescue Committee, Mercy Corps, Oxfam-Great Britain, Save the Children-United States, and World Vision. This group has committed to jointly improving their emergency response capacity and contributing to the sector as a whole. As part of their work within the IWG, these organizations are working together not just to document best practices from their experiences in responding to major disasters throughout the world but also to develop common materials and programs for training their field staff. One of the activities already undertaken by the IWG organizations is the completion of several multi-agency evaluations of responses to disasters, including the response to the 2005 Indian Ocean tsunami. Another activity of the IWG has been a joint training of a standing team on accountability and monitoring and emergencies, the members of which are to help improve the monitoring and evaluation capacity of their respective agencies as well as other agencies. The IWG also plans to publish a field reference guide based on established standards but written for practitioners.¹⁸
- Finally, the Sphere Project Humanitarian Charter and Minimum Standards for Disaster Response is a successful example of evidence-based planning and management of disaster response at an international level. These standards have been credited with resulting in the appropriate response of various agencies to disaster situations, including and especially the prevention of

¹⁸This discussion of the IWG contains supplementary material from "The Emergency Capacity Building Project Helps the Humanitarian Community to Be More Accountable," (Wright, 2002).

outbreaks of infectious diseases. Today, virtually all major international relief agencies subscribe to the Sphere standards. The Sphere Project is the product of the work of the Steering Committee for Humanitarian Response (SCHR), another association of international humanitarian organizations - Care International, Caritas Internationalis, the International Committee of the Red Cross, the International Federation of Red Cross and Red Crescent Societies, International Save the Children Alliance, Lutheran World Federation, Médecins sans Frontières, Oxfam, and World Council of Churches.

Local Capacity

Another major theme described by experts and related to effective disaster management is the importance of local capacity for both early detection of emergencies and first response. While a common notion among the general population may be that government is responsible to provide early warning and first response, these actions can also come from within threatened and affected communities. External resources should support rather than drive a community's response.

Similar to the discussion above about preparedness being stronger in communities that are regularly affected by disaster, local capacity in general is strong where linked with previous experience. As examples cited by respondents, Bangladesh, one of the most disaster-prone countries - susceptible to cyclones and floods in particular - is generally strong in terms of preparedness. Likewise, Ethiopia, because of its regular experience with drought, has a notably strong food security network. In comparison, in communities that are not regularly affected by disaster there is an unfortunate tendency to rely heavily on the Red Cross/Red Crescent as first responders. This is problematic as early warning and rapid response, which can most effectively be carried out by threatened and affected communities themselves, may not be as timely or effective. One respondent illustrated the value of local capacity by noting that by the time responders get from one side of a major metropolitan area to the other, much less from one city in a large country to another, community-based early responses are already underway.

National response efforts must actually make use of local capacity, such as community-based social service organizations, to respond to hard-to-reach populations, whether in outlying or other marginalized areas. These organizations represent considerable "latent" capacity for disaster response that could be harnessed if they could be properly brought into the broader response efforts. It is not uncommon for international organizations to partner with local organizations as they tend to "know their population, where they are, what they need and how to assess them," as one expert noted. Several examples of notable efforts to incorporate and utilize local capacity in disaster response were cited by respondents. One of these was the International Medical Corps' efforts in the Sudan to partner with local governments to help rebuild and replenish staff at primary health care centers throughout the parts of the country afflicted by both manmade and natural disasters.

Finally, the effectiveness of local capacity is also dependent upon community responders having a clear sense of what to do, what their roles are, and when they are to activate. In particular, it is necessary to have protocols in place for ensuring that this local community response capacity is both empowered to act and is protected (e.g., that response personnel do not have to abandon their official response activities to respond to personal response activities, such as rescuing their own families).

Relief-to-Recovery Orientation

Respondents observed that effective disaster management systems are also characterized by an early emphasis on promoting the long-term recovery of disaster-stricken communities rather than simply relief from the immediate impacts of such disasters. Social institutions can be weakened and populations can be further marginalized if the beneficiaries of response efforts are treated as passive recipients of relief rather than active participants in the deliberations about relief and especially long-term recovery and redevelopment. In contrast, when response efforts are pursued with an eye toward long-term recovery as well as relief of immediate problems and beneficiaries of the efforts are meaningfully involved in the recovery process, the long-term development prospects of communities are improved. As one respondent explained, societies will recover fully from disasters only if

there is something to attract surviving residents to stay in or return to their communities, such as health care or schools. As such, effective disaster response is characterized by its integration with long-term development efforts as quickly as possible. This includes engaging survivors in directing and managing their own recovery process as much as possible right from the start, in particular those survivors that were marginalized prior to the disaster or as a result of the disaster.

Emergency Medical Care

The experts interviewed noted that the risk of secondary health impacts, such as outbreaks of contagious or infectious diseases, from a natural disaster is relatively low, particularly, but by no means exclusively, in more industrialized countries. In large part, respondents attributed this low level of risk to the dissemination and application of evidence-based standards, such as the Sphere standards, discussed previously.

Regardless of the actual level of risk, however, there may be a rather high degree of fear regarding health risks in the wake of disasters. Moreover, while there may be a relatively low risk of epidemic infectious diseases, there needs to be recognition that chronic health problems pose a growing challenge to disaster recovery, as survivors are in need of prescription medicines and suffer from mental health problems such as post-traumatic stress and depression. One of the experts remarked that post-disaster mental health problems are still mostly overlooked. In order to address this concern, greater effort must be put into alleviating fear of health risks, including dispatching medical resources earlier, securing appropriate transportation for the delivery of medicines, food and medical devices to affected populations, and training response teams to identify any potential psychological injuries suffered by the affected population.

Capacity to Respond to Catastrophic Disasters

Finally, a number of the experts we interviewed noted that an essential characteristic of effective disaster management systems is their capacity to respond appropriately even to a catastrophic disaster. Howitt and Leonard noted that the normal, bottom-up model of the U.S. disaster response system is insufficient for responding to emergencies, like Katrina, that exhibit

significant elements of novelty (Howitt & Leonard, 2006). Elements of novelty that distinguish certain emergencies from more common, though still possibly very severe, incidents can come in three forms:

1. threats that have never before been encountered, either locally (such as an earthquake in an area that has never before experienced one) or globally (such as an outbreak of a previously unknown infectious disease);
2. threats occurring at unprecedented scales and outstripping available resources; or
3. threats characterized by the interaction of known factors in a way that poses unique challenges.¹⁹

One expert interviewed suggested that nations that are less vulnerable to regular disasters are more likely to have systems that fail in the face of catastrophic disasters. Countries that are more vulnerable to disasters, according to this expert, take "a certain pride" in their vulnerability and their capacity to cope with, respond to and overcome this vulnerability. In comparison, countries that are less prone to disasters, are more likely to be characterized by a tendency to underestimate their vulnerability and thus engage in planning for more localized disasters, overestimate the reliability of their response system, and fail to develop a robust capacity for responding to disasters beyond the scope of their pre-established plans. As a result, when catastrophic disaster strikes, these systems are less responsive and flexible and are more prone to complete failure. The key characteristic, then, of a system capable of coping with catastrophic disaster is the capacity to recognize and respond creatively and flexibly when the system is being overwhelmed. And the first step to developing this capacity, according to the experts interviewed, is for a society to acknowledge and accept that it is vulnerable.

¹⁹Howitt and Leonard (2006) suggest that Katrina was a crisis primarily due to factors of type (2) and type (3).

Conclusion

The interviews with U.S.-based international disaster management experts were designed both to complement the findings provided by the case studies examined and to glean further insights not found in these cases and the other literature reviewed. The preceding discussion captures the major themes and key perspectives they offered during our interviews. These contribute in important conceptual ways to the lessons described in the next chapter.

5. LESSONS LEARNED

From our examination of international disaster management based on the case studies and interviews, we derive seven key lessons that we believe are applicable to both the United States and the larger global community. These are described in the sections that follow.

(1) Different models, but common principles, underlie effective coordination.

A number of the case studies illustrate the importance of appropriately strong and inclusive coordination of the various entities that are involved in disaster management, and especially in urgent post-disaster response and recovery efforts. While effective coordination is critical in all phases of the disaster management cycle, there is no single model for achieving good response coordination. The case studies we examined and experts we interviewed suggest a number of principles to guide effective coordination, and the case studies illustrate a number of different coordination models.

Effective coordinating body

Coordination can take many forms, from formal management by high-profile government bodies to informal management by experienced nongovernmental organizations. For example, when Mozambique was overwhelmed by seasonal flooding in 2000, the Mozambican government established within the national the Disaster Management Institute a response coordinating body led by the foreign minister. Under this body's guidance, the country was able to absorb the thousands of personnel dispatched to the emergency by more than 250 different organizations. Similarly, within hours of the 2003 earthquake in Bam, Iran, the government set up a coordinating body that immediately launched a joint rescue operation between the army, various government ministries, and the Iranian Red Crescent Society. That coordinating committee managed the efforts of nearly 1,800 aid personnel from 44 countries. After the 1998 flooding in Bangladesh, established NGOs with experienced staff led a coalition of NGOs and were reasonably successful in coordinating volunteers and avoiding overlap in service provision. Similarly, after India's 2001 earthquake in Gujarat, an NGO network guided relief and

recovery efforts. Cuba's effective disaster coordination system is facilitated by two main factors: it has a centralized decision-making structure and clearly defined roles for local actors, and it has a standing coordinating authority (the National Civil Defense) with extensive experience in effective disaster response that works closely with local governments and non-governmental actors.

Experienced professional leadership

The experts we interviewed specifically noted the importance of experienced professional leadership, including appropriate training, experience and national systems that minimize turnover in disaster management staff. The institutional structure created in Mozambique, the emergency medicine subspecialty created by the Czech Republic, and the reliance on experienced NGOs for coordination of the flood response in Bangladesh and earthquake response in India illustrate different potential approaches toward securing experienced leadership.

Active information exchange

Active information exchange also contributes to effective response coordination. Mechanisms can include regular coordinating meetings; centralized information centers and electronic information networks that can be accessed remotely by response agency personnel, both of which can serve as central repositories for information and analysis related to the relief efforts; and sectoral response coordinating committees that facilitate relief activities in a particular sector such as health or education.

Appropriate level of coordination

Effective coordination should reflect management that does not pose undue obstacles to the activities of organizations responding to a disaster. In catastrophic disasters in particular, a free flow of assistance is needed, and governments adapt to this reality, as illustrated by our case studies from Iran, in response to the Bam earthquake, and India in response to the Gujarat earthquake. Effective disaster response efforts are thus generally characterized not by exclusive control but by inclusive coordination.

Our case studies illustrate a range of models for coordinating disaster response – a central body such as that established in Mozambique, decentralized operations as illustrated in Iran following the 1993 earthquake, and a coalition of NGOs as illustrated in Bangladesh. Whatever the model, however, the coordinating agency needs to allow government agencies and NGOs that have specific experience in a certain sector, such as health, to assume responsibility for response efforts in these sectors. Otherwise, these relief efforts can become mired in unnecessary levels of review that can delay time-sensitive relief efforts or potentially diminish the effectiveness of interventions in these sectors. Advance screening and pre-accreditation of relief agencies is one approach to facilitate timely and appropriate disaster response.

Specialized agencies with relevant expertise must not only be allowed to participate in the response or the coordination, but must also be delegated a certain amount of authority to act. Examples of such agencies include the U.S. Department of Health and Human Services and the Coast Guard, the International Federation of Red Cross and Red Crescent Societies and UN OCHA.

(2) Community participation is critical at all phases of the disaster management cycle.

A second lesson from international disaster management comes from the focus on training local community members in high-risk areas and then engaging them in preparedness, early detection and warning activities, immediate post-disaster emergency response and longer term recovery and redevelopment activities. Community participation complements the efforts of government and other institutions. Several of our international case studies illustrate community involvement and participation in one or more phases of the disaster management cycle, including prevention and preparedness (Cuba, Mozambique, Philippines), response (Iran) and recovery/redevelopment (Cuba, Mexico, India).

The roles and responsibilities of communities and individuals members must be clearly defined and understood so that they are both trained and empowered to act when disaster strikes. For example, the Cuban government (in

an ongoing manner, including in advance of Hurricane Michelle in 2001) implemented a massive education campaign on disaster response, including annual simulation exercises. The engagement of community members in the identification of disaster risks, potential challenges to disaster response efforts, and potential means of mitigating these problems, has led to a deeper public awareness of disaster management practices and a national "culture of preparedness."

Taking plans from paper to practice, such as through regular simulation exercises, can identify operational weaknesses in the plans that can then be resolved before the next disaster strikes. Exercises can either be designed specifically for community level stakeholders, or these stakeholders can participate in broader local government exercises. Like Cuba, Mozambique also conducts simulation exercises prior to the annual flooding season. Further, local community leaders are trained in their own languages and, as such are particularly relevant in their own communities, able to communicate at a technical level appropriate to laypersons. In addition, through ongoing programming, they develop positive relationships with many of the organizations subsequently involved in disaster relief, so that those relationships are already established before a disaster strikes.

In the aftermath of a disaster, involvement of local residents in response, recovery and redevelopment is similarly invaluable. In the wake of the Bam earthquake in Iran, more than 8,500 volunteer relief personnel were sent from outside the community, and in order to avoid alienating local residents, the Iranian Red Crescent Society recruited local elders to act as liaisons between the relief workers and a given community. After India's 2001 earthquake, a network of NGOs established centers in small localities across the earthquake's impact area so that information could be easily collected from and disseminated to local residents.

More recently, the United Nations Development Program began training local citizens in search-and-rescue skills and first-aid techniques some months before the 2004 tsunami. As a result, one village that had received training experienced only 24 deaths, compared to four times more deaths in a neighboring village that had not yet been trained, only half a mile away. Likewise, with the housing destruction resulting from India's 2001 earthquake, the principal NGO network overcame a shortage of engineers by

training local persons in earthquake-safe building techniques, illustrating both the importance of those techniques and the positive results of local empowerment and capacity.

(3) Both technology and public awareness contribute to effective early warning.

An early warning system is more than purely a technology issue. The international disasters we examined indicate that an effective system combines technology with creative and effective means of conveying the information to local citizens in a format they can understand and use. As such, effective early warning includes not just the timely release of emergency information, but also ongoing dissemination of the information, efforts to assist the public in interpreting it, and clear identification of the actions that should be taken in response to early warnings.

The evacuation of the area around Mount Pinatubo in the Philippines illustrates the value of early warning and public awareness-building. As noted in chapter 3 and described in greater detail in Appendix 4, the local people living on the slopes of the volcano first detected and reported suspicious activity to government authorities, who then established seismic monitoring that provided the early alert that in turn led to the successful evacuation of more than 75,000 residents, saving an estimated 5,000-20,000 lives. In Indonesia as well, prior to the 2002 rainy season, government scientists not only developed sophisticated technology for predicting the likely locations and magnitudes of landslides, they also disseminated the information through a timely press conference. In the Czech Republic, the local meteorological institute issued regular forecasts and warnings throughout the 2002 flooding season. They even provided relevant forecasts to neighboring Germany. Cuba has designed an early warning system with the goal of helping its citizens prepare early but without panic when potential danger is on its way, increasing the frequency of updates and information as storms draw nearer. The Mozambican government, when significant rains were predicted in late 2000, retrained community volunteers and intensified the work schedules of government officials involved in preparation.

(4) Disaster management should be evidence-based when possible.

Another prominent theme in successful international disaster management is the importance of utilizing an evidence-based approach for planning and managing disaster response activities. This is, of course, not a new insight, but one worth underscoring based on the findings from our study. Various experts we interviewed characterized the desired approach to disaster response as the public health approach. This approach systematically analyzes the health status of populations in the wake of disasters to help guide appropriate response efforts. For example, in the Philippines, health teams were pre-positioned at evacuation centers and ready with simple forms addressing key outbreak-prone conditions. This information guided subsequent resource allocation. In Iran, following the 1993 earthquake in Bam, active disease surveillance and health needs assessment were carried out, based on tent to tent visits, and used to guide programming. Operationalizing the principle of evidence-based management involves conducting a rapid but thorough needs assessment, reflecting the input and needs of the local population, and using the results to guide relief programming.

(5) An early orientation to long-term recovery can be important.

Effective disaster management systems are often characterized by an early emphasis on promoting the long-term recovery of disaster-stricken communities rather than simply relief from the immediate impacts of such disasters. An example from our case studies is the Red Cross's introduction of disaster-resistant construction techniques into Vietnam to improve the country's capacity to withstand typhoons and floods. Prior to the introduction of the disaster-resistant construction, victims of disasters could find themselves trapped in a cycle of vulnerability and poverty as the homes that were provided for them in relief-oriented operations proved vulnerable to subsequent disasters.

Societies are more likely to recover from disasters when there is something to attract surviving residents to stay in or return to their communities, such as health care or schools. As noted above, an example of this was Mexico's establishment of "renovation councils" that organized victims from each community in Mexico City in which housing was being

rehabilitated or reconstructed following the 1985 earthquake in order to incorporate residents' input into the redevelopment process. While this process may have slowed recovery efforts to some extent in the beginning as the renovation councils reached consensus around redevelopment designs, actual redevelopment of housing and the pace of the re-establishment of the population in the disaster-stricken areas proceeded more rapidly than anticipated once agreement was reached.

(6) Countries can and should learn from previous disaster experience.

One of the most salient insights from our examination of international disaster management is the importance of actually acting upon what is learned during past disaster experience to improve preparation for future disasters, including catastrophic disasters. The early warning system that proved effective in the Czech Republic in 2002 was established as a direct result of earlier flooding in 1997. In Mozambique, flooding in 1999 helped the local government disaster unit and the Red Cross prepare for the major flooding that followed in 2000 and 2001. After significant flooding in Vietnam in 1998, international organizations supported the building of disaster-resistant homes which were allocated to the most vulnerable in time for repeated flooding in 1999. Similarly, India's 2001 earthquake led to a major boom in earthquake-resistant construction.

As described in chapter 4, disaster preparedness can be hard to "sell" to budget authorities and to the public. This is particularly critical in geographic areas that experience disasters intermittently and thus where residents are less likely to understand or trust warnings and calls for preparation and evacuation. In areas where disasters are occasional but massive (e.g., Europe - floods, Mexico City - earthquakes, Philippines - volcanic eruption) and the value of widespread preparedness may not be widely recognized, there is an unfortunately heavy reliance on ad hoc response versus preparedness and planned response. In these cases, various disaster management experts recommend recurrent training of the public in appropriate disaster response efforts.

Perception by a community of its vulnerability to natural disasters, often based on past disaster experience, can be an important motivator for

concrete actions to prepare for future disasters. Individual level behavior change models such as the "Stages of Change" (Prochaska diClemente) and "Health Belief" (Rosenstock; Janz & Becker) models posit perceived vulnerability as an important prerequisite to behavior change. Populations that accept their vulnerability may thus be more ready to take actions to prepare and respond more appropriately and effectively to disasters. However, as illustrated by Hurricane Katrina, which occurred in an area that routinely experiences hurricanes, perceived community vulnerability may be necessary but is not sufficient to drive action to improve disaster readiness and response.

(7) Disaster management solutions must be appropriate to the local setting.

A final lesson emerging from our series of international case studies is the importance of locally appropriate solutions. For example, the Vietnam Red Cross in 1994 planted and protected submerged mangrove forests along Vietnam's east coast to protect much of the country's sea dyke system by dampening the shock of incoming waves. The savings in dyke maintenance far exceed the cost of the mangrove forests. Such a system may be potentially effective but not necessarily appropriate for other countries. In another situation, 157 lives were saved through the use of rescue dogs after Iran's Bam earthquake, a number far exceeding those saved by international search-and-rescue teams and a major step for Iranian responders, since dog teams had previously been rejected due to their perceived uncleanness within Islamic culture. The Czech Republic faced a substantial shortage of doctors with training in emergency medicine; as a result, it designated emergency medicine as an official medical subspecialty, leading to significantly more trained medical providers. These examples illustrate the value of locally appropriate solutions that may not be uniformly applicable in all settings. These solutions were relevant to their local contexts; similar approaches may not be applicable to disaster preparedness and response in other countries, including the United States.

6. CONCLUSIONS AND RECOMMENDATIONS

In the wake of Hurricane Katrina, the United States is acutely aware of the need to strengthen its capacity to deal with large-scale natural disasters. While various efforts are underway to assess the difficulties experienced in the U.S. response to Katrina, the goal of this project has been to identify exemplary practices and extract broader lessons from international disaster management in order to inform and improve United States disaster management practices. Natural disasters regularly occur worldwide, in many places with greater frequency and severity than in the United States. As such, the disaster experiences of other nations and the international organizations involved in responding represent potentially valuable sources of information from which the United States and others can draw to improve their own disaster management efforts. We believe that the specific exemplary practices and broader lessons gleaned through this study are relevant to the United States.

Political will, community support, and adequate funding for disaster preparedness and response are critical. Moreover, understanding the factors contributing to success helps replicate successes in the future - this is the underlying notion within the emerging interdisciplinary field of positive organizational scholarship. This concept captures our core conclusions and forms the basis for our recommendations.

This report demonstrates that the experience of disaster management in other nations can be relevant to U.S. preparation for the future. Three recommendations emerge from our analyses:

1. **Institutionalize the process of learning from international disaster management.**

U.S. policy makers should glean lessons from exemplary international practices on a continual basis. One way to do that is to consult with international disaster management experts in United Nations agencies, nongovernmental organizations, and countries that have demonstrated exemplary practices in specific areas of interest. Another way would be to strengthen systematic linkages between federal institutions responsible for domestic disaster management, e.g., within DHS, and those

responsible for international disaster response, e.g., USAID/OFDA. The knowledge and capabilities of disaster management experts can be used to inform all phases of the disaster management cycle, including disaster preparedness, response, and recovery and redevelopment. U.S. policymakers can also take advantage of existing resources (such as the Active Learning Network for Accountability and Performance in Humanitarian Assistance, the Interagency Working Group on Emergency Capacity, and Sphere guidelines), tailoring information to apply to the U.S. context.

2. Apply relevant practices from international experience.

U.S. policy makers should review the principles, exemplary practices and lessons learned in this report and adopt or adapt relevant ones to help improve domestic disaster management. Some themes clearly apply broadly in the United States as well as internationally: building strong coordinating bodies for disasters, enhancing the involvement of local leaders and citizens (before, during, and after the disaster), and seeking ways to transmit early information about predicted disasters in appropriate ways that allow people to prepare without inciting public panic. Other lessons apply in specific scenarios, such as how to manage evacuations most effectively or how to use local citizens in search and rescue. With those, the need is to examine which domestic situations are sufficiently similar to benefit from the application - through direct adoption or adaptation - of relevant practices.

3. Systematically identify, document and archive exemplary practices.

The literature and databases we consulted tended to focus on negative or incomplete information related to disasters and disaster management. What is needed is a clear definition of what constitutes exemplary practice in disaster management and then systematic documentation and archiving of such practices, especially those that reflect more rigorous evaluation to link disaster management practices to measurable outcomes. Establishment of such an archive could also facilitate a new line of inquiry in the field of international disaster management, consistent with the principles underlying the emerging field of "positive organizational scholarship." This is a growing interdisciplinary field that examines

factors contributing to organizational success as a way to replicate future success. We believe that this study suggests the value of this approach as applied to disaster management. The United States and all countries can benefit from creating a well-known and readily accessible global library of exemplary practices in disaster management. This would become an important resource that experts can use to adapt or replicate past successes in future disaster situations anywhere in the world.

The United States has recently experienced significant natural disasters, and now is the time to learn from its past experiences, draw on the world of experience across borders, and prepare for the future. Our study offers concrete steps that can be taken in this direction.

APPENDIX 1: U.S. DOMESTIC DISASTER MANAGEMENT

U.S. DOMESTIC DISASTER RESPONSE DOCTRINE

Emergency management and response in the United States can be characterized as a "bottom-up" or "pull" system, which assigns initial and primary responsibility for disaster response to the local authorities, with the expectation that support from state and federal authorities can supplement this response as necessary. This structure, in which "incidents are typically managed at the lowest possible geographic, organizational, and jurisdictional level" (Jenkins, 2006), reflects the general principle that those authorities that are closest to the event are most capable of responding appropriately. Local governments are typically both physically located most closely to any disaster and also have the most specific and comprehensive awareness of the local environment. As such, provided that local authorities are equipped with at least a minimal emergency response capacity, the system is designed on the assumption that these authorities are the most capable of responding quickly and effectively to initial disaster elements.

If local authorities become overwhelmed, state governments can step in to provide both additional levels of general resources and more specialized resources and capabilities. Typically, state governments can also rapidly secure additional resources and capabilities from nearby states if needed.²⁰ Yet, because state agencies and resources will generally not be located within an area that suffers from a disaster, states are assumed to be less capable than local authorities to provide first response services and are thus seen to play a supporting role instead.

²⁰ All 50 states, the District of Columbia, Puerto Rico and the U.S. Virgin Islands are now members of the Emergency Management Assistance Compact (EMAC), an interstate mutual aid agreement through which any member can request and receive assistance from other states to provide assistance after disasters overwhelm the affected state's capacity. Congress approved the creation of EMAC in 1996, building on the earlier efforts of the Southern Regional Emergency Compact that Florida and 16 other states created in 1993 after their experiences with securing assistance from the federal government and other states in response to Hurricane Andrew in 1992. EMAC is administered by the National Emergency Management Association, the professional association of state emergency managers.

In a similar fashion, federal government agencies can provide even greater levels of resources as well as more specialized resources and capabilities, but they are even more distant and less familiar with local conditions. Federal agencies will also generally face even greater difficulty integrating with local responders than state agencies. As such, the federal government plays an important role in the response system, but is generally called upon only when local and state responders require additional help.

While this relationship continues to characterize the federal government's role in disaster response, the federal government has begun to play a slightly more involved role since 2002 and the passage of the Homeland Security Act (discussed below) - such as developing standards for state and local first incident management and articulating specific incident types under which federal assistance can be provided prior to being requested by states or localities.²¹

The Evolution of the Modern Federal Emergency Response System

The modern structure of the U.S. federal response system can be traced back to the establishment of the Federal Emergency Management Agency (FEMA) in 1979 (see table A.1.1). Prior to the establishment of FEMA, federal emergency operational and coordination functions were dispersed among more than 100 federal agencies (US FEMA, 2006). In response to the requests of the National Governors Association, which sought to relieve states of the burden of interacting with myriad federal agencies, President Carter proposed to Congress Reorganization Plan No. 3 of 1978 to consolidate federal emergency response functions under one agency.

President Carter's reorganization of the federal response system under FEMA introduced a number of principles that still characterize the federal emergency response system today. Foremost, the plan established unity of command for federal response activities under a Principal Federal Officer, as well as establishing an "all hazards" positioning of federal resources, which made all federal resources, including civil defense forces, available as

²¹ From 2002-2005, the federal government distributed \$11 billion in grants to improve state and local government emergency preparedness and response and tied receipt of some of these funds to state and local adoption of certain guidelines and standards ((Jenkins, William O.Jr., 2006), p.1)

appropriate for preventing and responding to disasters of any type. Second, President Carter's reorganization promoted the principle that federal involvement in disaster response should be minimized, entailing principally support to state and local preparedness and response. Finally, the reorganization emphasized that emergency response activities should be, as much as possible, extensions of the regular missions of federal, state, and local agencies (US Code, 1978). This last principle continues to characterize FEMA's role today as the primary coordinator of the emergency response functions of the various federal departments, agencies and offices rather than as a provider itself of emergency services.

In 1988, Congress reaffirmed FEMA's role as the entity through which the federal government coordinates its disaster relief efforts with the passage of the Stafford Disaster Relief and Emergency Assistance Act. The Stafford Act (1988) amended the Disaster Relief Act of 1974, which first established the process by which a Presidential Disaster Declaration of an emergency triggers federal assistance. In the earlier 1974 act, Congress authorized federal funding for two types of occurrences - "emergencies" and "major disasters" (Disaster Relief Act of 1974, 1974). An emergency declaration provides a state with limited federal assistance to meet a specific need, such as search and rescue or debris removal. A major disaster declaration triggers more assistance to a state, such as the ability of individuals to receive unemployment compensation, food, and cash grants. With the 1988 amendments, FEMA was officially designated as the lead agency responsible for managing the federal response to declared disasters (Stafford Act, 1988).

This structure, with some updating, characterized the federal emergency response system up until 2002. Following the terrorist attacks of September 11, 2001, the federal government significantly revised its system of response to emergencies. The National Strategy for Homeland Security, issued in July 2002, called for a further consolidation of federal emergency response capabilities. In November 2002, Congress passed the Homeland Security Act that established the Department of Homeland Security (DHS), which assumed operational control of 22 separate federal departments, agencies, and

offices, including FEMA, that were previously responsible for various elements of federal disaster management responsibilities.²²

Table A.1.1: Timeline of Modern Domestic Disaster Management Doctrine

Year	Description
1979	FEMA established to coordinate federal response assets
1988	Stafford Disaster Relief Emergency Assistance Act (“Stafford Act”) <ul style="list-style-type: none"> • Reaffirms FEMA’s coordinating role • Defines process for state requests for federal assistance to declared “emergency” or “disaster”
2002	National Strategy for Homeland Security (July) Homeland Security Act (November) <ul style="list-style-type: none"> • Established the Department of Homeland Security to further consolidate federal disaster response assets
2003	Homeland Security Presidential Directive 5 (November): <i>Management of Domestic Incidents</i> <ul style="list-style-type: none"> • Charged DHS to develop comprehensive National Incident Management System (NIMS) and National Response Plan (NRP) • Defined “incidents of national significance” and triggers for their declaration by DHS or the President Homeland Security Presidential Directive 8 (December): <i>National Preparedness</i> <ul style="list-style-type: none"> • Charged DHS to develop National Preparedness Goal
2004	NIMS issued (March) <ul style="list-style-type: none"> • Systems approach to incident management • Core concepts, principles, terminology, organizations processes and roles and responsibilities of local, state and federal first responders • Facilitates different first responder disciplines working together in any area, for all types of emergency NIMS officially in place and required for DHS grants as of federal fiscal year 2005 (October) NRP finalized (December) <ul style="list-style-type: none"> • Facilitates coordination of emergency response support across federal agencies
2005	NRP officially in place (April)

With the Department of Homeland Security established, President George W. Bush issued in February 2003 Homeland Security Presidential Directive 5 (HSPD-5) dealing with the “Management of Domestic Incidents” (The White House, 2003a). Through HSPD-5, the President directed the Secretary of Homeland Security to develop and administer a national system for incident management coordination and an integrated all-hazards response plan as called

²² Within the DHS Emergency Preparedness and Response (EPR) Directorate, FEMA continues to be the federal agency charged with coordinating federal assistance during disasters. FEMA continuously monitors for potential disasters and mobilizes resources in anticipation of the need for federal assistance, and maintains the National Response Coordination Center (NRCC). FEMA also enforces standards, certifications, and qualifications for participation in such programs and provides funding for equipment and training. As introduced previously, however, FEMA has relatively few deployable staff and does not have its own critical response assets, and is not the operational provider of most federal response support. The agency serves primarily as a coordinator of other federal departments and agencies and as the single point of contact for state and local officials securing federal response assistance. Operational teams that FEMA is responsible for administering, such as the Urban Search and Rescue (US&R) teams, are state and local first responders from around the country that volunteer to be activated, deployed, and reimbursed by FEMA for their help during response activities (The White House, 2006a, p.17).

for in the National Strategy for Homeland Security (The White House, 2003a). Specifically, HSPD-5 tasked the Secretary of Homeland Security with (a) the creation of a comprehensive National Incident Management System (NIMS) "to provide a consistent nationwide approach for federal, state, and local governments to work effectively and efficiently together to prepare for, respond to, and recover from domestic incidents, regardless of cause, size, or complexity" (HSPD-5, paragraph (15); The White House, 2003a) and (b) the development and administration of an integrated National Response Plan "to provide the structure and mechanisms for national level policy and operational direction for federal support to state and local incident managers and for exercising direct federal authorities and responsibilities, as appropriate" (HSPD-5 paragraph (16) and (16) (a); The White House, 2003a).

Then, in December 2003, the President issued a companion Homeland Security Presidential Directive HSPD-8 dealing with National Preparedness (The White House, 2003c). HSPD-8 describes the way federal departments and agencies will prepare for a response to a domestic incident as specified in HSPD-5. As HSPD-8 notes,

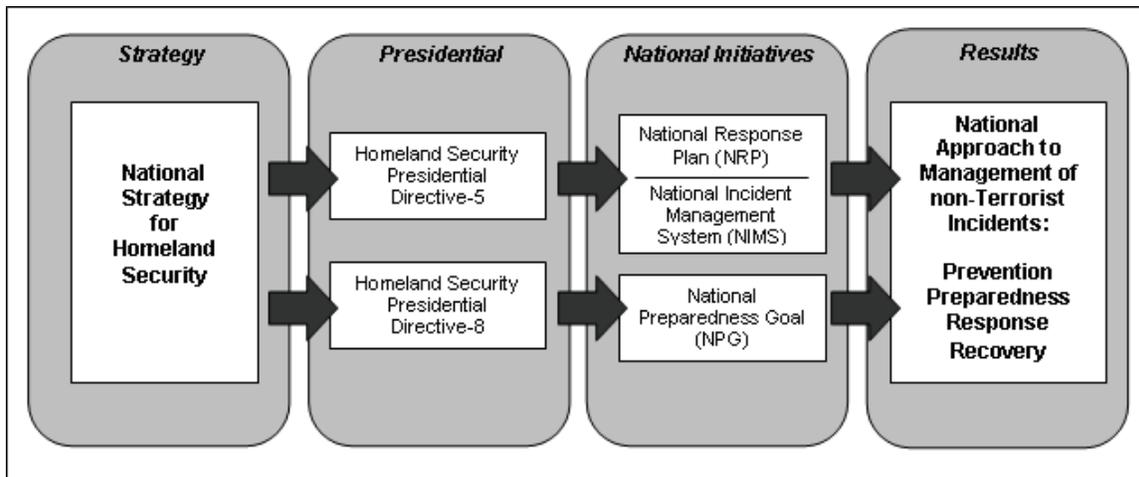
The national preparedness goal will establish measurable readiness priorities and targets that appropriately balance the potential threat and magnitude of terrorist attacks, major disasters, and other emergencies with the resources required to prevent, respond to, and recover from them. It will also include readiness metrics and elements that support the national preparedness goal including standards for preparedness assessments and strategies, and a system for assessing the Nation's overall preparedness to respond to major events, especially those involving acts of terrorism. (HSPD-8, paragraph (6) (The White House, 2003).

Together, the NRP, National Incident Management System, and the National Preparedness Goal provide the overall structure for the federal government's response to domestic disasters (see figure A.1.1). In the most simple terms,

- The National Response Plan defines what needs to be done to manage a nationally significant incident, focusing on the role of federal agencies, while
- The National Incident Management System defines how to manage such an incident, specifying a command and management process to be used with the National Response Plan, and

- The National Preparedness Goal (NPG) identifies how well such management is expected to be done, specifying critical tasks and capabilities.

Figure A.1.1: United States Approach to Management of Non-Terrorist Incidents



Source: Adapted from *National Preparedness Goal* (2005).²³

DHS issued the final version of the NRP in December 2004, and it became fully effective in April 2005 (US Department of Homeland Security, 2004). With a stated purpose to “establish a comprehensive, national, all-hazards approach to domestic incident management across a spectrum of activities including prevention, preparedness, response, and recovery,” the NRP,

- defines those situations in which federal authorities are to provide support and when federal authorities are to assume control;
- describes operational procedures for federal support to state, local, and tribal emergency managers; and
- organizes capabilities, staffing, and equipment resources in terms of functions that are most likely to be needed during emergencies, in order to facilitate federal interaction with state, local, and

²³ This adaptation excludes HSPD-7 (The White House, 2003b), dealing with *Critical Infrastructure Identification, Prioritization, and Protection* and the corresponding National Infrastructure Protection Plan (NIPP), which primarily address policy for protecting critical infrastructure from terrorist attack.

tribal governments; the private sector; and nongovernmental organizations (US Department of Homeland Security, 2004).

The plan provides guidance for all federal entities that may be called upon to provide assistance or conduct operations in response to a qualified incident (US Department of Homeland Security, 2004).²⁴

As introduced above, the National Incident Management System, issued in March 2004, establishes a core set of concepts, principles, terminology, and organizational processes, and defines roles and responsibilities of federal, state, and local first responders during emergencies. NIMS is intended to improve the ability of different jurisdictions and first-responder disciplines to work together in various areas. NIMS identifies six major components of a systems approach to incident management: (1) command and management, (2) preparedness, (3) resource management, (4) communications and information management, (5) supporting technologies, and (6) ongoing management and maintenance. Since federal fiscal year 2005, state and local governments are required to adopt NIMS in order to receive federal (DHS) preparedness grants or contracts. In their review of the U.S. disaster response system in light of the Hurricane Katrina experience, Howitt and Leonard describe the benefits of integrated management systems:

IMS has important strengths in organizing emergency response. It factors critical emergency tasks, establishing a clear division of labor and assignment of functional responsibility. It unambiguously defines the chain-of-command, provides a manageable span of control for each function, and establishes a resource allocation decision-making structure - critically important to

²⁴ The National Response Plan identifies the emergency response functions most likely to be needed during an incident in the Emergency Support Function Annexes, which include (1) transportation, (2) communications, (3) public works and engineering, (4) firefighting, (5) emergency management, (6) mass care, housing and human services, (7) resource support, (8) public health and medical services, (9) urban search and rescue, (10) oil and hazardous materials releases, (11) agriculture and natural resources, (12) energy, (13) public safety and security, (14) long-term community recovery and mitigation, (15) external affairs. Additionally, the NRP provides guidelines for common activities that support the emergency response to the majority of incidents, including (1) financial management, (2) international coordination, (3) logistics management, (4) private-sector coordination, (5) public affairs, (6) science and technology, (7) tribal relations, (8) volunteer and donations management, (9) worker safety and health. Finally, the NRP provides specific guidance for responding to seven different types of contingency or hazard situations that require specialized, incident-specific implementation of the NRP - (1) biological, (2) catastrophic, (3) cyber, (4) food and agriculture, (5) nuclear/ radiological, (6) oil and hazardous materials, (7) terrorism. Importantly, the guidelines regarding catastrophic and terrorism incidents are overarching and applicable for all types of incidences that qualify

avoid dispute about "who's in charge" and to enable rapid deployment and direction of personnel and equipment. It systematically promotes information flows up, down, and across the organization - and to the public. As a result, IMS is highly flexible in response to incident type, scale, and location. It has been applied to wildland and urban fires, industrial explosions, earthquake response, hospital emergency room operations, and hostage scenarios (Howitt and Leonard, 2006, p.219).

Finally, the National Preparedness Goal (NPG) addresses the White House's position that "a National Preparedness System must begin with a common vision for preparedness—what end-state are we seeking to achieve and how do we plan to get there?" (The White House, 2006a, p.67). The Goal provides the means for the Nation to answer three fundamental questions: How prepared do we need to be? How prepared are we? And, how do we prioritize efforts to close the gap (US Department of Homeland Security, 2005)? The NPG uses NIMS, particularly the component on preparedness, to provide guidance to entities at all levels of government to develop and maintain the capabilities to prevent, respond to, and recover from Incidents of National Significance as described in the NRP. The Goal also supports HSPD-7, dealing with "Critical Infrastructure Identification, Prioritization, and Protection," which requires DHS to work closely with other federal departments and agencies, state, local, and tribal governments, and the private sector to produce a National Infrastructure Protection Plan (NIPP) to identify, prioritize, and protect critical infrastructure and key resources against terrorist attacks as described in the NIPP (US Department of Homeland Security, 2005; The White House, 2003b).

Incidents Requiring Federal Response

With respect to federal response activities, the Stafford Act (1988) and the NRP identify the role of the federal government as principally to support state and local response activities, responding when an affected locality or state requests assistance because the disaster is of such severity and magnitude that an effective response is beyond their capabilities. As introduced previously, the Stafford Act also lays out the process for states to request a presidential disaster declaration (Stafford Act, 1988). Under the Stafford Act, the President can designate an incident as either an

"emergency" or a "major disaster" (Stafford Act, 1988). The President may, in certain circumstances, declare an "emergency" unilaterally, but may only declare a "major disaster" at the request of a governor that certifies the state and affected local governments are overwhelmed (Stafford Act, 1988). Under an "emergency," assistance is limited in scope and may not exceed \$5 million without Presidential approval and notification to Congress (Stafford Act, 1988). In contrast, for a major disaster, the full complement of Stafford Act programs can be authorized, including long term public infrastructure recovery assistance and consequence management (Stafford Act, 1988). In terms of timing of federal assistance, states often request federal assistance after disasters hit and preliminary damage assessments have been conducted, but they may also request assistance before disasters strike, based on the near certainty that federal assistance will be necessary after the incidence.

In 2003, HSPD-5 introduced a new category of incident requiring a federal response, requiring DHS to prepare to respond to Incidents of National Significance, defined as "those high-impact events that require a coordinated and effective response by an appropriate combination of federal, state, local, tribal, private-sector, and nongovernmental entities in order to save lives, minimize damage, and provide the basis for long-term community recovery and mitigation activities" (The White House, 2003a). The decision to declare an Incident of National Significance is made by the Secretary of Homeland Security, in consultation with other departments and agencies, and the White House, as appropriate (US Department of Homeland Security, 2006b). While there are no automatic triggers for declaring an incidence of national significance, there are various situations that could lead to a declaration, including a state authority requests assistance in responding to a major disaster or emergency as provided for by the Stafford Act; a catastrophic incident is identified by DHS; a federal department or agency requests the assistance of the Secretary of Homeland Security; more than one federal department or agency has become substantially involved in responding to an incident; or, the President directs the Secretary of Homeland Security to assume responsibility for managing a domestic incident (US Department of Homeland Security, 2004). As defined, all emergencies and disasters declared by the President are Incidents of National Significance. In fulfillment of

HSPD-5 (The White House, 2003a), DHS developed the National Response Plan (NRP) (US Department of Homeland Security, 2004) to guide the response to Incidents of National Significance.

Catastrophic Incidents

Within the National Response Plan, DHS also identified a special category of incident, "catastrophic incidents," that trigger accelerated provision of federal support (US Department of Homeland Security, 2004). The Catastrophic Incident Annex of the plan outlines the types of events that can cause damage so massive that first responders, local governments, and state governments are unable to request, or "pull," federal assistance, creating a situation in which it might be necessary to "push" federal support rather than wait for it to be requested (US Department of Homeland Security, 2004). In these cases, federal assistance may be provided both prior to a disaster and without waiting for specific requests from the state or local governments (US Department of Homeland Security, 2004). The NRP defines "catastrophic" incidents as:

"Any natural or manmade incident - including terrorism - that results in extraordinary levels of mass casualties, damage, or disruption severely affecting the population, infrastructure, environment, economy, national morale, and/or government functions. A catastrophic event could result in sustained national impacts over a prolonged period of time; almost immediately exceeds resources normally available to state, local, tribal and private-sector authorities in the impacted area; and significantly interrupts governmental operations and emergency services to such an extent that national security could be threatened." (US Department of Homeland Security, 2004)

When a disaster is determined to be "catastrophic," the NRP calls for the federal government to act proactively rather than in response to state and local governments' requests for assistance - expediting or even temporarily suspending normal operating procedures (US Department of Homeland Security, 2004). DHS is expected to implement and coordinate an accelerated and proactive national response to assist and augment state and local response efforts, and all other federal agencies and other entities with responsibilities under the Emergency Support Functions of the National Response Plan are supposed to immediately initiate response activities (US

Department of Homeland Security, 2004). FEMA has established protocols to pre-identify and rapidly deploy essential resources in response to catastrophic incidents.

KEY NATIONAL RESPONSE AGENCIES AND ROLES

Department of Homeland Security

When a federal emergency, major disaster or national incident is declared, the Department of Homeland Security plays a lead role in coordinating the federal response (see table A.1.2). The key DHS elements active in these situations include the Homeland Security Operations Center (HSOC), the Interagency Incident Management Group (IIMG), the Joint Field Office (JFO), a FEMA National or Regional Response Coordination Center (NRCC or RRCC), and FEMA Emergency Response Teams.

Table A.1.2: Key U.S. National-Level Disaster Response Agencies

FEDERAL
<p>Department of Homeland Security</p> <ul style="list-style-type: none"> • Federal Emergency Management Agency • Coast Guard • HSOC: Homeland Security Operations Center • IIMG: Interagency Incident Management Group • JFO: Joint Field Office • FEMA NRCC or RRCC: National/Regional Response Coordination
<p>Department of Defense: Military support to civil agencies</p> <ul style="list-style-type: none"> • DCO: Defense Coordinating Officer • U.S. Army Corps of Engineers
National Guard
Other Federal agencies (see Table 4.3)
NON-FEDERAL
American Red Cross

Together, the Homeland Security Operations Center (HSOC) and the Interagency Incident Management Group (IIMG) are responsible for monitoring potential major disasters and emergencies and, when such an event occurs or is likely, for providing ongoing monitoring and decision-making support to the Secretary of Homeland Security and the White House. HSOC is a collective operation of more than 35 federal intelligence and state and local law enforcement agencies that share information with each other on an ongoing

basis to monitor potential threats to homeland security. The IIMG, in comparison, is a group of senior representatives from DHS, other federal departments and agencies, and, as appropriate, non-governmental organizations such as the American Red Cross, who are convened by DHS to provide ongoing monitoring and decision-making support to the Secretary of Homeland Security and the White House during Incidents of National Significance or other incidents, as determined by the Secretary of Homeland Security. IIMG is also responsible as for maintaining ongoing coordination from DHS with the Principal Federal Official, the representative of the Secretary of DHS designated to manage federal assistance in an Incident of National Significance, and the JFO Coordination Group of federal, state, and local officials directing the coordinated response and recovery operations.²⁵

Federal Emergency Management Agency

For most Incidents of National Significance, FEMA's initial response activities will include the establishment of a RRCC to coordinate the initial federal activities until a JFO can be established in the affected area. Depending on the scope of the event, FEMA may also establish a NRCC, consisting of FEMA personnel and representatives of those federal agencies with active responsibilities for Emergency Support Functions, to support the operations of the RRCC. Before an incident (when there is warning) or soon thereafter, the RRCC typically deploys an Emergency Response Team-Advance Element (ERT-A) to conduct preliminary damage and needs assessments and begins coordinating with the state as well as any federal resources that may be part of the initial deployment. For large-scale, high-impact events or

²⁵ Due to the different requirements set out for federal assistance in the case of Incidents of National Significance and Stafford Act emergencies or major disasters, federal response efforts may be directed by a Principal Federal Official (PFO), required for Incidents of National Significance and/or a Federal Coordinating Officer (FCO), required under the Stafford Act (1988). Under the Stafford Act (1988), a designated FCO has the authority to request and direct federal agencies to use their authorities and resources to support or conduct response and recovery operations. In those cases in which a PFO and FCO are both designated in response to an incident, the PFO is expected to facilitate the overall federal incident management and assistance activities within the unified command structure that is set up in conjunction with state and local officials but does not have direct authority over the FCO or other federal officials (Stafford, 1988).

when FEMA otherwise determines it is needed, FEMA can also deploy a national-level field response team (ERT-N).²⁶

Coast Guard

As the only one of the nation's five armed services to be located within the Department of Homeland Security, the Coast Guard is unique in the role it plays as a military, multi-mission, maritime service in support of homeland security. In addition to the responsibilities assigned to the Coast Guard by Title 14 - "saving life and property, on and under the high seas and waters over subject to the jurisdiction of the United States" (Establishment of Coast Guard, 1915), the Maritime Transportation Security Act of 2002 assigned it the additional responsibility for enforcement of port safety, security, and marine environmental regulations including the protection and security of vessels, harbors, and waterfront facilities, deepwater ports and waterways safety (Maritime Transportation Security Act of 2002, 2002). As such, the U.S. Coast Guard plays a critical role in response to incidents not only at sea but also in coastal areas subject to sea-related natural disasters, such as hurricanes, floods or tsunamis. This role was recognized in President Bush's description of the Coast Guard as the "the world's premier lifesaving service" during the ceremony in which he awarded the service with the Presidential Unit Citation for its efforts in response to Hurricane Katrina (The White House, 2006b).²⁷

Department of Defense

In the context of homeland security, the Department of Defense (DOD) and its various armed forces elements can be mobilized only in support of a civilian-led federal agency, referred to as Civil Support or Military Support to Civil Authorities (MSCA). Under the NRP and the DOD Joint Doctrine on Homeland Security, Military Support to Civil Authorities is normally provided only when local, state and other federal resources are overwhelmed and the Lead Federal Agency responding to an incident or natural disaster requests

²⁶ Nationally, FEMA maintains 2 ERT-Ns, and each FEMA region maintains an Emergency Response Team (ERT).

²⁷ For more information on the Coast Guard's involvement in the response to Hurricane Katrina, see Coast Guard Response to Hurricane Katrina (US Coast Guard, 2006).

assistance to save lives, protect property, and lessen the threat of catastrophe in the United States.²⁸ When the a military response is anticipated to be necessary for a disaster response, DHS can request that the Office of the Secretary of Defense approve the provision of MSCA in the disaster area under the authority of a Defense Coordinating Officer (DCO). If the size of the response demands it, a joint task force will be created to direct the DOD response under the command of the DCO. The DCO, however, does not have operational control of the U.S. Army Corps of Engineers or National Guard personnel operating in state active duty or Title 32 status.

National Guard

The role of the National Guard is different from the role of the federal military under the command of the Department of Defense as prescribed in the NRP and the MSCA and discussed above. The National Guard plays a unique role among U.S. military services, as the only service that abides by two oaths-of-office, one to the governor and one to the President of the United States. Under normal circumstances, when not federalized, National Guard troops fall under state command, and as such may be called up by a governor to respond to a state emergency. While on state active duty status, the Guard's mission is to serve its state or territory during times of crisis, disaster, civil disturbance or other threats to life and property as directed by the governor in accordance with the state's emergency response plans. Because National Guard units activated by a governor must be supported financially by the state, many states cannot use the National Guard extensively in this manner. A governor may, however, seek "Title 32 status" for the National Guard, which leaves the governor and the state Adjutant General in command but provides federal funding for the support of the mobilized units. In addition to

²⁸ An exception to this principle is the doctrine of immediate response, a DOD directive that allows deployment of some DOD resources prior to receiving formal requests from a lead federal agency, under which local military commanders may take such actions as necessary to save lives, prevent human suffering, and mitigate great property damage or other imminently serious conditions resulting from any civil emergency or attack requiring immediate action. In such situations when a disaster has been anticipated, Northern Command has designated a DCO in the absence of a Presidential directive and before state authorities have made specific requests for DOD support via FEMA. This designation is informal and intended to facilitate the DCO's integration into the state emergency operations system as early as possible to begin assessing the needs of the affected area.

mobilizing their own National Guard units, states can also request other National Guard units made available by state EMAC compacts.²⁹

Other Federal Agencies

While other federal agencies can have a number of responsibilities in the provision of federal disaster assistance, primary responsibility for the execution of the various Emergency Support Functions (ESF) is assigned to particular agencies in the NRP. The ESF Coordinators and Primary Agencies of the various Emergency Support Functions are listed in table A.1.3 below.³⁰

Table A.1.3: National Response Emergency Support Functions and Responsible Federal Agencies

	Emergency Support Function	ESF Coordinator / <i>Additional Primary Agencies</i>
1	Transportation	Department of Transportation
2	Communications	Department of Homeland Security (Information Analysis and Infrastructure Protection/ National Communications System)
3	Public Works and Engineering	Department of Defense (U.S. Army Corps of Engineers) / <i>Department of Homeland Security (Federal Emergency Management Agency)</i>
4	Firefighting	Department of Agriculture (Forest Service)
5	Emergency Management	Department of Homeland Security (Federal Emergency Management Agency)
6	Mass Care, Housing, and Human Services	Department of Homeland Security (Federal Emergency Management Agency) / <i>American Red Cross</i>
7	Resource Support	General Services Administration
8	Public Health and Medical Services	Department of Health and Human Services
9	Urban Search and Rescue	Department of Homeland Security (Federal Emergency Management Agency)
10	Oil and Hazardous Materials Response	Environmental Protection Agency / <i>Department of Homeland Security (U.S. Coast Guard)</i>
11	Agriculture and Natural Resources	Department of Agriculture / <i>Department of the Interior</i>
12	Energy	Department of Energy
13	Public Safety and Security	Department of Homeland Security, Department of Justice
14	Long-Term Community Recovery and Mitigation	Department of Homeland Security (Federal Emergency Management Agency) / <i>Department of Agriculture, Department of Commerce, Department of Housing and Urban Development, Department of the Treasury, Small Business Administration</i>
15	External Affairs	Department of Homeland Security (Federal Emergency Management Agency)

Source: *National Response Plan*, December 2004

²⁹ During Hurricane Katrina, the governors of Alabama, Mississippi, and Louisiana requested and received Secretary of Defense approval for all National Guard forces deployed to their states to operate under Title 32 status.

³⁰ As a more complete discussion of the responsibilities of these primary agencies under each ESF is beyond the scope of this report, readers are referred to the annexes of the National Response Plan Emergency Support for further detail.

These functions are largely carried over from the earlier Federal Response Plan, i.e., are longstanding and well understood by relevant stakeholders. Agencies with primary responsibility are designated as either ESF Coordinators, responsible for managing the particular response function, or Primary Agencies, which carry out the function. (ESF Coordinators for a function are always also designated Primary Agencies for that function.)

American Red Cross

The American Red Cross (Red Cross) is the only nongovernmental organization with primary agency responsibilities under the NRP. Under the plan, the Red Cross functions as a primary organization in implementing ESF #6 regarding Mass Care, Housing and Human Services. As such, the Red Cross assumes the role of providing food, shelter, emergency first aid, disaster welfare information and bulk distribution of emergency relief items. Local chapters usually provide support for the first two days of a disaster. The national Red Cross is structured to provide relief (mostly shelter and feeding) from day two through day 30 of a disaster.

APPENDIX 2. INTERNATIONAL DISASTER MANAGEMENT

INTERNATIONALLY ACCEPTED DISASTER PRINCIPLES AND PRACTICES

In *Living with Risk: A global review of disaster reduction initiatives*, the United Nations Inter-Agency Secretariat of the International Strategy for Disaster Reduction (UNISDR) traces the evolution of thinking on disasters over the 30-year period from the 1970s through the 1990s, from a focus on relief operations and crisis management to a comprehensive and integrated disaster risk reduction approach. This disaster risk reduction framework aims to "minimize vulnerabilities and disaster risks throughout a society, to avoid or to limit the adverse impacts of hazards, within the broad context of sustainable development" (UNISDR, 2004a, p.7). This focus on prevention, mitigation and preparedness, represents a shift from a decades-old view of disasters as "temporary disruptions" whose impacts only need to be addressed by "humanitarian response" or "technical interventions." Today, there is a greater appreciation that disasters are "intimately linked with sustainable development" (UNISDR, 2004a, p.386).

The disaster risk reduction approach identifies "vulnerability" as an important link between risk and development. That is, risk is a function of hazard and vulnerability, or the "conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards" - and vulnerability is a function of development (UNISDR, 2004a, p.41). This formulation helps to explain why persons who are poor are often those most affected by disaster as well as those who have the greatest difficulty recovering from disaster, and thus identifies poverty reduction as a critical element in disaster reduction (Costea and Felicio, 2005, p.5).

Table A.2.1: Key Disaster Risk Management Principles from the International Decade for Natural Disaster Reduction

Year/s	Description
1990-1999	International Decade for Natural Disaster Reduction (IDNDR)
1994	<p><i>Yokohama Strategy and Plan of Action for a Safer World</i></p> <ul style="list-style-type: none"> • Role of individual countries to protect their people and infrastructures • Role of the international community to mobilize resources for disaster risk reduction worldwide • <u>Risk reduction practices</u>: (1) Risk assessment, (2) early warning, (3) vulnerability reduction, (4) risk reduction linked to socioeconomic development, (5) disease prevention and preparedness integrated into development policy and planning, (6) community participation
1997	<p>Adoption of universal/worldwide minimum standards (Sphere project): <i>Sphere Handbook – Humanitarian Charter</i> – Minimum Standards in Disaster Response</p> <ul style="list-style-type: none"> • <u>Content standards – relief activities</u>: (1) Water, (2) nutrition, (3) food aid, (4) shelter, settlement and non-food items, (5) health services, (6) food security • <u>Process standards</u>: (1) Participation, (2) assessment, (3) response, (4) targeting, (5) monitoring, (6) evaluation, (7) relief staff competencies, (8) management of relief operations
1999	<p>United Nations Interagency Secretariat for Disaster Reduction (UN/ISDR)</p> <ul style="list-style-type: none"> • Established to coordinate continued promotion of 1994 <i>Yokohama Strategy</i> • Led by Interagency Task Force composed of regional organizations, civil society organizations • Currently coordinates all UN programs for disaster risk reduction
2005	<p>UN World Conference on Disaster Reduction (Hyogo, Japan)</p> <p><i>Hyogo Framework (Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters)</i></p> <ul style="list-style-type: none"> • Reaffirms role of individual countries to reduce disaster risk: integrated, multi-hazard approach • Reaffirms importance of concerted international cooperation • New role for regional institutions • Five priorities: (1) public commitment, (2) risk assessment and early warning, (3) risk awareness and knowledge development, (4) multi-approach risk reduction, (5) preparedness and response readiness

Thinking on disasters has evolved over the past few decades in significant part as a result of various efforts initiated by the United Nations, beginning most recently with the United Nations' designation of the 1990s as the International Decade for Natural Disaster Reduction (UNISDR, 2004a) (see table A.2.1). Under the IDNDR framework, the United Nations called on governments to formulate national disaster-mitigation programs and integrate them into their national development programs, to establish national disaster risk reduction committees in cooperation with relevant scientific and technological communities, and to take measures, as appropriate, to increase public awareness of natural disaster risks and risk reduction strategies. Recognizing as well "that natural disasters often transcend national boundaries," the IDNDR framework called upon the various

regional institutions of the United Nations "to play an active role in implementing the activities of the Decade" (UNISDR, 2004a, p.6).

Nearing the halfway mark of the IDNDR, in May 1994, the UN organized a conference in Yokohama, Japan, to review progress made in the reduction of natural disasters during the decade. The *Yokohama Strategy and Plan of Action for a Safer World* that resulted from the conference identified ten principles for disaster risk reduction. Among these principles, the Yokohama Strategy identifies that "each individual country bears primary responsibility" for protecting its people, infrastructure, and other national assets from the impact of natural disasters, but also calls on the "international community [to] demonstrate strong political determination... to mobilize adequate financial, scientific and technological resources," for disaster risk reduction worldwide and particularly in developing countries. In addition to standard disaster risk reduction practices, such as appropriate *risk assessment* and *early warning*, the Yokohama strategy emphasized the link between risk reduction and socioeconomic development, calling for *vulnerability reduction*; the integration of *disaster prevention and preparedness* into *development policy and planning* at the national, regional, bilateral, multilateral and international levels; and the *protection of the environment* in a way that is consistent with poverty alleviation. Finally, the strategy also identified the critical role of *community participation* at the local, national, regional and international level in making disaster risk reduction efforts successful (UN World Conference on Disaster Reduction, 2006, pp.5-6).

In July 1999, as the International Disaster for Natural Disaster Reduction was drawing to a close, the United Nations established the Inter-Agency Secretariat for Disaster Reduction (UN/ISDR) as the lead UN institution responsible for continuing to promote the work identified in the 1994 *Yokohama Strategy*. Today, the UN/ISDR manages all United Nations strategies and programs for disaster risk reduction, including the integration of such activities with the organization's development and humanitarian efforts. UN/ISDR policy is led by an Inter-Agency Task Force, chaired by the Under-Secretary-General for Humanitarian Affairs and whose membership is made up by representatives from regional organizations, civil

society organizations and other United Nations programs (Costea and Felicio, 2005, p.8).³¹

Most recently, in 2005, the United Nations organized the World Conference on Disaster Reduction (WCDR), in Kobe, Hyogo, Japan. One product of the WCDR was the *Review of the Yokohama Strategy and Plan of Action for a Safer World*. The *Review* recognized various achievements in disaster risk reduction that had been accomplished in the decade since the 1994 Yokohama Conference. Among these achievements identified were a global recognition of the social dimensions of human vulnerability and the link between disaster risk reduction and sustainable development; the progress made towards mainstreaming disaster risk reduction into national planning and development strategies; the inclusion of risk reduction measures in important environmental and sustainable development agreements (e.g. the Millennium Development Goals); and international efforts to increase the availability, dissemination, and use of knowledge concerning disaster risk reduction (United Nations Inter-Agency Secretariat of the International Strategy for Disaster Reduction, 2006).

The 168 governments participating in the WCDR also adopted the *Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters* (the *Hyogo Framework*), as a blueprint for reducing global disaster losses by 2015. Building upon the Principles contained in the 1994 *Yokohama Strategy*, the 2005 *Hyogo Framework* once again recognizes the primary responsibility for of individual states to reduce disaster risk by creating integrated, multi-hazard approaches to disaster risk reduction, while acknowledging that "in the context of increasing global interdependence,

³¹ Among the other United Nations programs that participate on the Inter-Agency Task Force are the Food and Agriculture Organization, the ITU, UN Development Programme, UNITAR, UN Environment Programme, UN Economic, Social and Cultural Organization, UN-HABITAT, World Food Programme, World Health Organization, WMO, World Bank, United Nations University, UNCRD. Among the regional organizations participating are the African Union, Asian Disaster Preparedness Centre (ADPC), Asian Disaster Reduction Centre (ADRC), Commonwealth of Independent states (CIS) Interstate Council, European Commission Directorate General - Joint Research Centre (EC/ DG-JRC), Ibero-American Association of Civil Defence and Civil Protection, Inter-American Committee on Natural Disaster Reduction, Organization of American States (OAS), NEPAD Secretariat, and the South Pacific Applied Geoscience Commission. Among the civil society organizations and relevant professional associations participating are the International Federation of the Red Cross (IFRC), WHO Collaborating Centre for Research on the Epidemiology of Disasters (CRED), Belgium Drought Monitoring Centre (DMC), Global Fire Monitoring Centre (GFMC), International Council for Science (ICSU), and Munich Re

concerted international cooperation and an enabling international environment are required to stimulate and contribute to developing the knowledge, capacities and motivation needed for disaster risk reduction at all levels” (UNISDR, 2004a, p.5) The *Hyogo Framework* identifies five priorities to further reduce disaster risk worldwide:

1. *Public Commitment*: Establish disaster risk reduction as a national and a local priority with a strong institutional basis for implementation
2. *Risk Assessment and Early Warning*: Identify, assess and monitor disaster risks and enhance early warning systems including capacities for forecasting and disseminating warnings
3. *Risk Awareness and Knowledge Development*: Build a culture of safety and resilience at all levels through education, training, research and innovation
4. *Multi-approach Risk Reduction*: Reduce underlying risk factors, through the application of various measures, including environmental management, land-use and urban planning, protection of critical facilities, application of science and technology, international partnership and networking, and financial instruments
5. *Preparedness and Response Readiness*: Strengthen disaster preparedness and reaction capacities to support effective response at all levels (UNISDR, 2005, p.11; UNISDR, 2004a, p.17)

In addition to calling on states and international organizations to take action on these five priorities as appropriate to their own circumstances and capacities, the *Hyogo Framework* also calls on regional institutions for the first time to take specific steps to reduce disaster risk (Costea and Felicio, 2005, p.35), including: the development of methodologies and standards for hazard and vulnerability monitoring and assessment, the sharing of information and effective mobilization of resources; the compilation and publication of regional baseline assessments of disaster risk and periodic reviews on progress on disaster risk reduction; the strengthening of existing specialized regional disaster risk reduction research and training centers; and the development of regional mechanisms and capacities for early warning to disasters (UNISDR, 2005, p.20).

Coinciding with the evolution of the disaster risk reduction framework, a set of universal minimum standards for humanitarian assistance operations also evolved from 1997 onward. With the aim of improving the quality of assistance provided to people affected by disasters and enhancing the accountability of the humanitarian system in disaster response, the International of the Red Cross and Red Crescent (IFRC) movement along with a number of other humanitarian agencies led the development of the Sphere Project, which was an initiative to establish universal standards for disaster response efforts worldwide. The Sphere Handbook, consists of a Humanitarian Charter - which describes the core principles that govern humanitarian action and reasserts the right of populations affected by disaster to protection, assistance and life with dignity - and Minimum Standards in Disaster Response - regarding six key humanitarian relief activities - (1) water, sanitation and hygiene promotion, (2) nutrition, (3) food aid, (4) shelter, settlement and non-food items, (5) health services, and (6) food security (Sphere Project, 2004).³² The Handbook also identifies standards to be taken into account in all relief activities, dealing with such matters as - (1) participation, (2) assessment, (3) response, (4) targeting, (5) monitoring, (6) evaluation, (7) relief staff competencies, and (8) management of relief operations.

In particular, the Charter and Standards stress the importance of protecting and providing adequate assistance for all affected groups in a nondiscriminatory manner and according to their specific needs. This requires recognition of the differing vulnerabilities, needs and capacities of affected groups. The Handbook identifies specific factors, such as gender, age, disability and HIV/AIDS status, that affect vulnerability and shape people's ability to cope and survive in a disaster context. As such, the Handbook identifies standards for seven special populations and circumstances that should be recognized and addressed in disaster situations: Populations - (1) children, (2) older persons, (3) disabled persons, (4) women, (5) persons with HIV/AIDS; circumstances - (6) physical protection and (7) the

³² The first trial edition of the Sphere Handbook was published in 1998, with the first final edition published in 2000. A second edition, the current edition, was published in 2004, incorporating feedback from agencies that have used Sphere in the field. The original 1998/2000 edition of the Handbook included standards for only the first five activities - the sixth, food security, was added in the 2004 edition.

environment. Other factors that the Sphere Handbook recognizes as potentially complicating vulnerability assessments and response measures include ethnic origin, religious or political affiliation, or displacement. The Sphere standards emphasize that the failure to recognize the differing needs of vulnerable groups and the barriers they face in gaining access to services can cause further marginalization of groups.

As of April 2005, the Sphere Project maintains an office at the headquarters of the IFRC in Geneva, and over 400 organizations from 80 countries have contributed to the development of the Handbook. Today, the focus of the Sphere Project is on the assessment of where and how its Charter and Standards are being used. These in turn will be used as the basis for better evaluating the impact of the Project as a whole on the quality and accountability of humanitarian response. As part of this effort, Sphere is developing a database of Sphere activities, including training materials and their use in emergency situations, which will complement the project information already available through the Sphere website (www.sphereproject.org).

UNITED STATES FOREIGN DISASTER ASSISTANCE

Under the Foreign Assistance Act of 1961, the Office of Foreign Disaster Assistance (OFDA) within the United States Agency for International Development (USAID) is the U.S. government institution charged with providing emergency assistance to foreign countries afflicted by a natural disaster or complex emergency.³³ Reflecting established international standards, the objectives of USAID's disaster assistance are to preserve life, minimize suffering, foster self-sufficiency, and enhance recovery. USAID guidelines also specify that relief efforts should focus on providing assistance to the most vulnerable groups, including "the malnourished, children, nursing and pregnant women, child- and women-headed households, the elderly, and the disabled" (USAID, 2005, p.7).

In response to foreign disasters, OFDA can mobilize a variety of resources, including disaster assistance response teams and experts/teams in

³³ Until recently, most requests for OFDA assistance were related to natural emergencies such as earthquakes, floods, or droughts. In the 1990s, conflict-related complex emergencies predominated (USAID, 2002).

the areas of search and rescue, health and medical intervention, shelter assistance, and water purification. As necessary, OFDA can also coordinate with the Department of Defense for the management of response logistics, transport of relief supplies, and outreach. In addition to its own disaster response efforts, OFDA also provides support for the disaster response work of InterAction, a coalition of 160 U.S.-based international development and humanitarian nongovernmental organizations, and for United Nations efforts to coordinate international responses to foreign emergencies.

Two key documents set out the guidelines for U.S. response to international disasters: the *USAID Field Operations Guide for Disaster Assessment and Response* (USAID, 2005) and *Disaster Reduction: A Practitioner's Guide* (USAID, 2002). The *Field Operations Guide* identifies standard operating procedures for responding to disasters, focusing particularly on post-disaster assessment of affected populations and standard response efforts in regards to food nutrition, health, water, sanitation, shelter, agriculture, search and rescue, logistics and infrastructure. The *Practitioner's Guide*, a supplement to the *Field Operations Guide*, contains technical information for OFDA staff and non-governmental organizations for interventions in seven areas - seeds systems, livestock and fisheries, water and sanitation, work incentives and food aid, settlements and shelter, health and nutrition, and hydro-meteorological extremes (e.g. floods and droughts) (USAID, 2002, p.4).

As presented in these documents, the objectives of U.S. international disaster response interventions are to:

- Lessen the impacts of current emergencies while reducing vulnerability to future emergencies
- Identify and preserve productive assets at the household level
- Strengthen existing capabilities and reinforce effective patterns or strategies for coping with emergencies
- Ensure that those most in need are being reached
- Enable participation of regional, national and local institutions, village councils, farmer organizations, women's associations or other groups

- Assist communities to shift the focus away from conflict towards alternative systems for overcoming current problems (USAID, 2002, pp.7-8).

The disaster response activities engaged in by USAID/OFDA in pursuit of these objectives emphasize prevention, preparedness and planning. According to the USAID/OFDA typology of disaster response activities, prevention activities, such as the use of disaster-resistant construction techniques, can reduce risks before disasters occur; preparedness activities, such as the establishment of an early warning system, can facilitate timely and appropriate actions to mitigate the impact of potential emergencies, and planning activities, such as the implementation of public works programs, can help to ameliorate the consequences of disaster (USAID, 2002, p.3).

Moreover, as represented in its objectives, while OFDA places a high priority on preserving lives and minimizing suffering, the agency also recognizes that encouraging self-sufficiency and long-term development is necessary to help affected populations, especially those most vulnerable populations, to survive future disasters and enjoy sustainable livelihoods over the long-term. Even in protracted disasters, properly designed relief activities can both help the affected populations survive in the short- and medium-term and promote their self-sustainability and development in the long-term. And, unfortunately, poorly designed relief activities can do the opposite. As such, OFDA aims to integrate traditional relief interventions (such as emergency shelter and food aid) with measures to strengthen communities' capacities to prevent and plan for emergencies and to maintain or reestablish the self-sufficiency and productivity of the population.³⁴ In particular, the OFDA *Practitioner's Guide* identifies several strategies for linking relief to development (USAID, 2002):

³⁴ U.S. Congressional funding distinguishes between relief and development activities. Relief activities provide resources in emergency settings in order to enable communities to return to their pre-emergency conditions. Development, on the other hand, engages communities at the policy level to encourage long-term well-being of the populations by promoting greater self-reliance, sustainable social and political structures, and increased economic productivity (USAID, 2002, p.6).

- Enlist community participation to design interventions that are appropriate to a community's preferences and increase the likelihood that the target population will accept and take ownership of these interventions, which increases their potential for success.
- Enhance local capacity by complementing existing knowledge and capabilities with resources from outside the community in order to prepare the populations prepare or respond appropriately to prevent and mitigate emergencies.
- Minimize migration-caused stress in a manner that addresses the benefits and costs of migration and assists vulnerable, displaced and especially involuntary migrants to re-establish self-sufficiency.
- Incorporate gender perspectives to address the concerns of men, women, adolescents and children, all of whom can be affected uniquely by disasters, while taking care not to marginalize different segments of the population.
- Use market channels to deliver relief assistance to stimulate economic activity and encourage self-sufficiency and productivity, while monitoring market behavior for signals of intervention needs.
- Understand the sociocultural context to identify vulnerable populations who need special assistance and resilient populations who may become more self-sufficient and productive with appropriate assistance, and identify complementary interventions that address more than one sector simultaneously.
- Consider environmental impacts that arise from disasters and design appropriate interventions to prevent or address damage such as erosion, soil depletion or deforestation, that can threaten future productivity and self-sufficiency.
- Use financial management tools. Financial management tools, such as cost-benefit analysis, can help in comparing intervention options, maximizing the effectiveness of limited resources, and recognizing both the positive and negative consequences of emergency interventions.

In addition to these strategies, USAID/OFDA identifies eight Programming Principles of Developmental Relief, as noted in table A.2.2 below.

Table A.2.2: Programming Principles of Developmental Relief

Collaboration/Coordination	OFDA expects implementing organizations to work together to avoid overlap, gaps in relief assistance, and confusion among local communities regarding assistance programs and availability of services. Implementing partners should regularly share information with other organizations in the area, particularly in accord with established information centers, and work to standardize data collection methodologies and minimize security risks.
Context-specific conditions	OFDA-funded programs should strive to avoid disrupting social organization and networks by recognizing existing social relationships such as community and gender roles and responsibilities, the natural and political environments, local economies, and cultural beliefs and practices. Programs are appropriate and relevant to these conditions, and should consider both immediate and possible long-term impacts. OFDA acknowledges that as some practices must change during disasters and encourages programs to include training and local community participation in order to ensure that new behaviors or temporary technologies are adopted safely.
Livelihoods	The resumption of income- or food-generating activities plays a crucial role in helping disaster-affected populations recover from disasters. OFDA favors programs that support and encourage the maintenance or rehabilitation of livelihood assets and skills where possible, recognizing that the introduction of new livelihood initiatives will require consideration of economic dynamics and other context-specific conditions.
Mitigation, preparedness, and prevention	Programs that operate at the regional, national, and community levels to help prepare for or lessen the impact of disasters are critical to reducing a country's dependence on external relief assistance. OFDA promotes disaster prevention, mitigation, and preparedness activities both in the course of implementing a disaster response and as a pre-disaster strategy to reduce disaster impacts in areas at risk.
Promotion of international standards	OFDA supports the use of international standards in all disaster response programs. While recognizing that reaching the minimum standards (such as <i>The Sphere Project</i>) is not always possible, OFDA encourages their use as a guideline when designing disaster response and mitigation activities.
Systematic information collection	OFDA encourages organizations to provide for the systematic collection of information in their areas of implementation to the extent possible. Systematic information collection is defined as using a methodology that is established, or can be replicated by others, and whose results are comparable. This is vital in designing appropriate strategies and programs and for targeting the most urgent needs.
Training/Capacity building	Where appropriate, OFDA supports programs that include methods and activities that serve to train local staff, NGOs, community groups, and other organizations, building their capacities both to function as organizations as well as to enhance technical skills of individuals. OFDA encourages the use of appropriate technologies, whether local or introduced.
Use of existing local capacity/local community interaction	OFDA-funded programs should incorporate the views, opinions, and experiences of local communities and officials in planning, designing, and implementing programs, wherever possible.

USAID also describes eight Fundamentals of a Livelihood Strategy to promote self-sufficiency, productivity and the maintenance or restoration of livelihoods (see table A.2.3 below).

Table A.2.3: USAID/OFDA Fundamentals of a Livelihoods Strategy

Fundamentals of a Livelihoods Strategy
1. Rigorous Assessment
2. Aggressive Capacity Building
3. Appropriate Market Support
4. Protecting Essential Assets
5. Easing the Burdens of Vulnerable People
6. Timely Interventions
7. Limiting Harmful Population Displacement
8. Establishing Sustainable Systems

(USAID, 2005, p.8)

After the first principle, rigorous assessment, the principles are not listed in order of importance, and instead represent a set of tools, each of which will be more or less important depending on the context of each emergency. The outline in table A.2.4 summarizes principles, strategies and associated actions (USAID, 2002, Annex B, pp.89-90):

Table A.2.4: Operationalizing the Fundamentals of a Livelihood Strategy

Principles	Strategies	Actions
Complex emergencies require strategic assessment, analysis and interventions	Assess the political, military, social and economic aspects of each crisis in complex emergencies and respond accordingly.	Prepare relief workers to act strategically. Move beyond distributing free relief. Formulate country strategies. Improve coordination.
The key is capacity building.	Integrate capacity building aspects into all relief interventions.	Define capacity building. Do capacity assessments. Avoid creating dependency. Weigh the pros and cons of capacity building.
Markets are necessary to facilitate productivity and self-sufficiency.	Use markets to maximum advantage.	Monitor markets. Protect the poorest. Strengthen key infrastructure. Understand the community's tax base.
Social dynamics influence the success of relief responses.	Intervene to ease the impact of complex emergencies on civilians by enhancing the coping strategies of women, children and the elderly	View people not as victims but as proactive survivors. Avoid burdening the vulnerable. Strengthen women's capacities to provide for dependents. Design health programs with women's responsibilities in mind.
Stress migration undermines productivity and self-sufficiency.	Analyze the source of migration and minimize stress migration and its effects.	Determine if migration is harmful. Understand urban migration. Counter dependency of forcibly displaced populations. Provide jobs and economic opportunities.
Poorly designed interventions undermine self-sufficiency and increase vulnerability.	Establish sustainable systems.	Understand the underlying system. Meet emergency needs. Ensure a return to pre-crisis intervention level of services.

Finally, because disaster-affected populations also have their own strategies for using limited resources to their best advantage, OFDA calls for relief efforts to be sensitive to local cultures, including the coping strategies of populations and especially vulnerable groups, and, as necessary, the sources and motivations for conflict. By being sensitive to the local culture and the many ways aid can influence people's actions, interventions can be adapted to most appropriately address the unique needs of affected populations (USAID, 2005, pp.3,6).

APPENDIX 3. HURRICANE KATRINA CASE STUDY

Summary Statistics	
Date:	August 29, 2005
Human Consequences:	> 1,300 deaths; > one million displaced
Economic Losses:	\$125 billion

The U.S. Gulf coast is a hurricane-prone region, and New Orleans has been known for years to be particularly vulnerable to devastation. The below-sea level city is surrounded by three large bodies of water - the Gulf of Mexico, the Mississippi River Delta and Lake Pontchartrain. In 2002, the New Orleans *Times-Picayune* published a special report series, *Washing Away*, on the risk of a major hurricane. This special report foretold some of New Orleans' key challenges and weaknesses in disaster response including the need to evacuate at least 72 hours in advance (despite the fact that hurricane path predictions are not considered reliable at that point), the inability of many of the city's residents to evacuate due to a lack of personal vehicle, and the use of places of refuge within the city rather than shelters (McQuaid and Schleifstein, 2006). (A refuge of last resort is a structure not pre-designated as a "shelter", for people who cannot or do not evacuate. Unlike a shelter, a refuge of last resort may not be stocked with food, water, utilities or supervision and are not guaranteed to be safe in strong hurricane situations.)

In 2004, the Federal Emergency Management Agency (FEMA) concluded an exercise with a hypothetical Category Three Hurricane named Pam, which accurately predicted the Hurricane Katrina scenario (US FEMA, 2004). In October 2004, *National Geographic* ran a feature on the impact of a hurricane on New Orleans. The article quoted Joe Suhayda, a retired coastal engineer at Louisiana State University, who predicted, "The killer for Louisiana is a Category Three storm at 72 hours before landfall that becomes a Category Four at 48 hours and a Category Five at 24 hours - coming from the worst direction" (Bourne, 2004). *National Geographic* reported that FEMA "lists a hurricane strike on New Orleans as one of the most dire threats to the

nation, up there with a large earthquake in California or a terrorist attack on New York City" (Bourne, 2004).

Many predicted the devastation that a major storm would cause to this area, and particularly New Orleans, yet the aftermath of Hurricane Katrina indicates that preparations and responses were inadequate. For illustrative purposes, this chapter focuses primarily on the the impact of and reponse to Hurricane Katrina in Louisiana and New Orleans, in particular, as the region hardest hit by the storm. As longer-term recovery and redevelopment efforts are still ongoing as well, this chapter focuses principally on the first two stages of disaster management, prevention/preparedness³⁵ and immediate post-disaster response.

EVENT DESCRIPTION

Hurricane Katrina hit Louisiana as a Category Four on August 29, 2005. While federal disaster declarations were issued for more than 90,000 square miles of land, the city of New Orleans was the hardest hit. Approximately five hours after the hurricane's eye made landfall in Louisiana, Katrina's storm surge breached the levee system that protected the city of New Orleans from Lake Pontchartrain and the Mississippi River, flooding nearly the entire city. Katrina and her aftermath resulted in the deaths of more than 1,300 people, displaced more than a million and left more than five million without electricity. The estimated damage is \$125 billion, making Hurricane Katrina the most destructive and costly natural disaster in the history of the United States (The White House 2006a).

ISSUES IDENTIFIED

The following sections illustrate the disaster management activities undertaken in relation to Katrina, focusing on the efforts of the State of Louisiana, the City of New Orleans, and the federal government. These activities are discussed under the broad headers of prevention/preparedness and response.

³⁵ For clarity, preparedness/planning will focus on standing policies. Actions taken in anticipation of the specific disaster, with the exception of early warning, will be discussed in the response section.

Prevention/Preparedness

Coordination/Management

The Louisiana Emergency Operations Plan (EOP) (State of Louisiana Office of Homeland Security and Emergency Preparation (OHSEP), 2005) is an all-hazard plan that establishes the policies and structure for the state government's management of emergencies and disasters and assigns operational responsibilities for actions that the state government will take to provide for the safety and welfare of its citizens in the case of natural, technological and national security emergencies and disasters. The EOP is designed to coordinate closely with the United States National Response Plan (NRP) and with the Emergency Operations Plans of the Parishes of Louisiana, and provides a general framework, within which the state's agencies, Parish agencies, volunteer groups and private organizations can develop detailed Continuity of Government (COG) procedures, arrangements and agreements.

As a general approach, the EOP calls for a bottom-up approach to disaster response. It assumes that the initial response to a disaster will be conducted by local authorities with the state providing support as needed.

In the case that a state response is mobilized, the EOP tasks the Director of the State of Louisiana's Office of Homeland Security and Emergency Preparedness (OHSEP) with managing the state's operations and for coordinating the activities of all non-state actors (State of Louisiana, OHSEP, 2005). While OHSEP is to manage the state's response operations, the actual operations are to be carried out by various agencies of the Louisiana state government tasked with primary or support responsibility for the various "emergency support functions" (such as public health and medical services, transportation, communications, public safety and security, and search and rescue) as enumerated in the EOP. Recognizing that "volunteer organizations" may also provide direct assistance in an emergency situation, the EOP calls on these organizations to "coordinate with the department, agency or office having the primary responsibility for each function" and to "learn what types of support and what kinds of action are required" (State of Louisiana OHSEP, 2005, p. 10 and p. Basic 4-CC-1). All of these disaster operations are to be managed out of a state Emergency Operations Center (EOC) to be established by OHSEP, with which parish EOCs are to coordinate their

parish-level disaster management efforts (State of Louisiana OHSEP, 2005, pp. 2-3).

In the case that "it is clearly demonstrated that it is beyond local and state capability to cope with the emergency/disaster," the EOP identifies that FEMA "has the responsibility for the coordination of federal emergency/disaster operations and resources in support of state and local government capabilities and for directing and coordinating the delivery of federal disaster relief assistance programs" (State of Louisiana OHSEP, 2005, p.3 and p.9).

Planning and Exercises

Responsibility for formulating and updating the EOP and related plans, procedures, arrangements and agreements and for coordinating emergency and disaster operations for the State of Louisiana falls to the OHSEP. As outlined within the EOP, the emergency operations planning process for the State of Louisiana is expected to be continuous, and the EOP is expected to be updated annually.

Regular exercise of these plans is expected to be part of this continuous improvement process. As such, Louisiana holds Statewide Hurricane Exercises, which exercise local governments' emergency management operations in Louisiana's parishes. The 2004 Hurricane Pam exercise provided a sense of the severity of such a disaster and highlighted the need to evacuate large numbers of the population and to establish 1,000 shelters (US FEMA, 2004). The New Orleans Comprehensive Emergency Management Plan also calls for at least one annual "full-scale functional exercise that utilizes all levels of City Government" as well as training, joint drills and exercises (City of New Orleans, 2005).

State agencies and non-state organizations within the state are expected to develop their own detailed disaster management plans, procedures, arrangements and agreements; regularly train their personnel to implement these policies, and update them as needed. And, these agencies are also asked to advise OHSEP if they find areas of the Plan that need improvement (State of Louisiana OHSEP 2005, p.xi). Supplements to the EOP dealing with particular hazards and with regional planning problems can also be issued periodically.

At the time Katrina struck in August 2005, Louisiana and federal officials had been working for two years on a disaster plan to prepare for a massive storm, but had not yet completed the planning (Lipton, Drew, et al., 2005).

Early Warning

The United States has a highly developed early warning system, with the the National Weather service (NWS), a part of the U.S. Department of Commerce under the the National Oceanic and Atmospheric Administration (NOAA), serving as both the primary source of weather data and forecasts for the United States and the sole official source of warnings during life-threatening weather situations. Within NWS, the National Hurricane Center - Tropical Prediction Center (NHC/TPC) is tasked "to save lives, mitigate property loss, and improve economic efficiency by issuing the best watches, warnings, forecasts and analyses of hazardous tropical weather, and by increasing understanding of these hazards" (United States National Weather Service TPC/National Hurricane Center, 2006).

The first advisory related to Hurricane Katrina was issued on Tuesday, August 23, six days prior to Hurricane Katrina's landfall (United States National Weather Service TPC/National Hurricane Center, 2005a). The NHC/TPC reported the formation of Tropical Depression Twelve, that the government of Bahamas had issued a tropical storm warning and that a similar warning might be required for parts of Southern Florida later that evening. On August 24, Tropical Depression Twelve was upgraded to Tropical Storm Katrina. By the time the storm was within 72 hours of landfall, the NHC/TPC had issued no fewer than 25 public advisories and ten forecast advisories on Katrina.³⁶ On August 26, the National Weather Service predicted that Hurricane Katrina (which had grown to a Category Two hurricane) would hit Mississippi and Louisiana, and Katrina was upgraded to a Category Three and then Category Five hurricane on August 27 and 28, respectively. On the night of August 27, two days before landfall, Max Mayfield, Head of the National Hurricane Center, called several Louisiana and Mississippi officials, including New

³⁶ As of November 2006, the National Weather Service TPC/National Hurricane Center maintains an archive of advisories issues related to Hurricane Katrina at <http://www.nhc.noaa.gov/archive/2005/KATRINA.shtml?>

Orleans Mayor Nagin, to impress upon them the severity of the coming storm, and on August 28 he briefed U.S. Department of Homeland Security and FEMA officials on the storm, including the possibility of levee breaches (Glasser and Grunwald, 2005; O'Brien and Bender, 2005).

Evacuation

In terms of evacuation, the emergency evacuation plans of both the State of Louisiana and New Orleans, in identifying local parishes as being responsible for the evacuation of their residents, specified that personal vehicles were to serve as the primary means of hurricane evacuation for the population. (State of Louisiana, OHSEP, 2000, and City of New Orleans, 2005).

Because of this reliance on private vehicles, one of the challenges to evacuation in the region was posed by the potential for considerable delays that could result from traffic congestion on the highways and roads leading away from the coast. In 1998, for example, individuals evacuating due to Hurricane Georges spent six hours driving the 80 miles to Baton Rouge (McQuaid & Schleifstein, 2004). In response to these experiences and difficulties anticipated when preparing for Hurricane Floyd in 1999, significant efforts were made to improve the region's highway evacuation procedures, including modifications for a contraflow system to facilitate one-way traffic on major escape routes (Thomas, 2005a).

A second major challenge was the simple lack of access to private vehicles for many of the region's residents. As of August 2005, an estimated 57,000 households, most of them poor and minority, did not have vehicles (Hegland, 2005). An estimated 54 percent of poor households, which accounted for 28 percent of the city's population, did not possess a vehicle. Not surprisingly, this problem was even more acute for poor elderly households, of which 65 percent lacked a personal vehicle (Sherman & Shapiro, 2005, p. 2). Moreover, 35 percent of black households, which comprised two-thirds of the city's population, did not have a personal vehicle, as compared to 15 percent of white New Orleans households (The Economist, 2005).

Both state and city plans addressed this issue by suggesting that individuals lacking personal vehicles could be evacuated by school and municipal buses, government-owned vehicles and vehicles provided by volunteer

agencies (State of Louisiana OHSEP, 2005, p.II-2; O'Brien & Bender, 2005). However, in May 2005, just three months prior to Katrina's landfall, New Orleans Emergency Preparedness Director Joseph Matthews acknowledged that these resources would likely not suffice in the case of a major disaster, noting "we just don't have the resources to take everybody out" (Hegland, 2005). In the wake of Katrina, Brian Wolshon, a consultant to the State of Louisiana on the evacuation plan, noted that the state and city plans simply did not address how New Orleans' "low mobility population" would be evacuated (Shane & Lipton, 2005).

Finally, in spite of the various state and local plans for carrying out an evacuation, these plans did not necessarily address the resistance of the population. This resistance was exemplified in a study by Louisiana State University after the evacuation for Hurricane Ivan in September 2004. In that survey, nearly one of every three New Orleans residents polled responded that they would not evacuate the area if threatened by a major hurricane, and more than one in four residents would even refuse to leave their homes (Globalsecurity.org).

Shelters

As part of their emergency plans, the state of Louisiana and city of New Orleans had both identified shelters to be used in the event of a hurricane or other disaster. However, the New Orleans Comprehensive Emergency Management Plan provides direction for such information not to be released to the public prior to the actual landfall of a storm in order to avoid identifying shelters that may not be appropriate and to avoid directing individuals to shelters that might be filled to capacity when they arrive (City of New Orleans, 2005).

Two additional factors complicated the shelter situation in contending with Katrina. First, as much of the New Orleans region lies below sea level and is thus vulnerable to catastrophic flooding, the American Red Cross will not operate shelters inside the area when it is threatened by hurricanes that are Category Two or greater (Laska, 2004). Second, although communities may maintain a list of emergency shelter resources available within their areas, there do not exist corresponding state or national registers that can be used

to identify shelter resources outside the affected area in the case that an event overwhelms local resources.

Health

According to a U.S. House of Representatives report, although the medical assistance and response to Hurricane Katrina was successful, "poor [health] planning and preparedness, however, were also too big a part of the story, resulting in delays and shortages of resources, and loss of life in the region" (U.S. House of Representatives, 2006).

One telling example of the challenges to health preparedness at the local level was the lack of readiness of various hospitals to "shelter in place" their patients, which is their primary priority in the case of a disaster. In spite of this responsibility, however, many hospitals in New Orleans did not have their emergency generators and electric switch equipment positioned above flood level (United States Senate, 2006). In fact, the *Southeast Louisiana Catastrophic Hurricane Functional Plan*, completed only one year earlier, had anticipated that all medical treatment facilities in the area would lose electricity and communications, and would be rendered isolated and useless (Innovative Emergency Management, 2004). In anticipation of such problems, the Louisiana EOP also assigns to the state's hospitals and nursing homes the responsibility to develop and implement their own emergency evacuation plans in case they are unable to shelter in place. Nonetheless, it was never completely planned how patients left in hospitals would be evacuated after a storm (United States Senate, 2006).

At the national level, the majority of the FEMA-sponsored national disaster medical system (NDMS) teams of medical personnel were not deployed until after Katrina had struck the Gulf Coast, with very few NDMS teams having been pre-positioned in the region before the hurricane's landfall. In fact, only one NDMS team was in position to provide medical care immediately after the storm hit (United States Senate, 2006). Similarly, only limited amounts of HHS, FEMA, and Department of Defense supplies had been pre-positioned in the region prior to landfall (U.S. House Of Representatives, 2006).

Response

Coordination/Management

On August 26, three days before the hurricane struck, the National Weather Service forecasted that Katrina would hit the Mississippi and Louisiana shores as a Category Four Hurricane, which would exceed the design limitations of the New Orleans levees (United States National Weather Service TPC/National Hurricane Center, 2005b). That day Mississippi Governor Haley Barbour and Louisiana Governor Kathleen Babineaux Blanco each declared a state of emergency in their respective states (State of Mississippi, Office of the Governor, 2005; State of Louisiana, Office of the Governor, 2005b). In addition, the Governors of Alabama, Florida, Mississippi and Louisiana requested Department of Defense coordinating offices be established (United States Department of Defense, Office of the Assistant Secretary of Defense for Public Affairs, 2005).

The following day, two days before the hurricane struck, Louisiana Governor Blanco requested federal support in the form of "emergency protective measures, direct Federal Assistance, Individual and Household Program assistance, Special Needs Program assistance, and debris removal" (State of Mississippi, Office of the Governor, 2005c). As required by the Stafford Act, Governor Blanco identified the state and local resources available for the disaster response. These resources included:

- Department of Social Services: Opening three Special Need Shelters and establishing three on standby;
- Department of Health and Hospitals: Opening three shelters and establishing three on standby;
- Office of Homeland Security and Emergency Preparedness: Providing generators and support staff for Special Needs Shelters and public shelters;
- Louisiana State Police: Providing support for the phased evacuation of the coastal areas.
- Louisiana Department of Wildlife and Fisheries: Supporting the evacuation of the affected population and preparing for search and rescue missions (State of Mississippi, Office of the Governor, 2005c).

FEMA Director Michael Brown arrived in Louisiana (Baton Rouge) on August 28, the day before Hurricane Katrina hit. At 11 am on Monday, August 29, after Katrina had made landfall, Brown proposed sending 1,000 workers from the Department of Homeland Security into the region within 48 hours and 2,000 within seven days (Thomas, 2005b). The need for two days to deploy the first workers was identified as necessary to allow workers to complete training programs (Marek, 2005).

Once on the ground, FEMA was responsible for responding to the assistance offered by other states, organizations and countries. In several instances, the process of gaining FEMA approval is reported to have delayed or even precluded the assistance offered by these outside sources. As an example, buses and planes offered by the state of Arkansas and airboaters from Florida were rejected by FEMA without explanation (Lipton, et al., 2005; Ripley, Tumulty, et al., 2005). In another example, hundreds of firefighters responding to a nationwide call for help were held by FEMA in Atlanta before being sent to the Gulf Coast; FEMA's spokesperson said there was no urgency for the firefighters to be deployed as they were primarily going to do "community relations work" rather than rescue (Lipton, et al., 2005). Finally, in some cases, foreign countries offered supplies and equipment to assist with the response but could not do so until FEMA could determine how to use them (Ripley, et al., 2005).

Communications

New Orleans' emergency communications system – the result of a US \$7 million grant received by the city in 2003 – survived the hurricane and was able to operate until the early morning of August 29 until the generator that powered the city's main emergency communications transmitter shut down after its radiator, located in the roof of a downtown skyscraper, was punctured by a large shard of glass sent hurtling through the air by strong wind gusts (Ripley, et al., 2005; Roane, 2005).

Compounding this loss of the main emergency communications transmitter, the radios used by police, firefighters, and the mayor's office exhausted their batteries. Later, satellite phones would not recharge. Since landlines and cellular phones did not work either, emergency teams were cut off for two days (Ripley, et al., 2005). Telephone and cellular phone

service died, and through most of the crisis the state's special emergency communications system was either overloaded or down. So, officials were not able to communicate the assistance they required from the federal government or inventory the damage (Lipton, et al., 2005).

On August 30, Federal Communications Commission Chairman Martin established an internal Task Force consisting of senior executives and management from within the Commission. Chairman Martin directed the Task Force to coordinate the FCC's hurricane response efforts, which fall into two categories: (1) regulatory relief; and (2) industry outreach and coordination with other federal agencies (Moran, 2005, p.4).

Evacuation

As noted above, on August 26, three days before the hurricane struck, the National Weather Service forecasted that Katrina would hit the Mississippi and Louisiana shores as a Category Four Hurricane, which would exceed the design limitations of the New Orleans levees (United States National Weather Service TPC/National Hurricane Center, 2005b). The following day, two days before the hurricane struck, New Orleans Mayor Nagin issued a press release with the following preparation recommendations:

- Fill cars with gas
- Remove potential yard debris
- Board windows and glass doors
- Ensure that nearby catch basins are clear of leaves or trash
- Stock up on bottled water, batteries, and non-perishable food items
- Check on family, friends and neighbors, especially the elderly, to ensure that all have an evacuation plan, and
- Make provisions for pets.

The Mayor's recommendations emphasized preparation for evacuation, rather than evacuation itself. Although a city-wide evacuation was not ordered 72 hours prior to landfall, city and parish officials did call for evacuation of particularly vulnerable areas. Local officials in six parishes (Plaquemines, St. Benard, St. Charles, Lafourche, Terrebonne and Jefferson) called for mandatory or voluntary evacuations and Mayor Nagin advised

residents of Algiers, the lower ninth ward and other low lying areas to evacuate (City of New Orleans Office of the Mayor, 2005).

The highways leading out of the area were filled with traffic, and the state facilitated the evacuation by opening all inbound lanes to outbound traffic. The contraflow traffic system was activated on Interstate 10 heading west and Interstates 55 and 59 heading north at 4 pm on August 27 (Anderson, 2005). One hour later Mayor Nagin called for a voluntary city-wide voluntary evacuation, and indicated that he was investigating the legal ramifications of calling a mandatory evacuation with regards to the city's liability for closing hotels and other businesses (Anderson, 2005).

On August 28, the day before landfall, the National Hurricane Center issued a bulletin calling Hurricane Katrina "a most powerful hurricane with unprecedented strength" and predicted that "most of the area will be uninhabitable for weeks" (United States National Weather Service TPC/National Hurricane Center, 2005c). As noted earlier, the head of the National Hurricane Center, Max Mayfield, reportedly called several Louisiana and Mississippi officials, including Mayor Nagin, to impress upon them the severity of the coming storm (Knight Ridder Newspapers, 2005). At 10 am on Sunday, August 28 (less than 24 hours before the storm would hit), Mayor Nagin called for a mandatory city-wide evacuation (WWLTV.com, 2005). The sheer volume of people who chose to leave on Sunday caused significant traffic delays. State Police spokesman Lieutenant Lawrence McLeary stated, "The state just does not have the infrastructure to deal with a last-minute 'catastrophic evacuation'" (Anderson, 2005).

As mentioned above, large numbers of the affected population did not have access to personal vehicles. Although the New Orleans city Comprehensive Emergency Plan called for buses to evacuate citizens (O'Brien & Bender, 2005), this was not implemented. In fact, on August 28 city officials decided to veer from the plan due to the high volume of traffic on the highways. The new plan was to take the "low mobility" populations to the Superdome until after the storm (Sullivan, 2005).

The buses, which were intended to transport people out of the city once the worst of the storm was over, were left in the path of the hurricane, and photographs show 200 buses that could have evacuated 13,000 people sitting in a flooded downtown parking lot (Mulrine, 2005).

With approximately 100,000 people stranded in an uninhabitable city, Governor Blanco ordered a mandatory evacuation of New Orleans on August 31. Federal officials indicated that 475 buses would start transporting the approximately 25,000 individuals in the Superdome to the Houston Astrodome (Anderson & Moller, 2005). Sally Snead, with Kerry Meetings and Events, the nation's largest transportation company, said that FEMA contacted them at midnight the evening of August 29 to request 200 buses. The number FEMA ultimately requested rose to 1,100 (Sullivan, 2005).

Although the state sent empty buses north of New Orleans after the hurricane hit, they were stuck in a mall parking lot outside of the city. Night had fallen and drivers did not enter the city due to the security situation. Due to the various delays in organizing transportation, it took more than a week to evacuate 100,000 people via bus, rail, plane and helicopter. While many of the individuals from the Superdome were bused to the Houston Astrodome, evacuees were subsequently, and many still remain (as of August 2006), scattered around the country.

Evacuee Registration

Once individuals had successfully evacuated from the disaster-stricken area, they faced the challenge of locating their loved ones. As evacuees were sent throughout the country, limited, if any, records were kept to track these people. Evacuees and other Americans became resourceful and several independent Internet sites served as bulletin boards for families and friends who were trying to reunite. FEMA's web site listed links to private missing persons sites, but did not provide its own database (CNN, 2005c). The U.S. Coast Guard's site allowed individuals to submit a missing- or stranded-person report; however, it could take up to four days to be assigned a case identification number (Baumann, 2005). On September 5, a national call center was established to assist in finding missing Hurricane Katrina victims (National Center for Missing and Exploited Children, 2005).

Shelters

On August 27, Mayor Nagin informed New Orleans residents that two special needs centers (in Alexandria and Monroe) were open and more would be opened as needed, including the Superdome as a "refuge of last resort," which

would open at 8 am the next day. Individuals who intended to seek refuge in one of the special needs centers were told to call a local number to determine their eligibility (the phone lines opened at seven am on August 28) and were advised to bring several days' worth of food, medical supplies, batteries for any medical devices and sleeping gear. In addition to the various special needs centers, no official shelters were opened in New Orleans, leaving displaced persons access to only the various refuges of last resort that had been set up, which offered only minimal protection and little food, water, bedding or other necessities (McQuaid & Schleifstein, 2004).

In addition, Mayor Nagin informed citizens that the city's emergency management system was responding only to medical emergencies, and citizens were advised to contact non-emergency ambulance providers for assistance in moving to the shelters. The Regional Transit Authority stated that ten buses with special lifts for handicapped individuals would transport those with special needs to the Superdome (City of New Orleans, 2005b).

When Mayor Nagin called for a mandatory city-wide evacuation at 10:00 am on August 28, he reiterated that refuges of last resort, including the Superdome, would be open for those who were unable to evacuate. However, the Mayor stated that these places would likely lose electricity and possibly plumbing and supplies would be limited. Twelve pick-up places were identified for buses to transport citizens to the Superdome (WWLTV.com, 2005). Terry Ebbert, the city's homeland-security director, stated that individuals were "expected to fend for themselves" (Hegland, 2005).

As mentioned above, buses that were intended to evacuate individuals out of the city were re-routed to the Superdome. Thus, the Superdome became a shelter for tens of thousands of people. In 1998, approximately 14,000 people sought refuge from Hurricane Georges in the Superdome. There was violence, looting and a lack of food and water in the Superdome during the 1998 hurricane. In 2004, the Superdome was used as a special needs center for Hurricane Ivan. While this time the Superdome only housed approximately 1,000 people, it again was not stocked with the necessary food or water supplies (O'Brien & Bender, 2005). The experiences of Hurricanes Georges and Ivan signaled the inadequacy of the Superdome as a shelter for thousands of people, yet it quickly became one during Hurricane Katrina.

As predicted, the Superdome's air conditioning failed. Then the lights went out. While the generator kept the Superdome dimly lit, it quickly became a chaotic and unsanitary refuge. On Wednesday, August 31, all running water was shut off, and toilets overflowed (Special Report: After Katrina, 2005).

In the immediate aftermath of Hurricane Katrina, thousands of individuals came from throughout the flooded city to the Ernest Morial Convention Center, which had not been intended to be used even as a refuge of last resort. Individuals said that police and city officials told them to go there to board buses to take them out of the city. Similar to the Superdome, water, food and supplies were limited; sewage filled the floors; and violence erupted (Special Report: After Katrina, 2005).

A convoy of National Guard arrived at the Convention Center on Tuesday, August 30; however, they were only using the center as a staging area for their mission of debris removal. On Thursday, September 1, FEMA Director Michael Brown stated that the federal officials only became aware of the situation at the convention center earlier that day (Lawrence & Lavander, 2005).

After Hurricane Katrina had already hit, Housing and Urban Development Secretary Alphonso Jackson contacted local leaders in various states to identify available shelter in their communities for the Katrina evacuees (Lunney, 2005).

Health

Many of the challenges created by Hurricane Katrina to the healthcare system had no precedent. Physical access to healthcare facilities was hindered, and the health structure suffered immense damage. Several large hospitals were destroyed and many others were left inoperable. Practically all health facilities in the city were forced to close. This situation made it extremely difficult to deal with the multiple environmental and health hazards that arose after Katrina's landfall: standing water, oil pollution, sewage, household and industrial chemicals, and both human and animal remains (The White House, 2006a).

Patients in several facilities that did not evacuate before landfall were suddenly in dire circumstances when rising floodwaters made it

increasingly more difficult to provide them with the minimum standards of care. Most hospitals in New Orleans were unable to function after Katrina's landfall because their emergency generators were rendered inoperable by the floods (United States Senate, 2006). Many patients and staff suffered from dehydration because access to fresh water became scarce in some flooded areas (Lister, 2005). Hundreds of patients were trapped in nursing homes and hospitals lacking the most basic supplies and services. Since these facilities were not a priority during the rescue process, many patients died before any rescue efforts reached them (The White House, 2006).

Given the gravity of the situation, on August 31 HHS declared a Federal Public Health Emergency for Alabama, Florida, Louisiana, Mississippi, and Texas. This action allowed HHS to waive certain requirements for various health programs such as Medicare, Medicaid and the State Children's Health Insurance Program (Lister, 2005). Nearly all HHS agencies and offices participated in the response effort, collaborating with DOD, state, and local health officials.

In total, more than 30,000 applications were sent by volunteer health care workers and 3,800 of them received credentials to deploy as part of the response (HHS, 2005). HHS deployed 24 public health teams that included epidemiology, food safety, sanitation, and toxicology experts (The White House, 2006), and FEMA deployed more than 87 NDMS teams to the region (CBS, 2006). According to a statement by Dr. Roy L. Alson, Commander of Disaster Medical Assistance Team NC-1, over 110,000 individuals were treated or immunized by NDMS teams (Alson, 2005).

In spite of the severity of Katrina, the Bipartisan Committee to Investigate the Preparation for and Response to Hurricane Katrina considered the medical response to the disaster to have been successful (U.S. House of Representatives, 2006).

The response was not without challenges, however, exemplified in large part by several cases of volunteer doctors who were brought to the region but were subsequently never formally deployed to an assignment and others who deployed and set up facilities that were ultimately never used (Rood, 2005). In fact, the White House review of the response attributes much of this success of the health response to Katrina to medical and public health professionals who had to "improvise and use their own initiative" to overcome

the inefficiencies of the medical support system, which was slow to deploy them or failed to adequately supply them (The White House, 2006).

Conversely, the White House report (2006) on the Federal Response to Hurricane Katrina attributes much of the blame for the failures of the public health response the failure of HHS to fulfill its role as coordinator for Emergency Support Function 8, Emergency Health and Medical Services:

HHS struggled in its NRP role as coordinating agency for ESF-8. HHS lacked control over vital medical assets, over-relied on departmental routines, and did not have adequate disaster plans. FEMA compounded HHS coordination difficulties. FEMA deployed NDMS teams without HHS' oversight or knowledge. FEMA administrative delays in issuing mission assignments exacerbated the lack of coordination within ESF-8 and created additional inefficiencies. In order to respond swiftly, HHS felt compelled to take emergency response actions without mission assignments, bypassing FEMA. While this may have pushed additional assets to the region, it also had a deleterious effect on the Federal government's situational awareness of its deployed assets.

Emergency Supplies

As mentioned above, there were no shelters for individuals who could not or did not evacuate prior to Hurricane Katrina. Thus, the places where individuals sought refuge were not stocked in advance with emergency supplies such as bottled water, ready-to-eat meals, medical supplies and blankets.

After the storm hit, the massive flooding made movement throughout the city difficult. In addition, many relief supplies were not in the vicinity. For example, FEMA requested thousands of trucks of ice, but then relocated them to locations as far away as Idaho. Dan Wessel, owner of Cool Express, said that only one-third of his ice company's trucks had unloaded the ice that FEMA ordered (Myers, 2005). In general, NGOs including the American Red Cross were not allowed to bring relief supplies into New Orleans in the aftermath of Hurricane Katrina. In a joint news conference, the American Red Cross and Louisiana state officials said that the state requested that the Red Cross delay bringing relief supplies into New Orleans, and then the mass evacuation of the shelters made that effort unnecessary (CNN, 2005b).

Some relief supplies were provided, however. For example, the Salvation Army provided ready-made meals in the Superdome; bottled water was scarce, however (O'Brien & Bender, 2005). On Friday, September 2, the National Guard

arrived to provide food, water, and security at the convention center (Burnett, 2005). By the next morning, Lieutenant Colonel Jerry Cooks reported that National Guard troops served more than 70,000 meals outside the convention center and had a supply of another 130,000 on hand (CNN, 2005a).

Security and Law Enforcement

The Louisiana and New Orleans security plans rely heavily on existing security forces, and particularly the police. In the days leading up to Hurricane Katrina, the general feeling was that the 1,600-person police force could handle Katrina just as it had dealt with many other storms before (O'Brien & Bender, 2005).

As the hurricane approached the Gulf Coast, the governors of Louisiana and Mississippi mobilized about 6,500 National Guard troops and made plans to send them into the area for security, rescue, relief and recovery activities after the storm had passed. After the levees broke, it soon became evident that Louisiana's National Guard force was overwhelmed. Governors from around the country pledged their National Guard troops for the relief mission, but due to confusion at the local and federal levels the troops were held up. For example, on August 29 New Mexico Governor Bill Richardson attempted to send 200 National Guard troops to Louisiana, but it took four days for them to be approved by the Guard Bureau in Washington (O'Brien & Bender, 2005).

At the Superdome, where 24,000 to 30,000 people were sheltered, there were 90 policemen and 300 troops from the Louisiana National Guard patrolling the facility. Once food and water became scarce and the buses for evacuation were delayed, despair mounted and violence broke out. At least 10 people died in the Superdome (Lipton, et al., 2005) (O'Brien & Bender, 2005).

While those sheltered at the Superdome were searched for weapons, those at the convention center were not. There were many reports of gunfire, theft and harassment. Since the facility was only dimly lit, the police could not fire into the crowds and they could only search with flashlights for anyone with a gun after hearing gunshots or seeing muzzle flashes.

Moreover, when someone was caught, police could do little as jails were flooded and no temporary cells had been established. The offenders were taken into another hall and left there, hoping they would not return. For three days, at least 250 armed troops from the Louisiana National Guard were camped

out in an exhibition hall at the convention center separated from the crowd by a wall, and used their trucks as a barricade when they were afraid the crowd would break in. They were never deployed to restore order and eventually withdrew (Haygood & Tyson, 2005). State officials reported that at least 24 people had died either inside or just outside the convention center by the time units of the Arkansas National Guard moved into the center on September 2 (Lipton, et al., 2005).

The situation on the streets of New Orleans showed a similar break-down in law and order. Looters were targeting all kinds of stores, some of them looking for survival supplies, others for clothes, electronics, even guns. On August 31, Mayor Ray Nagin ordered police officers to leave their search and rescue efforts and return to the streets to stop the increasingly hostile looting (Associated Press, 2005).

The pressure on law enforcement officers was too strong for many of them to withstand. Officials reported that nearly 10 regular officers stationed at the Superdome and 15 to 20 at the convention center quit in the middle of the crisis, along with several hundred others across the city (Lipton, Drew, et al., 2005). In addition, police officers were themselves victims of the hurricane. Many lacked provisions; many were trapped in their homes or at police headquarters. When police headquarters had to be abandoned on August 30, Deputy Chief Steve Nicholas expected to see the military on the streets, but instead he found only chaos (O'Brien & Bender, 2005). Attorney General Alberto Gonzalez said on October 20 that full restoration of the New Orleans Police Department will probably require a long-term federal commitment of additional personnel and an undetermined amount of money (Johnson, 2005).

On August 31, senior officials gathered at the White House to discuss the possibility of federalizing the National Guard, a measure that was opposed by the governors of both Louisiana and Mississippi. By September 2, senior officials agreed this action could be perceived as a federal invasion and decided against it (Los Angeles Times, 2005).

Even though the National Guard was not federalized, active duty troops could have been dispatched to carry out non-law enforcement missions. In fact, two days before Katrina struck, liaison officers were put inside emergency headquarters of the Gulf Coast and military commanders were told to prepare their units for possible deployment. On August 31, active duty troops

from the 82nd Airborne Division and 1st Cavalry Division were put on alert, but they were never deployed. The argument against deploying more active duty troops was to avoid overshadowing the local relief effort (Los Angeles Times, 2005).

On September 2, the NORTHCOM commander and the Defense Secretary had discussions throughout the day about deploying more active duty troops to the Gulf Coast. Finally, on September 3, Secretary Rumsfeld overruled his NORTHCOM commander, and President Bush announced the deployment of 7,200 active duty soldiers and Marines in his weekly radio address (Los Angeles Times, 2005). By Friday, September 2, 58,000 National Guard troops were on duty to protect law and order and provide relief services along the Gulf Coast, as well as 17,000 members of the active-duty Army, Navy, Air Force, and Marines, constituting the largest domestic military deployment since the Civil War (US National Guard Bureau, 2006; O'Brien & Bender, 2005).

Search and Rescue

With the threat of Hurricane Katrina, the Coast Guard deployed rescue helicopters from Cape Cod, Massachusetts, on August 28. Helicopters from locations along the Eastern Seaboard arrived in the gulf just before the storm (O'Brien & Bender, 2005). Government estimations as of September 2006 are that the Coast Guard saved or medically evacuated more than 33,000 people (US Department of Homeland Security, 2006c). A retired Coast Guard commander and search and rescue specialist explained: "We don't have to get approval to execute. The Coast Guard is organized by geography. All of those districts act autonomously. They each have a command and control center" (O'Brien & Bender, 2005).

National Guard troops also participated in search and rescue missions. At the same time, some active military units inside Louisiana were not allowed to help in the storm's immediate aftermath. As they watched National Guard helicopters conduct search and rescue missions, active duty pilots were unable to fly because commanders would not sign off on their missions (Los Angeles Times, 2005).

On Friday September 9, search and rescue operations were suspended in New Orleans and authorities focused on gathering bodies (O'Brien & Bender, 2005).

KEY FINDINGS

Although the U.S. possesses a highly developed early warning system and government plans to effectively respond to natural disasters, the experience of the preparation for and response to Hurricane Katrina can suggest several areas for strengthening U.S. disaster management.

Coordination: Although emergency plans at all levels in the United States generally adhere to a structure that calls for states government to help their local governments respond to disasters and for the federal government to support states' response activities as necessary, there were notable challenges to the actual coordination of these activities in the response to Hurricane Katrina. In the case of Louisiana, for example, there was a lack of coordination of local emergency plans within the state emergency plan. Also, while FEMA was the ultimate authority in the task of responding to Katrina, the scale of the response to Katrina was beyond anything that the agency had addressed previously and thus its procedures to identify needs and coordinate relief responses was seriously tested. Finally, while the inclusion of non-governmental organizations in disaster response activities is addressed in the Louisiana State Emergency Operations Plan, the systems utilized to coordinate the response to Katrina precluded or slowed the exploitation of resources from involvement of resources from other areas of the United States, other countries and international organizations.

Planning and Exercising: It is not only important for government agencies and other key actors to prepare for a disaster, it is also important to cultivate a culture of preparedness in which community members are themselves prepared with an understanding of the larger disaster preparations and response. For example, although Louisiana and New Orleans have annual exercises to help make refinements in disaster preparedness and response, these exercises do not emphasize the role of individual citizens. An informed public is invaluable in disaster management - particularly in minimizing the impact of a storm.

Evacuation: In the face of a major disaster, effective evacuation can significantly reduce the human losses suffered; however, evacuation of the New Orleans area was impeded by a delayed evacuation, a plan that was not consistent with the needs of the affected population, and a failure to

effectively implement the evacuation plan. Effective evacuation of the area of more than 1 million people would have required approximately 72 to 84 hours. There are very few northern escape routes out of Louisiana and high ground is more than 80 miles away from the city. This means that high volumes of cars are traveling on few roads for long distances in order to reach safety. The contraflow system is designed to alleviate some of this burden; however, its effectiveness was hindered by the delayed call for evacuation.

Emergency Supplies: There was an inadequate stockpiling of relief supplies such as bottled water, ready-to-eat meals, medical supplies and blankets in advance of the hurricane, and relief efforts after the storm were stymied by several conditions. First, the massive flooding made moving throughout the city and hence delivery of supplies difficult. Second, many relief supplies were not in the vicinity. In general, the delivery of relief supplies was late and inadequately coordinated.

Human Capacity: There was minimal National Guard presence and deployed capabilities in response to Hurricane Katrina. Although Pentagon officials have denied that the ability of the National Guard to respond to the disaster was hampered by the war in Iraq, nearly 35 percent of Louisiana's Guard forces and 40 percent of Mississippi's were deployed in Iraq at the time Katrina hit the Gulf Coast. Hundreds of troops in Iraq from both states specialize in the tasks used regularly in disaster relief (Los Angeles Times, 2005). In addition, FEMA did not have large numbers of staff that could be rapidly deployed to the region. FEMA Director Michael Brown indicated that the first staff would arrive in the region after two days, to enable them to complete training including a sexual harassment program.

**Table A.3.1: Timeline of Hurricane Katrina Events
From one week prior to landfall to two weeks following landfall
(August 23 - September 12)**

Prior to Landfall	
August 23	U.S. National Hurricane Center reports the formation of Tropical Depression Twelve
August 24	Tropical Depression Twelve upgraded to Tropical Storm Katrina Hurricane Katrina hits Florida as a Category One
August 26	National Weather service predicts that Hurricane Katrina (which has grown to a Category Two) will hit Mississippi and Louisiana Louisiana and Mississippi Governors both declare a state of emergency
August 27	Hurricane Katrina grows to a Category Three LSU computer model predicts flooding from levee failures President Bush declares an emergency for the State of Louisiana which authorizes FEMA to respond to the situation New Orleans Mayor Nagin calls for a voluntary city-wide evacuation Contraflow traffic system activated at 4 pm
August 28	Hurricane Upgraded to a Category Five Head of the National Hurricane Center, Max Mayfield, called several Louisiana and Mississippi officials, including New Orleans Mayor Nagin, to impress upon them the severity of the coming storm and briefed Homeland Security and FEMA officials on the storm including the possibility of levee breaches Mayor Nagin calls for mandatory evacuation of New Orleans at pm Superdome and nine other sites named as site "refuges of last resort" FEMA Chief Brown arrives in Baton Rouge FEMA sends emergency supplies Coast Guard Admiral Robert Duncan disperses cutters, helicopters and other vessels and request additional forces
Landfall	
August 29	Hurricane Katrina makes landfall as a Category Four storm Levee breach causes massive flooding Superdome roof damaged, including erosion of waterproof membrane FEMA Director Michael Brown proposes dispatching 1,000 Homeland Security employees within two days and 2,000 within seven days
August 30 ³⁷	Additional levee breaches result in flooding of 80% of New Orleans Homeland Security Secretary Ridge declares Katrina an "incident of national significance" names FEMA Director Brown on-site disaster coordinator FEMA activates the National Response Plan New Orleans Mayor Nagin issues bulletin that waters will continue to rise New Orleans Mayor Nagin authorizes a forced evacuation

³⁷ Henceforth the focus is on Louisiana, and particularly New Orleans.

After Landfall	
August 31	<p>Military Task Force (the Department of Defense's active duty support) is activated and the number of National Guardsmen in the Gulf Region rises to 8,300</p> <p>Louisiana Governor Blanco orders mandatory city wide evacuation of New Orleans</p> <p>Evacuees moved to Astrodome</p> <p>FEMA relief supplies and workers sent to the affected area</p> <p>Public health emergency declared for the hardest hit parts of the Gulf region</p>
September 1	<p>30,000 National Guard troops are promised to the Gulf region</p> <p>Sandbags for the levees arrive</p>
September 2	<p>A total of 58,000 National Guard and 17,000 members of active-duty military services are now on duty in the Gulf region</p> <p>President Bush visits the area and acknowledges government failures</p> <p>Congress approves \$10.5 billion in federal funding for immediate relief and rescue</p> <p>Commercial airlines begin assisting in evacuation</p>
September 3	<p>Department of Labor pledges \$62 million for dislocated workers</p> <p>Police department reports large numbers of officers quitting</p>
September 4	<p>Superdome evacuation completed</p> <p>Louisiana Governor Blanco declares State of Public Health Emergency</p> <p>Carnival Cruise offers ships to relocate 7,000 people</p>
September 5	<p>Investigations into federal response pledged</p>
September 6	<p>U.S. Army Corps of Engineers commences pumping of New Orleans</p> <p>Additional financial commitments made by U.S. Department of Labor</p>
September 7	<p>President Bush requests an additional \$51.8 billion in assistance</p>
September 8	<p>Congress approves additional \$51.8 billion in assistance</p>
September 12	<p>FEMA Director Michael Brown resigns</p>

APPENDIX 4: INTERNATIONAL CASE STUDIES

4.1. BANGLADESH - FLOOD (1998)

Summary Statistics

Date:	July - September 1998
Human Consequences:	918 deaths, 31 million affected
Economic Losses:	\$2 billion (Beck, 2005)

Floods are a normal part of the natural and human ecology of Bangladesh. Three of the world's largest river systems in the world run through Bangladesh on their way to the Bay of Bengal: the Ganges-Padma in the west, the Brahmaputra-Jamuna in the north, and the Meghna in the east. These three major rivers have their peak flows during the monsoon season, which runs from July through September. Because less than ten percent of the catchment area of these rivers (which totals 1.55 million square kilometers) lies within Bangladesh, rainfall in the neighboring countries of India, Nepal, Bhutan, and China, and snowmelt in the Himalayas are major determinants of flooding in Bangladesh (del Ninno et al., 2001, p.2).

Annual flooding, typically covering about 30 percent of the country, is usually a welcome event in Bangladesh. The annual major river flooding, or *borsha*, which deposits fertile silt on the floodplains, is necessary for growing rice in the winter, as well as increasing the supply of fish - a key source of food for poorer households - prior to the rice harvest. However, in years when the peak water levels of all three rivers occur at the same time, as in 1954, 1974, 1987, 1988, and 1998, severe floods have occurred. In addition to these major river floods, Bangladesh experiences flash floods in the eastern and northern rivers, generally lasting only a few days, local floods due to high rainfall in the monsoon season, and coastal floods due to storm surges generated by cyclones (del Ninno et al., 2001, p.3).

Prior to the 1998 flood described here, the last major floods in Bangladesh occurred in 1987 and 1988. In 1987, floods covered about 40 percent of the land area, affected approximately 30 million people, and caused about 1,800 deaths. The floods in 1988 were even more serious, covering about 60 percent of the land area, affecting approximately 45

million people, and causing more than 2,300 deaths (del Ninno et al., 2001, p.4).

Since 1970, Bangladesh has experienced 49 floods, or one to two per year, along with 83 tropical cyclones, hurricanes or typhoons, and four droughts, famines or food shortages (Beck, 2005, p.3).

Event Description

Unlike the normal floods, which typically cover 30 percent of the country for several days or weeks during July and August, the 1998 "flood of the century" lasted ten weeks, through mid-September, and covered up to 68 percent of the total area of the country at times (Beck, 2005, p.iv). With water above the danger level³⁸ for almost two months, the 1998 flood was nearly twice as long as the 1988 flood, with 34 days of above-danger level flooding. The peak water level during the flood averaged about 11.45 meters above danger level, comparable to that of the 1988 peak level (del Ninno et al., 2001, p.4).

Initially, flooding was mainly limited to the eastern part of the country, through which the Meghna runs. During the third week of July, rising levels in the Ganges-Padma basin in the west and a heavy flow of water into the Brahmaputra-Jamuna in the north led to the flooding of 30 percent of the country by July 28. After two weeks of little change, the Padma river started to rise sharply, followed shortly thereafter by the other rivers, so that by August 30, 41 percent of the country was flooded. The flood situation reached its peak number of monitoring stations reporting flows above danger levels on September 7, when 51 percent of the total area was inundated. Water levels fell rapidly thereafter, and by September 25, no monitoring stations reported flows above danger levels (del Ninno et al., 2001, pp.3-4).

In addition to the deaths of hundreds of people and destruction of roads, houses, and other assets that resulted from the initial flooding, the floods had considerable secondary impacts as well, as described by the International Federation of Red Cross and Red Crescent Societies in an appeal for assistance early in the flood period:

³⁸ Danger levels are water levels identified by the government to be significantly above normal flood levels and thus represent a considerable threat to human settlements.

Scarcity of food, firewood and fodder has caused serious suffering throughout the country. Shortage of safe drinking water is prevalent in most places as the flood has damaged tube-wells and contaminated other sources of water. Outbreaks of water-borne diseases such as diarrhea, dysentery and fever have been reported. A large number of rural dwellings have been fully or partly damaged. Flood waters have also caused widespread damage to the rice crop and - worryingly for the later planting - to seed beds. Prices of basic food items have increased, hitting the poor particularly hard (IFRC, 1998).

Initially, the flooding had caused only relatively minor damage to crops, but ultimately the flooding resulted in a shortfall in aman rice production of 1.76 million metric tons (MTs) (the aman rice crop is that grown during the fall or monsoon season) and a total annual rice production shortfall of 2.04 million MTs (about 10.5 percent of the expected production for the year) (del Ninno et al., 2001, p.xv). These losses threatened a food shortage and a loss of purchasing power for basic necessities that could severely affect the health and livelihood of millions of persons, particularly the poor (Beck, 2005, p.3).

Exemplary practices Identified

Prevention/Preparedness

Thanks to the government's concerted investment in disaster preparedness, and buoyed by a general improvement in macro-social factors within the country, Bangladesh was able to significantly decrease the losses experienced in the 1998 floods compared to 1988 floods, in spite of the greater extent of the 1998 floods. A telling example of this success is the loss of only 918 lives in 1998, fewer than half the number lost in 1988.

Disaster Risk Management Orientation

Before the 1980s, the Government of Bangladesh's main focus was on the immediate and short-term distribution of relief during post-disaster periods. Since the 1980s, however, and in particular following the 1988 floods and 1991 cyclone, disaster preparedness and management has been increasingly conceptualized as part of the development process. The move from relief to disaster management can be seen in the 1993 renaming of the Ministry of Relief as the Ministry of Disaster Management and Relief. The government has

also initiated, to a certain extent, attempts to re-conceptualize the technical and institutional focus of response to disasters, and, as such, much of the policy planning since the 1988 floods has demonstrated a shift from "flood control," such as extensive embankments, to "flood proofing," which builds on coping strategies already used by rural and urban communities. This shift is most evident in the 2001 National Water Management Plan Development Strategy, which while attempting to reconcile the tensions between flood proofing and flood control nevertheless emphasizes the latter. NGOs have also followed suit, and the training of their staff in disaster management as well as the integration of disaster preparedness into their ongoing development work is credited with raising local preparedness, including the development of local contingency plans (Beck, 2005, p.8).

Social and Economic Development

In addition to Bangladesh's considerable investment in disaster preparedness, various macro-social factors were also responsible for the improvement in the response to the 1998 floods as compared to the 1988 floods. Some of these reasons include economic growth and reduction in poverty levels; changes in agricultural methods resulting in an increase in the relative size of the *boro* (winter) harvest, which reduced the seasonality of production and prices as well as the susceptibility of total production to adverse weather; the growth of civil society since 1991, and in particular the role of NGOs as both service providers and advocates for a more democratic society.

Response

Coordination/Management

Good formal and informal networking and local coordination between the government and NGOs, as well as among NGOs themselves, improved the initial response to the flood. Local authorities verified the quality and quantity of assistance prior to distribution, provided storage facilities, and cooperated in the procurement and distribution of local materials. The involvement of local authorities and community members in defining areas for NGOs to work in, identifying beneficiaries, and organizing public meetings to mobilize volunteers meant that there was little geographical or programmatic overlap of assistance among NGOs carrying out rehabilitation activities.

Regular meetings of the Association of Development Agencies of Bangladesh (ADAB) also helped to coordinate day-to-day activity, particularly between partner organizations and local government officials. Similarly, the Disaster Forum, an NGO umbrella group, produced situation reports that were widely circulated, and held meetings throughout the flood recovery period, which enabled organizations to exchange information, fill operational gaps, and avoid duplication of efforts. Another key reason for NGOs' ability to coordinate was that many of the larger NGOs, which helped to lead the coordination efforts, had started operations in Bangladesh in the 1970s and had retained key staff, including directors, since that period, which translated into a familiar ability to work with one another directly and through ADAB. This relative success of coordination in the Bangladesh case should be viewed in light of the very large number of actors involved in recovery activities - government, donor, private sector and NGO. Approximately 163 NGOs, and probably a large number of private sector companies under contract to donors, were involved in the response (Beck, 2005, pp.11-12).

Recovery/Redevelopment

Bridging Relief and Recovery

The shift in Bangladesh's orientation from disaster relief to disaster risk management was also made evident in response activities, as exemplified by the Bangladesh Rural Advancement Committee's (BRAC) decision to temporarily shift staff and resources from long-term development projects to assisting with the response to the 1998 floods but doing so in a fashion that provided relief in a manner that promoted long-term recovery and redevelopment. In spite of its normal focus on longer-term economic development BRAC, the country's largest NGO, played an important role in assisting persons affected by the floods to get back into their homes and return to their regular income-generating activities as quickly as possible. While BRAC had to suspend most of its regular operations, providing some three million poor individuals, mainly women, with loans for undertaking investments to increase the productivity of their income-generating work, as a result of the flooding. BRAC temporarily diverted its staff to support the recovery efforts following the 1998 floods. In total, BRAC invested, through

July 1999, \$680,000 in providing recovery assistance to about 850,000 landless and marginal farming households that had been affected by the flood in 55 of the country's 64 districts.

The main activities that BRAC engaged in coincided with the focus of its longer-term development activities, such as agriculture, forestry, silkworm farming, poultry farming, fisheries, sanitation, and shelter. In particular, BRAC's strategy of providing aid in kind rather than in cash enabled the recipients of its assistance to immediately begin to reestablish their livelihoods - for example, the provision of seeds allowed farmers to immediately begin planting grains and vegetables rather than requiring them to purchase supplies in a disrupted and inflationary market. Notably, this required some innovation on the part of BRAC, which in some cases had to purchase these supplies from the government and other importers because local sources of rice, mustard seed, organic fertilizer, and seedlings had been completely wiped out.

Food Security and the Private Sector

Bangladesh's liberalization of trade in rice in 1994 also provided the country with a distinct advantage in recovering from the 1998 flood as compared to the floods a decade earlier (Beck, 2005, p.9). By 1997 private sector imports of rice had grown to about five percent of Bangladesh's total annual rice production of 18.9 million metric tons. Building from this degree of trade integration, Bangladesh was able to rely on private sector imports to compensate for the loss of some 0.3 million metric tons of the *aus* (summer) crop and 1.7 million metric tons of the *aman* (fall) crop in the 1998 flood. In response to the removal of a 2.5 percent tax on rice imports and the expediting the processing of these imports through customs, the private sector imported more than 2.4 million metric tons of rice imports, or 85 percent of the total volume imported, between July 1998 and April 1999. The private sector was also able to import this rice and other grains faster than the government, with private sector imports arriving in the country within two to three weeks, while government imports took three to four months to arrive.

This ability of Bangladesh to maintain the supply of rice following the flooding also played an important role in avoiding spikes in the price of the grain. In comparison to the 1974 famine, when the average price of rice rose

some 12 percent per month for the first ten months of the year, the national average wholesale price of rice remained in the range of 14.14 to 14.83 *taka* per kilogram from September 1998 through mid-April 1999. In the second week of May 1999, the price of rice actually fell to 11.74 *taka* per kilogram as the *boro* (winter) harvest began. Beck (2005) reports that prices in the marketplace might have been as much as seven to 15 percent higher if the public sector alone had imported a similar level of rice.

Key Findings

The fact that Bangladesh experienced in a ten-year period two floods of magnitudes previously expected to occur only once every fifty years should highlight the relevance of the lessons learned from this case study to crises of exceptional magnitudes elsewhere. To their credit, the Government of Bangladesh and its partners appear to have taken some notable steps to contend effectively with catastrophic disasters.

Disaster Risk Management Orientation: One of the most significant actions in this direction is the government's re-orientation of its disaster response policies from being focused on the provision of relief to the management of disaster risk, which has improved the preparedness of the country as a whole. In the Bangladeshi case, this has included a shift away from flood-control efforts towards flood-proofing efforts.

Social and Economic Development: While not specifically undertaken for the purpose of improving disaster preparedness, several aspects of Bangladesh's socio-economic development contributed to decreased susceptibility to disaster, including the reduction of poverty, the improvement of agricultural productivity, and the expansion of the NGO sector.

Coordination: Related to this growth of the NGO sector, the Government of Bangladesh demonstrated its effectiveness in coordinating, with the support of the Association of Development Agencies of Bangladesh, the response of over 150 NGOs and various businesses to the 1998 flood.

Relief-to-Recovery Efforts: The shift in Bangladesh's orientation from disaster relief to disaster risk management was also made evident in response activities, as exemplified by the Bangladesh Rural Advancement Committee's

decision to temporarily shift staff and resources from long-term development projects to assisting with the response to the 1998 floods but doing so in a fashion that provided relief in a manner that promoted long-term recovery and redevelopment.

Private Sector Involvement: Finally, the government demonstrated a willingness and capacity to effectively incorporate the capabilities of the private sector in recovery efforts, such as through its promotion of private sector food imports, which significantly enhanced the restoration of food security in the country following the 1998 floods.

4.2. CUBA - CATEGORY 4+ HURRICANES (1996-2005)³⁹

Summary Statistics	
Date:	July 23, 1998
Human Consequences:	6 deaths, 818,000 evacuated
Economic Losses:	Not available
Date:	November 4, 2001
Human Consequences:	5 deaths, 712,000 evacuated
Economic Losses:	\$87 million
Date:	September 13, 2004
Human Consequences:	0 deaths, 1.3 million evacuated
Economic Losses:	Not available
Date:	July 8, 2005
Human Consequences:	16 deaths, 1.5 million evacuated
Economic Losses:	\$1.4 billion
Date:	October 17, 2005
Human Consequences:	4 deaths, 760,000 evacuated
Economic Losses:	\$704 million

Cuba has developed a culture of preparedness. The national disaster preparation and response plan relies heavily on active community involvement. As a result, Cuban citizens are highly educated on how to prepare for and survive a natural disaster. Cuba's early warning system assists in providing ample time for the national and local governments to implement their plans. Arguably one of the keys to Cuba's success is large-scale evacuation based on annual assessments of areas that need to be evacuated and the particular needs and resources of households and individuals. Disaster preparedness and response is clearly a priority of the Cuban government, as well as a fact of life for Cuban citizens.

Located in the hurricane-prone Atlantic Basin, the small island state of Cuba is hit by a hurricane almost annually. Hurricanes are, in fact, such a constant presence in the life of Cuba, that historian Louis Ferez has suggested that hurricanes have been a critical factor in shaping the economic and social development of Cuban society (Ferez, 2001). In the most recent

³⁹ Except where otherwise noted, the material for this case study draws on *Weathering the Storm: Lessons in Risk Reduction from Cuba* (Thompson and Gaviria, 2004).

decade, from 1996 to 2005, ten hurricanes struck Cuba - resulting on average in more than 600,000 persons evacuated and nearly one million directly affected; and almost 5,000 homes destroyed and 37,000 damaged per hurricane event (Ferez, 2001). These events are summarized in table A.4.2.1.

Table A.4.2.1: Hurricanes in Cuba and their Impacts, 1996-2005

Hurricane	Month/Year	Category	Deaths	Persons Evacuated	Persons Affected	Homes Destroyed	Homes Damaged	Cost, est. (\$ Mil.)
Wilma	10/2005	5	4	760,168	100,000	n/a	5,000	\$704
Dennis	7/2005	4	16	1,500,000	2,500,000	15,000	120,000	\$1,400
Ivan	9/2004	5	0	1,300,000	3,245	1,000	20,000	n/a
Charley	8/2004	2-3	4	215,532	244,005	20,000	70,000	\$1,000
Lili	10/2002	2	3	165,830	281,470	5640*	50,855*	n/a
Isidore	9/2002	2	0	280,000	42,500	5640*	50,855*	n/a
Michelle	11/2001	4	5	712,000	5,900,012	8,700	90,000	\$87
Irene	10/1999	1	4	162,665	254,990	224	3000	n/a
Georges	10/1998	3-4	6	818,000	147,000	2,100	40,000	n/a
Lilli	9/1996	3	0	200,000	336,676	2,922	22,066	\$13
Average	-	-	4	611,420	980,990	7,135	46,258	-

Sources: EM-DAT Emergency Database, ReliefWeb, Oxfam⁴⁰

At the same time, however, in spite of the massive physical and economic devastation that these storms wreak, on average only four persons are killed from any incident and only in one of the ten storms were more than five persons killed. Salvana Briceno - Director of the UN International Strategy for Disaster Reduction Secretariat noted, "The Cuban way could easily be applied to other countries with similar economic conditions and even in countries with greater resources" (UNISDR, 2004d).

Cuba today consistently fares better than its neighbors in terms of human casualties from natural disaster. For example, Cubans represented only

* As Hurricanes Isidore and Lili occurred within a period of 10 days, damage assessments calculated the two disasters together.

⁴⁰ Information on the number of deaths, total affected and estimated costs were obtained from WHO's EM-DAT Emergency Database. The number of people evacuated, homes destroyed and homes damaged, and estimated costs of Hurricane Wilma were obtained from ReliefWeb reports and Oxfam's 2004 report titled "Weathering the Storm: Lessons in Risk Reduction From Cuba." When reports included discrepancies, the most recent and/or most commonly cited numbers are used. *As Hurricanes Isidore and Lili occurred within a period of 10 days, damage assessments calculated the two disasters together.

18 of the 651 persons who lost their lives in one of the six hurricanes that struck Cuba and other countries in the Atlantic Basin between 1996 and 2002 (Thompson & Gaviria, 2004).⁴¹ This is largely due to Cuba's disaster management system which has minimized damage and deaths annually. Although any of the recent hurricanes that have struck Cuba could be used to illustrate this system, this case study focuses on hurricanes of Category Four or higher since 1996.

Event Description

Between 1996 and 2005, five hurricanes of Category Four or Five have affected Cuba: Georges (1998), Michelle (2001), Ivan (2004), Dennis (2005), and Wilma (2005).

Hurricane Georges made landfall on September 23 with winds of 120 to 140 kilometers per hour. It crossed the island from East to West its torrential rains and subsequent flooding isolated the Eastern tip of Cuba. Hurricane Georges killed 603 persons, including 209 in Haiti and 380 in the Dominican Republic on the neighboring island of Hispaniola, but only six in Cuba.

Hurricane Michelle was one of the strongest storms of the 2001 Atlantic hurricane season and the strongest hurricane to hit Cuba since 1944. The storm, which had reached Category Four speeds of maximum sustained winds of 140 miles per hour with gusts up to 155 miles per hour as it approached Cuba, first struck the island on November 4, 2001, at the Bay of Pigs on the island's south coast. Traveling north across the island, with a diameter of the eye of the storm measuring 25 miles and the diameter of circulation at more than 300 miles, Michelle passed over 45 percent of the Cuban territory, affecting 53 percent of the population, or 5.8 million persons. The storm caused heavy damage to property, infrastructure, agriculture and industry in the five provinces that cover much of the western half of the island. More than 166,000 houses were damaged, of which 12,579 were totally destroyed; 125 electric line towers and nine TV and microwave towers were knocked down; TV signals were interrupted for 20 minutes; and 54 percent of all sugar cane planted areas were impacted. In total, the cost of recovery was \$87 million.

⁴¹ Oxfam reports only 1 death from Hurricane Lili rather than 3 from EM-DAT. The EM-DAT statistic is used and the total death toll reported by Oxfam was increased by 2 to account for this discrepancy.

In spite of this economic damage, however, Michelle claimed the lives of only five Cubans. By contrast, a few days earlier, when Michelle traveled through Central America in a weaker form, twelve persons were killed (cubahurricanes.org) with another 26 listed as missing (Cawthorne, 2001).

Hurricane Ivan was the strongest hurricane of the 2004 Atlantic hurricane season, the only Category Five storm of the season and the sixth most intense Atlantic hurricane on record at the time. After causing 68 deaths in Grenada, Jamaica and the Cayman Islands, Ivan struck western Cuba on September 13, 2004, resulting in heavy flooding. Pinar del Rio, a provincial capital, was hit with sustained winds of 120 miles per hour and gusts of 162 miles per hour, and 15-foot waves crashed into Isla de Juventud. Ivan was so expansive that as it was drenching Cuba, it also caused 20-foot waves to crash into George Town, a Grand Cayman port approximately 250 miles away (Mayet-Ain, 2004).

Hurricane Dennis was the first major hurricane of the 2005 season and set several records for early season hurricane activity, including being the strongest Atlantic hurricane on record to form before August. With sustained winds of 215 kilometers per hour and gusts of 260 kilometers per hour, Dennis hit Cuba twice as a Category Four hurricane - first in Granma Province and then again by Camaguey, Ciego de Avila, Sancti Espirtu, and Las Tunas provinces. Dennis caused more than \$2 billion in damages to the United States and a similar amount of damage in the Caribbean, primarily in Cuba. At least 89 deaths (42 direct, and 47 indirect) are attributed to Dennis, sixteen in Cuba. By the time it left Cuba on July 9, 2005, Dennis had weakened to a Category Two hurricane (Oxfam, 2005).

Hurricane Wilma (2005) was the most intense hurricane ever recorded in the Atlantic basin. The storm's most destructive effects were felt in the Yucatán Peninsula of Mexico, Cuba, and Florida. Although Wilma did not make landfall in Cuba, its torrential rains and large waves caused significant flooding and damage. Ten days of continual rainfall and winds caused the collapse of approximately 1,000 homes, and the main highway to Santiago de Cuba, the island's second largest city, was cut off due to flooding. Mud slides hit three mountain communities, and a fishing village in Gramma province was completely submerged in water (Murray, 2005). At least 62

deaths are reported to have resulted from Wilma, with only four of these occurring in Cuba.

Exemplary Practices Identified

Prevention/Preparedness

Mitigating the impacts of the numerous natural disasters that threaten Cuba is a priority of the government. The Cuban government has invested significant resources to protect human lives in the face of natural disasters. Cuba has an established legal framework for disaster preparation and response and requires that all adult citizens receive civil defense training. In addition, all construction plans must meet the Institute of Physical Planning's criteria for reducing vulnerability to natural disasters. The United Nations Development Program credits Cuba's efficient national disaster prevention system for the limited loss of human life from hurricanes (Grogg, 2005a).

Disaster Alert System

Beginning three days before Hurricane Michelle struck in 2001, Cuba implemented massive public early warning through television, newspapers, hourly information by radio, and representatives of the Council of Civil Defense for every institution. One day before the hurricane struck, one TV channel was converted to full-time coverage of the hurricane situation. Cuba's minimization of deaths from hurricane events is due in large part to the effective implementation of the country's early warning system, which was updated in 1996 and is a coordinated effort of the national government, the Civil Defense forces and the National Meteorological Institute (INSMET). According to Cuban law, INSMET is responsible for informing the national Civil Defense and the national government about impending natural disaster risks as well as coordinating with radio and television broadcasters to make this information known to the public. Since 1996 and as illustrated in the case of Hurricane Michelle as described above, the Civil Defense and INSMET's National Forecast Center have organized their early warning activities according to the following schedule:

- "Informative" stage (three to five days before a hurricane is forecast to make landfall) - Early warning bulletins are issued at 24-hour intervals,
- "Alert" stage (48 hours before a hurricane is forecast to make landfall) - More detailed early warning bulletins are issued every six hours beginning, and
- "Alarm" stage (24 hours before a hurricane is forecast to make landfall) - More frequent and more detailed warnings are issued calling for the completion of all preparedness and evacuation activities (Rubiera, 2003, p.1).

In particular, according to Jose Rubiera (2003), Director of the National Forecast Center, this schedule and the wording of the bulletins are designed to motivate the population in the threatened area to prepare early but without panic. This is accomplished through the gradual increase in frequency and detail of the bulletins along with the use of technical enough language to convey adequate details and the nature of the threat but not such technical language as to not be readily understood by the general public.

Television and radio broadcasts of warnings, which are initiated at least 96 hours before the anticipated landfall of a hurricane, also play an important role in conveying these warnings to the general public along with recommendations as to the steps that persons should take in order to prepare for a storm. These broadcasts also employ certain tactics in order to convey the sense of urgency associated with these situations. For example, television and radio broadcasts of early warning bulletins are made from the NFC office rather than from a studio newsroom. Similarly, following the broadcast of an NFC warning bulletin, a broadcast will be made from the Civil Defense headquarters in which a Civil Defense spokesperson reviews guidelines on what to do when the storm arrives (Rubiera, 2003, p. 3; UNISDR, 2004c, p. 1).

Planning

In response to Hurricanes Georges, Michelle, Ivan, Dennis, Wilma, and others, Cuba activated its well-developed, four-phase disaster response plan (which parallels the early warning stages):

Phase I: Information, 72 hours prior to anticipated landfall

Phase II: Alert (48 hours prior to anticipated landfall)

Phase III: Alarm (duration of the hurricane)

Phase IV: Recovery (after the storm)

During the information phase, officials and community members meet to review emergency plans and clarify their respective roles. Three days before Hurricane Michelle struck in 2001, officials began preparations for evacuation of people and transfer of animals. The community was informed through a massive media campaign. In the alert phase, shelters are stocked and evacuations commence. For example, two days before Hurricane Michelle, shelters were stocked with food and medical supplies, people living in possible flood areas were evacuated, animals were transferred, materials located in insecure stockrooms were transferred, and tourists were evacuated. Intensive evacuation of all vulnerable households was carried out over the next two days. In the alarm phase, media broadcasts continue and the local, provincial, municipal and institutional directors of the National Civil Defense continue to respond to the emergency and maintain communication with each other through the radio. For example, during Hurricane Michelle, Cuban officials prohibited circulation of unauthorized people and vehicles. In the recovery phase, Civil Defense directors coordinate immediate clean up and reconstruction efforts. Immediately following Hurricane Michelle, officials evaluated the situation and began the planning, organization and implementation of response and recovery (Wieneke, 2002). Local censuses were conducted to assess damages and compiled into a national assessment that was used to prioritize rehabilitation efforts.

Cuba's national emergency plan is updated annually at the end of every hurricane season. The revisions incorporate the lessons learned - both what worked and what did not.

Local divisions of the Committee for the Defense of the Revolution maintain information on the neighborhood households that includes disaster preparedness assets, houses that are vulnerable to hurricanes and those that can serve as shelters, who went where during an evacuation and who has special needs. In addition, the national emergency plan details the assignment of individuals to a designated shelter or nearby hurricane-safe

house. The high level of community involvement in the national emergency plan ensures that individuals are aware of this assignment and know where to go well in advance of any potential disaster. These local plans are submitted to the zone director who is responsible for five or six zones. They are updated at the zone level and then sent to the municipal level. The municipal plans are then submitted at the national level. This system ensures that community-specific information is incorporated into the national plan. The bottom-up contingency planning means that often individuals are not simply informed of what they should do in the event of an emergency, but they actively participate in the creation of the plan.

The local and provincial authorities play a central role in the implementation of Cuba's emergency response system. The national government develops the local and provincial authorities' ability to respond effectively to disasters, including their participation in the annual update of the emergency plan, risk mapping and simulation exercises. Local authorities are responsible for conducting risk mapping to identify those individuals in their communities who will need and those who can provide extra assistance in an emergency situation.

In addition, the Red Cross implements disaster preparedness programs in seven of Cuba's disaster-prone provinces and has created four training manuals: disaster preparedness, safety at home, primary health and shelter management (IFRC, 2002).

Exercises

Cuba holds an annual two-day drill on hurricane risk reduction at the start of hurricane season (which lasts from June to November). For example, such an exercise was held in May 2001, six months before Hurricane Michelle. The first day of the drill, which is conducted nationwide in ministries, schools, hospitals and factories, identifies concrete actions to prepare for natural disasters and includes simulation exercises; and the second day consists of practical measures to mitigate damages in the event of a hurricane during the season (UNISDR, 2004d). This includes checking reservoir walls or dams for weak points, cleaning wells, identifying places to evacuate animals, and cutting tree branches to fallen debris and damage from branches falling on electrical or telephone wires.

Community Preparedness

Community preparedness is a cornerstone of Cuba's ability to effectively mitigate the impacts of natural disasters, and significant efforts by the Cuban government have fostered a "culture of safety." An international aid worker in Havana during Hurricane Georges described the level of community preparedness:

As we were foreigners, people assumed we didn't know what to do so we had a steady stream of neighbors in and out of our apartment, counseling us to fill the bathtub with water, tape the windows, unplug all electrical items, get batteries or candles, and put the car in the garage. Everyone in the apartment building was out helping to tape up the windows in the entry way. The neighborhood representative from the Federation of Cuban Women was out checking with her "vulnerable population" to see how they were doing. The community doctor was checking on patients in the neighborhood, determining if anyone needed to be moved to a hospital as a precautionary measure. People were stocking up on their rations, counting candles, filling receptacles with water, and cooking food. Everyone, even the children, knew what to do (Thompson & Gaviria, 2004).

Oxfam's interviews with a wide range of Cubans found that "everyone was clearly aware of what measures and procedures they needed to follow in case of a hurricane. They knew the stages of emergency warning, where to get information, how to secure their house, and where they would go for shelter if they needed to evacuate. A belief that the government would prioritize people's safety prevailed."

Disaster education is pervasive in Cuban society. All schools and many universities include disaster preparedness, prevention and response as part of their curriculum, and workplaces provide routine training on risk reduction. Family doctors teach health risk reduction for disaster contexts, and a massive media campaign provides further information. In addition to general protective actions, citizens are told where to seek refuge (Martin, 2005).

Response

Coordination/Management

The implementation of Cuba's four phase plan is evident in the Hurricane Michelle timeline and was also implemented in 2004 when Hurricane Ivan struck

the island. For example, 72 hours before anticipated landfall of Hurricane Ivan, individuals in disaster-prone areas were evacuated, electricity was cut to highest-risk areas and fruits were harvested (Bauer, 2004).

The National Civil Defense, a national institution, coordinates disaster response, which is primarily implemented by local authorities. As a hurricane approaches Cuba, the Joint Command of the National Civil Defense advises the Minister of Armed Forces when to announce the four phases and what measures to implement. Based on information from the Cuban Institute of Meteorology, the National Civil Defense initiates Cuba's early warning system and oversees continuous media broadcasts.

Cuban law identifies heads of provincial assemblies and municipal governments as the provincial and municipal National Civil Defense directors. They are tasked with organizing, coordinating and monitoring actions for disaster prevention and response. As Oxfam reports, "This creates a centralized decision-making process, which is key for emergency situations, alongside a decentralized implementation process, providing agility and adaptation equally necessary for effective emergency preparedness and response."

Legal Decree 170 specifically details the role of the ministries, social organizations and public entities in emergency situations. In addition, Cuban laws mandate a centralized decision-making structure and define the roles of local authorities. Although the National Civil Defense coordinates the response, local and provincial authorities play key roles. The Committee for Defense of the Revolution centers at the provincial, municipal and zone level are responsible for coordinating and informing the immediate area that it serves.

Evacuation

Cuba's national hurricane disaster response includes evacuation 72 hours prior to anticipated landfall. According to the Cuban government, 700,000 Cubans and 5,000 vehicles facilitated the evacuation for Hurricane Michelle (Sims & Vogelmann, 2002). Furthermore, Cuba has plans for moving electrical appliances and other valuables so that individuals do not refuse to evacuate for fear of losing their possessions (Martin, 2005). In addition to on-going media messages regarding evacuation, volunteers who were part of the Committees for the Defense of the Revolution went door to door to announce

the evacuation (Tamayo & San Martin, 2004). They were followed by police who enforced the evacuation order (Tamayo & San Martin, 2004). In addition, all forms of transportation – vehicles, buses, boats, helicopters and even horse carts – are used when needed, to relocate people to shelters (Martin, 2005).

Shelter

During Hurricane Wilma, the Cuban government reported that 80 percent of evacuees stayed in others' homes rather than government shelters (Arrington, 2005). Indeed, many Cubans often seek refuge in the homes of neighbors, relatives and friends when natural disasters strike. This is integrated into the national emergency response plan. Houses that are certified as hurricane safe are designated and used as places of refuge for other community members during an evacuation. Civil defense officials maintain updated lists of internally displaced persons, both in the shelters and in other residences on the island. These lists include information about who has received food and needs medicines in the shelters (Tamayo & San Martin, 2004).

Security and Law Enforcement

Local police play an active role in law enforcement and security during the various phases of Cuba's emergency response. As discussed previously, local police enforce evacuation orders. In addition, police are posted at each shelter to maintain order and ensure the security of evacuees.

Health and Emergency Supplies

As noted above, and in accordance with Cuba's national plan, two days before Hurricane Michelle made landfall in 2001, shelters were stocked with water, food, medicines and emergency supplies from government resources. They were inspected by epidemiologists and staffed by a director, doctor, nurse, police officers, and the Red Cross.

Cuba established the Henry Reeve Medical Brigade, comprised of doctors and other medical professionals trained specifically to respond to public health and disease emergencies associated with natural disasters. The purpose of the Brigade is to provide immediate medical assistance in countries experiencing a major medical emergency, particularly due to natural disasters such as hurricanes or floods (Grogg, 2005b). In addition, shelters are staffed by local medical staff who often already know the medical needs of many in the population they are serving (Cohn, 2005).

Recovery/Redevelopment

Post-disaster redevelopment in Cuba involves many community members. In the aftermath of Hurricanes Lili and Isidore in 2002, "reconstruction of houses, health facilities and schools began immediately" (Guerra & Montes de Oca Días, 2002). The day after Hurricane Dennis struck in July 2005, Cuban municipal authorities were clearing the streets of fallen debris and power lines (Tamayo & San Martin, 2004). In addition, community members work together to rebuild their communities. These local efforts are supported by construction and specialized brigades. In this manner, power, communication and water supplies were fully restored in less than a month after Hurricane Dennis hit (Guerra & Montes de Oca Días, 2002).

Key Findings

Cuba has a well-developed and annually-updated national hurricane response plan that is coordinated centrally by the National Civil Defense and implemented with significant participation from local entities. Substantial efforts are undertaken to ensure that the emergency response plan is up-to-date and efficient. Citizens are not only highly educated about the emergency plan, but are also key participants in its revision and implementation. The clear timeline and division responsibilities enable the plan to transfer from paper to practice in the event of an emergency. Although Cuba's government is significantly different from many other governments worldwide, the principles of its disaster response and preparedness include many measures that can be applied elsewhere. Nine components of Cuba's disaster planning and response are of particular note:

Community Participation and a Culture of Preparedness: Cuban citizens are involved at virtually all stages of planning and response. The Cuban Government implements a massive education campaign, including annual simulation exercises. This develops a culture of disaster awareness and a sense that disaster mitigation and response is not the responsibility of removed government officials, but is highly dependent upon local citizens.

Detailed Plan Developed at all Levels of Governance: Cuba's national emergency plan is highly detailed and is developed at each level of governance - starting at the community level. This plan incorporates

detailed and up-to-date information from local, county, and national levels. It specifically identifies evacuation plans at the community level, including which shelters should be used by various areas. The plans of various communities within a county are then compiled into a county plan. The national plan pulls together all the county plans. This allows a coherent, comprehensive plan with local information as its foundation. The specificity of the plan is essential in ensuring its effective implementation. In addition, the plan was developed in coordination with the very communities it affects.

Annually Updated Planning: Cuba reviews and revises its national emergency plan annually. In particular, annual updates take into consideration what worked and what did not during the previous hurricane season. As a result, the plan not only appears sound on paper, but is feasible and effective when implemented as well.

Annual Drill Nationwide: The two-day drill includes simulation exercises and practical measures to mitigate damages in the event of a hurricane during the season. This operational exercise not only ensures that the plan on paper is clearly understood and feasible, it also heightens public awareness that hurricane season is approaching. In addition, preventive measures are taken including examining reservoir walls or dams for weak points.

Centralized Decision-Making Process and Decentralized Implementation Process: The Cuban system involves a highly centralized decision-making process by one agency - the National Civil Defense, which then relies on its municipal and provincial branches for implementation. This facilitates a coordinated response with a clear primary point of contact, yet avoids a highly centralized bureaucracy that is disconnected with the realities of implementation in local communities. A legal decree specifically defines incident command, the role of all responders, and the centralized decision-making structure.

Timely and Coordinated Evacuations: Cuba's evacuation strategy is to begin evacuating the most vulnerable communities 72 hours in advance of anticipated landfall. Cuba evacuates large numbers of citizens to minimize loss of life and injury. The government does not simply call for an

evacuation, it coordinates it - relying heavily on community assistance from political and civil society organizations as well as the police.

Advance Shelter Preparations: Forty-eight hours prior to anticipated landfall, Cuban officials prepare the shelters by stocking them with water, food, medical and emergency supplies. In addition, the shelters are inspected and staffed with a director, a doctor, a nurse, a police officer, and a Red Cross representative. In many shelters, the medical team consists of local medical staff who are already familiar with the medical needs of many in the population.

Utilization of Local Police: The national emergency plan relies on local law enforcement to enforce the implementation of the plan and maintain law and order. Local police are actively and effectively used to enforce evacuation orders and to provide security at the government shelters.

Trained Medical Brigade for National Emergencies: Cuba's Henry Reeve Medical Brigade consists of doctors and other medical professionals specifically trained in responding to public health and disease emergencies in a natural disaster context. This provides not only a pool of medical personnel with expertise in this particular context, but also a structure and coordinating mechanism for the medical response.

4.3. CZECH REPUBLIC - FLOODS (1997 AND 2002)

Summary Statistics	
Date:	July 1997
Human Consequences:	50 deaths, 60,000 evacuated
Economic Losses:	\$2 billion
Date:	August 2002
Human Consequences:	18 deaths, 50,000 evacuated, 230,000 displaced
Economic Losses:	\$3 billion

The Czech Republic experiences regular flooding each year, with the cost of damage caused by the floods averaging nearly \$30 million annually. Flooding in the Czech Republic can be classified by season. In the summer, floods can be caused by long-lasting regional precipitation or short, high-intensity storms. The floods from the short storms, frequently with over 100 millimeters of rain falling in several hours, can occur anywhere along small rivers and can be particularly catastrophic, especially in depressed and fan-shaped river basins. The longer summer storms can cause flooding along all watercourses, with the greatest flooding occurring along larger rivers. In the winter, floods result from rivers blocked by the formation of ice dams, and in the winter and spring, floods are caused by snow melt combined with rain and occur most frequently in areas located at the foot of the mountain ranges (Sovjakova, 2002).

Event Description

In July 1997, countries in Central and Eastern Europe (CEE) were hit by heavy rains, hailstorms and high winds that led to what was at the time the worst flooding in a century. Over one million people were directly affected, as buildings, roads, agricultural land, and infrastructure was destroyed. The Czech Republic was one of the worst hit areas, along with southwest Poland, northern Slovakia and northeast Hungary. In the Czech Republic, floods hit 538 villages and cities in a total of 34 districts, covering approximately 40 percent of the country. Fifty people were killed by the

flooding, more than 60,000 people evacuated, and several hundreds of thousands more were directly affected (IFRC, 1997). Economic losses in the Czech Republic were estimated to be \$2 billion (Culp & Condon, 2002).

Only five years later, in August 2002, the CEE region suffered an even larger flood. Precipitated by over a week of continuous heavy rains, the floods killed dozens of people, directly affected thousands more, and caused billions of dollars worth of damage in the Czech Republic, Austria, Germany, Slovakia, Poland, Hungary, Romania, and Croatia. On August 12, Czech Prime Minister Vladimir Spidla declared a state of emergency in Prague and four other areas, as thousands were forced to evacuate from Ceske Budejovice, Cesky Krumlov and other communities in Bohemia. In Prague, about 50,000 people were evacuated, as parts of the historic town were closed (CNN, 2002). Altogether the floods covered 40 percent of the country, causing severe damage in as many as 753 Czech villages and cities in 31 districts, and directly affecting more than 1.5 million people, including displacing about 230,000 from their homes and killing 18 (Pokorny & Storek, 2002; AFP, 2003). Total economic damage in the Czech Republic alone has been estimated at \$3 billion (Culp & Condon, 2002).

Exemplary practices Identified

Prevention/Preparedness

Early Warning

In response to the devastation of the 1997 floods, the Czech Hydro-Meteorological Institute (CHMI), which along with the River Basin Boards is responsible for flood warnings in the Republic, restructured its forecasting and warning service to better offer actionable information for the prevention and mitigation of similar events (Nemec and Obrusnik, 2003). In order to do this, CHMI re-organized itself into a network of forecasting offices, with a Central Forecasting Office (CFO) in Prague-Komořany and six regional forecasting offices (RFOs) at the Institute's regional branches. Similar to the CFO, each RFO is a fully integrated forecasting and warning operation, capable of utilizing multi-sensor observation input (precipitation, river flow, World Meteorological Organization Global Telecommunication System data) and equipped with modern remote sensing devices such as weather radars and

satellites. The CHMI system also routinely exploits data from numerical weather models for heavy precipitation forecast, allowing for longer-horizon flood forecasts. Since 2002, the Central and Regional Forecasting Offices monitor forecasts for the major river basins in the country and disseminate this information along with any corresponding warnings via the State Crisis Management System and the country's national emergency management system, as well as via the popular media when necessary.

During the 2002 flood the CHMI system routinely issued summary reports with forecasts, water level measurements, and flood warnings to the SCMS, fire and rescue services, and media outlets. Altogether, CHMI issued 60 such reports throughout the 2002 flood event. The CFO also provided 15 special reports to the central staff of the State Crisis Management System (SCMS), and the director of CHMI participated in the SCMS central staff's meetings. The RFOs cooperated similarly with regional SCMS staff. The public was directly informed via special "flood pages" that were issued regularly on the Internet before and throughout the flood period. And, finally, in an effort to promote regional readiness and cooperation, CHMI also distributed forecasts and other information to crisis management authorities in Germany. These efforts of the CHMI were also supported by the establishment of the Central European Disaster Prevention Forum (CEUDIP), which was established in 1998 to promote greater inter-state cooperation in addressing the increasing frequency and magnitude of disasters in the region. The main priority established for the CEUDIP in 1998 was the improvement of early warning systems within the region, and through the cooperation of the meteorological and hydrological services of the participating countries, a regional radar network was established that enabled improved region-wide weather forecasting.

Emergency Medical Care

Another innovation implemented in the Czech Republic following the 1997 floods was the increased emphasis placed on emergency and disaster medical care in the country (Pokorny & Storek, 2002). This emphasis was signaled most clearly by the Minister of Health's designation of Emergency Medicine as an official medical specialty. On the ground, this translated into the establishment of the Chair for Emergency and Disaster Medicine at the

Institute for Postgraduate Medical Education in Prague and the initiation of programs at the institute and elsewhere to train physicians in the specialization of Emergency Medicine, which is the only specialty in the country that incorporates training on medical care in disaster situations. As of 2002, more than 200 physicians had completed their specialty in Emergency Medicine. In addition to the initial specialty training in Emergency Medicine, regular continuing education courses for specialists in Emergency Medicine were initiated, as were First Aid training programs for non-Emergency Medicine physicians in order to increase the knowledge and skills of all doctors in the country. Subsequently, in 2001 the Ministry of Health established a policy requiring every Czech physician to pass a First Aid training course before being allowed to complete their elected specialization.

Response

Coordination

Also, by the end of 2000, the Czech Republic had established three general laws related to disaster situations - the Law establishing an Integrated Rescue System, the Law on Crisis Management, and the Law on Economic Measures for Crisis States. In particular, the Law establishing an Integrated Rescue System, which provided an institutional framework for the cooperation of the police, fire services, emergency medical services, civil protection services and the army, along with other rescue organizations, is cited as having facilitated the organization and performance of rescue operations in the 2002 floods. During the 2002 floods, more than 27,000 people, including 3,800 professional firefighters, 11,500 voluntary firefighters, and 4,800 policemen, and more than 7,000 soldiers were mobilized for immediate rescue operations and then for recovery efforts. According to the Chair for Emergency and Disaster Medicine at the Czech Institute for Postgraduate Medical Education, this improved coordination framework allowed for some 230,000 people to be evacuated and moved to emergency shelters in the first hours of major flooding (Pokorny & Storek, 2002).

Key Findings

The improvement in performance of the Czech Republic's state flood warning and emergency response systems from the 1997 floods to the 2002 floods is an example of good practice of investment in the methods and operation of the country's disaster management system. While the rains and flooding of 2002 were even more extensive and severe than in 1997, within the country there were fewer casualties and more controlled property loss. In particular, the improvement of early warning systems and public awareness efforts, along with the improvement of disaster medicine and coordination of local and national emergency response, are examples of meaningful return on investment in disaster management.

Early warning: In response to the devastation of the 1997 floods, the CHMI restructured itself into a network of forecasting offices to better offer actionable information for the prevention and mitigation of future disasters. During the 2002 flood restructured CHMI system issued more than 60 pre-disaster reports with forecasts, water level measurements, and flood warnings to the SCMS, fire and rescue services, and media outlets. These efforts of the CHMI were supported by the establishment of the Central European Disaster Prevention Forum (CEUDIP) in 1998 to promote greater inter-state cooperation in addressing the increasing frequency and magnitude of disasters in the region.

Emergency medical care: Another innovation implemented in the Czech Republic following the 1997 floods was the increased emphasis placed on emergency and disaster medical care in the country (Pokorny & Storek, 2002). This emphasis was exemplified by the designation of Emergency Medicine as an official medical specialty, and by a subsequent requirement that every Czech physician must pass a First Aid training course before being allowed to complete their elected specialty.

Coordination: Finally, by the end of 2000, the Czech Republic had established three general laws related to disaster situations - the Law establishing an Integrated Rescue System, the Law on Crisis Management, and the Law on Economic Measures for Crisis States. According to the Chair for Emergency and Disaster Medicine at the Czech Institute for Postgraduate Medical Education, the improved coordination that resulted from these laws

allowed for hundreds of thousands of persons to be evacuated out of harm's way in the first hours of major flooding in 2002.

4.4. HONDURAS - HURRICANE (1998)

Summary Statistics	
Date:	October 25 – November 1, 1998
Human Consequences:	5,757 deaths; 441,150 displaced
Economic Losses:	\$3.6 billion

Honduras is the third poorest country in the Americas with a per capita income of \$6,800 in 2000.⁴² Over half of its 6.4 million residents live in households with incomes below the national poverty line. One third of the population is estimated to live in extreme poverty, or on less than \$1 a day. The economy of Honduras, which is considered one of the least developed in Latin America, is heavily dependent on the export of coffee and bananas. Honduras is also a heavily indebted economy, with public debt amounting to over 60 percent of GDP.

Tropical storms and hurricanes are the most important disaster events in Honduras, although seismic movements are also common (but major earthquakes are fairly rare). From 1969 to 2001, the country was hit by six hurricanes and four tropical storms. The most damaging of these was Hurricane Mitch, which devastated the country in late 1998. In particular, the northern part of Honduras, which lies along the Caribbean Sea and is characterized by relatively flat coastal areas and river plains, was most affected by these storms, and especially by the flooding, which can often cause damage to homes, transportation and communication networks, water systems, agriculture and livestock.

Event Description

Hurricane Mitch struck Central America on October 25, 1998, moved inland and remained over Honduras and other areas, especially Nicaragua, for seven days, until November 1, 1998. More than 1.5 million persons in Honduras were affected by the hurricane, including 5,757 deaths and 441,150 displaced

⁴² Except where otherwise noted, the material for this case study draws on *Learning Lessons from Disaster Recovery: The Case of Honduras* (Telford, 2004).

persons, the largest numbers on record for any natural disaster in the country.

Health problems that resulted from the hurricane included injuries from the storm itself as well as the related flooding, along with widespread secondary gastro-intestinal infections, acute respiratory infections, and dehydration. Additionally, the capacity of households to sustain themselves was strained by the damage caused by the flood. In rural areas, the loss of agricultural crops and livestock, and the erosion or salinization of arable land significantly impacted family livelihoods. In urban areas, there was a severe unemployment crisis due to the devastation of small- and medium-sized businesses that affected the poorest segments of the population in particular. These factors, along with the displacement of more than 400,000 persons due to the total destruction of 35,000 housing units and damaging of an additional 50,000, led to significant migration within the country as well as emigration to other parts of Central America.

The infrastructure damage that resulted from the hurricane included the destruction of major government buildings, hospitals, ports and airports, and especially highways, roads and bridges. With over 2,000 meters of concrete bridges alone were completely destroyed, the damage to the road network severely affected transportation and communications. The estimated cost of the infrastructure damage, \$525 million, represented more than 15 percent of the total costs estimated from damage caused by Mitch. Along with this damage to the transportation network, communities were most impacted by the damage to water systems.

The preliminary estimate of the direct and indirect damage costs of Hurricane Mitch in Honduras, some \$3.6 billion, was equivalent to 74 percent of the country's GDP.

Immediate response activities included search and rescue, emergency and temporary shelter, emergency public health, emergency water and sanitation programs (including the provision of potable water due to the widespread loss of sewage and drainage systems, as well as the disposal of human and animal remains). Over the longer-term, while the damage inflicted by Hurricane Mitch on Honduras was broad and significant, recovery efforts focused on physical reconstruction.

Exemplary practices identified

Prevention/Preparedness

Local Risk Management Capacity

Various sources cite the training of local personnel in local risk management, including disaster detection and mitigation, as an important lesson to be learned from the case of Honduras and Hurricane Mitch. The most noted example is that of the La Masica district, which located on the northern Caribbean coast of the country. Prior to 1998, local leaders in La Masica were the beneficiaries of flood early warning and risk mitigation training program sponsored by the Organization of American States and the Honduran Standing Committee on Contingencies. As a result of this training, when Hurricane Mitch approached in 1998, the local leadership of La Masica, independently of the central government, was able to assess the risk of flooding that was associated with the storm and take action to implement the flood mitigation plan that the community had developed. The district of La Masica lost no lives to the hurricane, compared to hundreds of lives lost in similarly populated and geographically situated communities around the country (Villagran de Leon, 2006).

The United Nations Food and Agriculture Organization (FAO) further suggests that the building of local institutions in Honduras aided in mitigating the impact of Hurricane Mitch in other ways as well (Battista and Bass, 2004). In particular, the FAO recognizes two Honduran districts, Atlantida and Lempira, for their natural resource management practices that contributed to the mitigation of the impacts of Hurricane Mitch. In Atlantida, the Joint Water Administration Board (JAA) is credited with managing the local water basin in a fashion that minimized the impact of the hurricane on water resources, which severely affected other parts of the country. In Lempira, the productive revitalization of eroded hillsides through agroforestry practices is credited with helping to mitigate the further destruction of the land from heavy storms, such as Mitch, and allowing local populations to maintain greater productivity following such events.

Recovery/Redevelopment

Decentralization, Simplification and Acceleration of Project Implementation

The operations of the National Fund for Social Investment (FHIS), in particular, have also been recognized as an example of good practice in the Honduran recovery after Mitch (World Bank, 2006a; World Bank, 2006b). As part of the immediate response to Mitch the FHIS decentralized its operations, deploying most of the senior staff to 11 temporary regional offices as part of emergency response teams in the most heavily damaged areas. These teams worked closely with communities and municipalities to assess immediate needs for shelter, sanitary water, sanitation systems, road access and bridge rehabilitation. FHIS technical experts were also working in northern Honduras within hours of the Mitch's landing, assessing the damage from extensive mud slides in the area. FHIS regional offices and emergency response teams were granted special authority to act on location, enhancing their capacity for rapid, effective project placement. The usual FHIS project cycle was also reduced from 50 steps to only 8 to enable more rapid response. As a result, local contractors were hired on site to commence work immediately. Decentralizing also enabled the emergency response teams to coordinate the NGOs' and multi-lateral organizations' earliest relief efforts among remote municipalities. Within 100 days, the FHIS carried out 2,200 projects with a total value of \$40 million, creating approximately 35,000 person-months of employment each month and covering 30 percent of the nation's reconstruction needs in social infrastructure. Another 2,500 FHIS projects with a total value of \$57 million were also already identified and/or appraised.

The World Bank also streamlined its disbursement schedule for the FHIS, using the then newly established Loan Administration Change Initiative system, thereby making it possible for the FHIS to respond more quickly to the most urgent local needs. The Bank also processed in just one month a supplemental credit of \$22.5 million for the Fourth Social Investment Fund Project in Honduras, and disbursed almost all of the subsequent Fifth Social Investment Fund project in Honduras within the first 12 months following Mitch.

This combination of FHIS-related actions emergency procedures - decentralization, rapid Bank disbursements through Loan Administration Change Initiative, the project cycle reduction, and immediate hiring of local contractors - allowed for a substantial acceleration of activities and results. As an example, the FHIS was able to secure 706 meters of bridge, with delivery from the United States, in just six weeks, and FHIS-supervised local contractors built the first and second bridges to be completed in Honduras following the disaster. Similarly, the FHIS was able to rapidly fund and carry out the emergency removal of massive debris, one of the immediate problems following the hurricane.

Community Involvement and Development-Oriented Recovery

According to the World Bank, the physical reconstruction of infrastructure and housing has been the most notable facet of the Honduran recovery from Mitch (Telford, 2004, p. vi). The Bank attributes success of these efforts to a variety of factors, including:

- Self-help schemes, in which displaced persons were employed in helping to redevelop their own communities and in some cases their own homes. This arrangement helped to ensure an adequate supply of labor for reconstruction projects, as well as also providing needed income support for persons from within the devastated communities, along with vocational training that provided them with greater opportunities following redevelopment.
- Consultation with and involvement of communities and families in redevelopment planning and decision-making. In those communities in which residents were more involved in the design and even (re)construction of their homes, redevelopment efforts were completed more quickly, were subject to fewer charges of corruption or profiteering; and were praised more by community members as meeting the needs of the community and having fewer undesirable social or economic impacts.
- Integration of physical reconstruction with investments in socio-economic and cultural facilities and infrastructure. For example, through the national Honduran Fund for Social Investment (FHIS), the Honduran government undertook to improve more than 1,600 educational facilities, in addition to more than 1,276 other reconstruction or

repair projects that it realized from 1998-2004. Similarly, according to the United Nations Secretariat of the International Strategy for Disaster Reduction (UN/ISDR), the Honduran government also took the opportunity for recovery to relocate schools from more vulnerable locations to more protected locations throughout the country (UNISDR 2004b). As of 2005, the FHIS had financed projects to rehabilitate an additional 40 percent of destroyed and damaged schools, clinics, and water supply systems (World Bank, 2006b).

- Substantial inflows of financial support and other high-quality resources, both human and material, into the devastated regions. In particular, in those circumstances in which extra-local agencies were significantly involved, reconstruction efforts were most successful when these external agencies either already had a presence in the communities, and therefore understood the social and economic context of their work, or where they worked closely with local partners who could provide them with this context and serve as effective intermediaries with the communities in which reconstruction was taking place.

These recovery efforts highlight one of the larger lessons to be taken away from the Honduran experience with Hurricane Mitch – recovery and reconstruction cannot be addressed in isolation from a community’s state of development and ongoing socio-economic development efforts. As the World Bank’s report on the lessons learned from Honduras and Mitch notes, “recovery is inextricably intertwined with poverty and the vulnerability of the affected state and communities before, during, and after the disaster. If we are serious about recovery, we must be serious about development.”

Key Findings

The numerous “good practices” from the Honduran disaster risk management and recovery efforts taken in response to Hurricane Mitch focused on (1) building local capacity for risk management, (2) increasing flexibility of institutions to allow for a more rapid and appropriate response, and (3) integrating urgent physical reconstruction efforts with investment in longer-term socio-economic and cultural recovery and redevelopment efforts. More specifically, these efforts included:

Local Risk Management Capacity: Local capacity for risk management, including disaster detection and mitigation, was a critical element in Honduras' efforts to cope with Hurricane Mitch. One particular example includes the district of La Masica's early warning and risk mitigation efforts that allowed for the implementation of the community's pre-developed flood mitigation plan and the loss of no lives to the hurricane, compared to hundreds of lives lost in similarly populated and geographically situated communities around the country. In other areas, such as the districts of Atlantida and Lempira, natural resource management practices similarly contributed to the mitigation of the impacts of Hurricane Mitch.

Decentralization, Simplification and Acceleration of Project

Implementation: Through a combination of various emergency procedures implemented to accelerate the activities of the Honduran national fund for social investment - including decentralization of its operations, rapid World Bank disbursements to the fund, a reduction in the length of project cycles, and immediate hiring of local contractors - the pace of recovery activities and their results was significantly increased.

Development-oriented Recovery: Finally, the Honduran recovery effort was also characterized by the integration of urgent physical reconstruction efforts with investment in longer-term socio-economic and cultural recovery and redevelopment efforts, including self-help schemes, that employed survivors in helping to redevelop their own homes and communities; consultation with and involvement of communities and families in redevelopment planning and decision-making; the relocation of community facilities such as schools from vulnerable locations to more protected locations throughout the country; and the cooperation of external relief agencies with local partners who could serve as intermediaries with the community.

4.5. INDIA - EARTHQUAKE (2001)

Summary Statistics	
Date:	January 26, 2001
Human Consequences:	20,000+ deaths, 300,000 injuries
Economic Losses:	\$3.5 billion ⁴³

Natural disasters are unfortunately common to the 50 million residents of Gujarat, a prosperous, industrialized state in western India. In addition to regular cyclones and flash floods, the state experiences, on average, droughts every three years and an earthquake every thirty years. Within Gujarat, the environmentally fragile district of Kutch has been especially hard hit, suffering six droughts, two cyclones, one flood and one earthquake in the 1990s alone.

Event Description

On January 26, 2001, the worst earthquake to strike India in nearly three centuries struck the western state of Gujarat. The quake, which measured 6.9 to 7.9 on the Richter scale, affected 21 of the 25 districts in the state, killed more than 20,000 persons and injured an additional 300,000.⁴⁴ The cost of reconstruction alone was estimated at \$2.5 billion, with total economic losses estimated to be \$3.5 billion. The devastation in the state was concentrated in the district of Kutch, in which 90 percent of all deaths and about 85 percent of all economic losses were suffered.

⁴³ Except where otherwise noted, the material for this case study draws on *From Relief to Recovery: The Gujarat Experience* (Sadasivam, 2001).

⁴⁴ The Gujarat earthquake is believed not to have been as strong as the quake that struck Calcutta in 1737 and killed 300,000 persons. It did, however, surpass the 1993 Latur earthquake, in neighboring Maharashtra, which measured 6.4 and killed 9,000.

Exemplary practices Identified

Response

Coordination/Management

In the immediate aftermath of the earthquake, there was a critical need for coordination of the required massive relief efforts, including the distribution of the millions of tons of relief supplies arriving in Gujarat. At the request of the government of Gujarat, the UNDP assumed responsibility for general coordination between government agencies and national and international NGOs, the first time that the government had collaborated with UNDP to such an extent. To this end, the UNDP convened regular meetings of the various actors involved in the response efforts with the goal of promoting a multi-sector strategy for transition from relief to long-term sustainable recovery. From February to May, UNDP convened 16 district-level coordination meetings to identify gaps in relief work, identify potential partnerships between the government and nongovernmental organizations (NGOs), and clarify and influence the government's relief policy. Similar meetings were convened at the sub-district level beginning in April.

Integrated Information Collection and Distribution

Kutch Nav Nirman Abhiyan (abbreviated as Abhiyan), a district-wide network of nongovernmental organizations in the Kutch District, also played a critically important role in facilitating the flow of information to guide the relief and recovery efforts. Within the first month following the earthquake, Abhiyan had set up 33 sub-centers, or *setus* (Sanskrit for "bridges"), across the district to assist with this effort. Each *setu* collected information regarding the relief operations underway in 15-20 nearby villages. Abhiyan also established the Kutch Rehabilitation Information Centre, which coordinated the Rehabilitation Information Management System (RIMS), an electronic data network among all of the *setus* that allowed the various agencies to quickly access village-level data regarding the condition of housing, health, schools, infrastructure, and livelihoods, and the progress of relief and recovery efforts throughout the

district.⁴⁵ While the *setus* had been established initially as informal operations of Abhiyan, the government later designated them as official earthquake rehabilitation support centers.⁴⁶

Disaster Impact Mapping

Finally, the UNDP also initiated the geographic information system (GIS)-supported mapping of the needs of the health and education sectors. With inputs from doctors and medical facilities in the public as well as private sectors, the system enabled the World Health Organization to develop a disease surveillance system to monitor for potentially serious outbreaks of disease, such as malaria and cholera. The GIS database also helped to coordinate later redevelopment efforts in the education sector.

⁴⁵ The type of information that the *setus* and RIMS network gathered included village profiles, data on the progress of the construction of temporary and permanent shelter and infrastructure, and data on the health status of those affected. For example, between April and August 2001, a compilation of data from the *setus* on housing compensation disbursements and rates of housing meeting seismic safety criteria indicated that reconstruction was proceeding as planned. In another example, a survey conducted by the *setus*, in collaboration with the Indian Medical Association, collected data on the number of people disabled by the earthquake and those receiving government compensation and medical support such as prosthetic limbs and therapy enabled the government to schedule physiotherapy sessions at the *setus* and the transportation of patients to rehabilitation camps. Another *setu* health survey resulted in the appropriate design of shelters to incorporate features for access by persons with disabilities. Finally, information collected by *setus* enabled the identification of the cause of a gap between government claims that 70% of Kutch district residents had received loss compensation and claims from residents that the figure was less than 50%. The problem had been that the bank had not transferred sufficient cash reserves to the village-level branches and did not have a sufficient number of persons on staff to service the claims as quickly as they came in, resulting in a backlog.

⁴⁶ While the *setus* were initially established to collect and disseminate information, they later began to also serve as a mechanism by which residents could express their grievances and receive help for influencing government policy, as well as recruit various NGOs private sector entities to participate in redevelopment efforts.

For example, following the government's assessments of the damages to houses in Kutch, residents voiced their concerns through the *setus* that many of the houses were mistakenly assessed as suffering damage in the G1-G3 categories, which would entitle them to lower compensation than if the houses had been assessed as suffering from G-4 or G-5 damage. The *setus* investigated several such complaints and passed their findings on to government agencies, and as a result several families were granted higher financial assistance to rebuild their houses.

In another example, the Kakarwa village council used reconstruction as an opportunity to order families that were considered social outcasts to leave the community. The Kharoi *setu* filed a grievance with the ombudsman (lokpai) that enabled the families to return to their homes.

Recovery/Redevelopment

Community Empowerment

With 344,000 houses destroyed and 888,000 damaged, the rebuilding of shelters was an immediate priority after the earthquake. In Kutch alone, at least 100,000 houses were destroyed and another 300,000 severely damaged.⁴⁷ Reflecting lessons learned from the 1993 earthquake in Latur, the reconstruction program emphasized the need to empower people to build their own homes as a way to promote accountability and the development of local capacity. As a component of this effort, families were allowed to reconstruct housing on the site of their original homes rather than being required to move to other villages. Abhiyan and other entities also advocated for reconstruction efforts to make use of primarily local labor and materials in order to promote to the economic recovery and development of the region.

In the Latur case, thousands of people waited as long as five years for their relocated houses to be rebuilt for them, and in many cases even when finished these houses did not incorporate basic earthquake-resistant safety features or other design features desired by residents, such as space for grain storage, cattle-rearing and milk-processing. Similarly, two years after that earthquake, a survey found that 97% of people in 52 villages were happy with the homes they had rebuilt themselves in their original locations, compared to only 48% of people satisfied with their relocated houses. In terms of cost, homes combining owner-construction and onsite reconstruction in Latur cost only \$320 (INR.15000) per unit, compared to relocated homes ranging from about \$1170 to \$4340 (INR.54000-INR.200,000) per unit, depending on whether a unit was constructed by the owner or a contractor. Finally, onsite reconstruction also had other advantages, such as the availability of existing infrastructure of roads, water supply, drainage, village tanks and electricity, as well as irrigated land, all of which can be lost with relocation.

⁴⁷ In comparison, the 1993 Latur earthquake left 45,000 houses in ruins and damaged 120,000.

Standardized House Sizes

In response to input from various international and national NGOs, the government adopted the position of allowing NGOs to rebuild houses of equal size for each family irrespective of the size of their destroyed homes. The government's policy on housing recovery initially required NGOs to build houses in three different sizes, depending on the size of the houses before the earthquake, which slowed recovery efforts.

Support for Self-Construction of Disaster-Resistant Housing

In light of the shortage of engineers and masons trained in building seismically safe houses throughout the state, an *aide memoire* of the World Bank recommended that demonstration houses should be quickly erected in every village in Gujarat to help make the inhabitants aware of these techniques. As such, the UNDP provided support to Abhiyan for the construction of 1270 model houses in approximately 90 villages. As an initial step, 500 model houses were first built in 74 different villages. Following this effort, an additional 770 houses, in 25 model communities, were erected throughout Kutch. Each of these model units cost approximately \$1,000 (INR. 42,000). Abhiyan also supported the retrofitting of existing houses on a demonstration basis, undertaking two or three model projects in each village of the district. Following this, Abhiyan promoted these techniques by providing support to 380 additional owners throughout the region. Because the cost of supporting owner-led retrofitting (\$150 (INR.7000) for material and \$21 (INR.1000) for labor) was less than half the cost of the retrofits undertaken directly by Abhiyan (\$430 (INR.20000)), more houses could be retrofit in this way.

In addition to providing immediate relief to the most vulnerable people in each village - widows, the elderly, women-headed households, and those with disabilities - these model houses, both the rebuilt and retrofitted examples, served as opportunities for training local persons in seismically safe construction techniques and creating awareness of these techniques and their importance. As part of the demonstration projects, five persons from each village were trained as masons with knowledge of earthquake-resistant design techniques. In turn, these masons have also trained other persons, boosting the number of masons in Gujarat to over 8,000. The Abhiyan team

that trained the masons included 25 engineers who had designed earthquake-resistant homes in Latur and had been recruited by UNDP, as part of its effort to recruit and deploy specialized staff, particularly those with previous experience in earthquake response, in support of the relief-to-recovery projects.

Additionally, the civil engineers that staffed the *setus* helped to educate villagers on the seismic safety design features required for government certification, which the villagers had to incorporate into their reconstructed houses in order to receive financial compensation for the reconstruction from the government.

Key Findings

Up until 2001, India lacked a comprehensive disaster-management strategy. The January earthquake in Gujarat changed this. Spurred by the level of devastation of the quake, the Indian government began to develop, with the assistance of the UNDP, a disaster management program focused on "transition recovery," or the development of longer-term prevention, preparedness and development efforts in the recovery process. Kutch Nav Nirman Abhiyan, a district-wide network of nongovernmental organizations in the Kutch District, was a critical partner in these efforts.⁴⁸

In their efforts to close the gap between shorter-term relief and longer-term sustainable development, the Indian government, the UNDP and Abhiyan focused their labors on improving the coordination of relief-to-development operations and the incorporation of sustainable construction practices into the recovery of housing.

As the efforts of the Gujarat government, UNDP and Abhiyan demonstrate, disaster can become a development opportunity if relief efforts form the basis for sustainable recovery rather than simply restoring the previous status quo. Through their efforts to coordinate relief operations and

⁴⁸ The evolution of Abhiyan is an interesting example of earlier good practice in "transition recovery," or efforts to recover from one disaster in a manner that improves future prevention and preparedness. Abhiyan began in May 1998 as an ad-hoc network of 22 local NGOs working together in response to the devastating cyclone that swept through the Kutch district. By 2001, Abhiyan had evolved into a permanent network of 29 member organizations, engaged in coordinated planning, advocacy and capacity-building activities for development.

promote sustainable reconstruction, the UNDP and especially Abhiyan provide models of relief-to-recovery operations.

Coordination: To facilitate coordination of the required large-scale relief efforts, the government of Gujarat for the first time asked the UNDP to assume responsibility for general coordination between government agencies and national and international NGOs. UNDP coordination included numerous district- and sub-district level coordination meetings to identify gaps in relief work, identify potential partnerships between the government and NGOs, and clarify and influence the government's relief policy.

Integrated Information Collection and Distribution: Within the first month following the earthquake, the RIMS, an electronic data network was established to enable relief agencies to quickly access village-level data collected by the 33 *setus* set up in the Kutch district to collect information regarding the relief operations underway in nearby villages. This data, regarding the condition of housing, health, schools, infrastructure, and livelihoods, allowed for the relief and recovery efforts throughout the district to be collectively monitored and coordinated.

Disaster Impacts Mapping: With inputs from doctors and medical facilities in the public as well as private sectors, the UNDP initiated the GIS-supported mapping of the needs of the health and education sectors in the affected district. The system enabled the World Health Organization to develop a disease surveillance system to monitor for potentially serious outbreaks of disease, such as malaria and cholera, and was also used in later redevelopment efforts in the education sector.

Housing Redevelopment: With 344,000 houses destroyed and 888,000 damaged, the rebuilding of shelter was an immediate priority after the earthquake. The redevelopment of housing was characterized by various good practices, including:

Community empowerment: Various efforts were undertaken to empower residents to rebuild their homes, which resulted in both faster and more cost-effective redevelopment. Among these efforts were included, allowing families to reconstruct housing on the site of their original homes and making use of primarily local labor and materials in order to promote to the economic recovery and development of the region.

Standardized house sizes: In the case of housing rebuilt by NGOs, the government adopted the position, partly in response to input from various international and national NGOs, of building replacement houses of equal size for each family irrespective of the size of their destroyed homes, which sped up recovery efforts.

Support for Self-Construction of Disaster-Resistant Housing: Because of the shortage of engineers and masons trained in building seismically safe houses throughout the state, the government of Gujarat, with the support of NGOs, undertook various efforts to increase the capacity for residents to self-construct their new or restored homes. As one effort, the government supported the development of demonstration houses, both new and retrofitted, in every village in Gujarat to help make residents undertaking self-construction efforts aware of these techniques. Complementing this effort, residents and laborers who worked on building or retrofitting these demonstration homes received training in disaster-resistant construction techniques, which they could then use to build their own homes or other families' homes.

4.6. INDIAN OCEAN COUNTRIES - TSUNAMI (2004)

Summary Statistics	
Date:	December 26, 2004
Human Consequences:	240,000 deaths, 1.768 million displaced
Economic Losses:	\$ 9.9 billion

Occurring on average eight times a year in the Pacific Ocean region and only once every three years in the Indian Ocean region (Rastogi & Jaiswal, 2006), tsunamis are considered to be among the most destructive natural disasters because of the broad impact they can have on the human, social and economic sectors of societies (Pararas-Carayannis, 1985).

In the Indian Ocean region, eighty percent of tsunamis originate from the Sunda Arc region, the volcanic area beneath Sumatra and Java in Indonesia that marks the separation between the tectonic plates underlying Indonesia and eastern Asia from those beneath India and Australia. Tsunamis originate from other parts of the Indian Ocean as well, such as from near the Andaman-Nicobar islands and the Burma-Bangladesh region in the east to the Kutch-Saurashtra region in western India and the Makran coast of Pakistan and Iran in the west, but far less frequently. Tsunamis pose a threat to all of the countries surrounding the Indian Ocean, and in particular those with coastlines that are directly exposed to the ocean, the Arabian Sea and Bay of Bengal (Rastogi & Jaiswal, 2006).

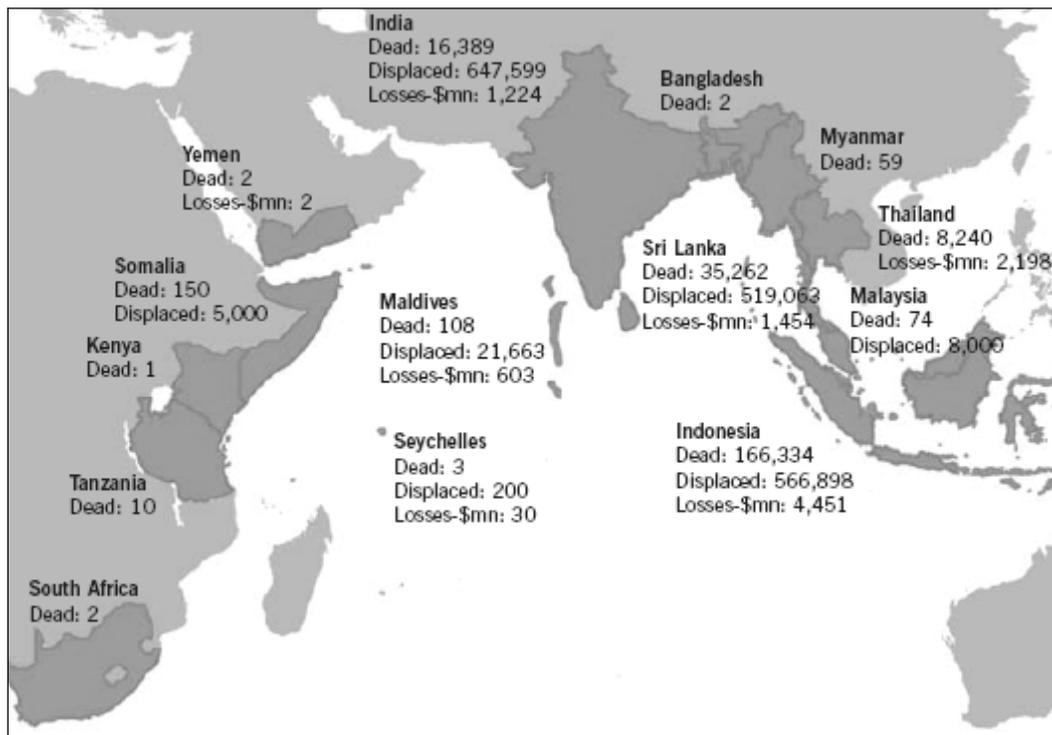
Prior to 2004, the deadliest tsunamis in South Asia included the 1941 tsunami caused by an earthquake in the Andaman Islands region and the 1945 tsunami caused by an earthquake off the Makran coast of Pakistan. More than 5,000 persons are reported to have died as a result of the Andaman event and more than 4,000 from the Makran event.

Event Description

On 26 December 2004, a magnitude 9.0 earthquake shook the Indian Ocean floor about 60 miles off the west coast of Sumatra, Indonesia, generating a chain of tsunamis rushing east and west and causing losses of lives or livelihoods in fourteen countries spread over two continents. The tsunamis

were registered on tide gauges in even more countries, but no major losses were reported outside of the Indian Ocean. An estimated 240,000 persons were killed by the disaster, with the last two having been swept out to sea in South Africa, more than twelve hours after the earthquake. An additional 1.768 million persons were displaced from their homes, and economic losses totaled nearly \$10 billion (Cosgrave, 2006, p.3; UN OCHA, 2006).

Figure A.4.6.1: Map of Countries Affected by 2006 Indian Ocean Tsunami



Cosgrave, 2006, p.13

Exemplary practices Identified

Preparedness

Local Disaster Management Capacity Building

In both India and Sri Lanka, the efforts of the UNDP and the respective national governments to develop local disaster management capacity are believed to have saved scores of lives. In India, the national government and the UNDP initiated the Disaster Risk Management (DRM) program in 2002 to

support the development of local disaster-management capabilities in 169 communities in the most multi-hazard-prone regions of the country (UNDP, 2005b). In Sri Lanka, a similar DRM initiative was launched by the national government and the UNDP in 2003, following that year's flooding and landslides. With support and guidance from the UNDP Bureau of Crisis Prevention and Recovery, the Sri Lanka initiative grew from a three-month, \$300,000 project to an ongoing program with a budget of over \$1.3 million in a year and a half (UNDP, 2005c).

These DRM programs, which the UNDP developed from lessons learned from its previous recovery efforts, focused on the development of a wide variety of local disaster institutions and capabilities that were considered essential to mitigating the impacts of and facilitating recovery from recurring natural disasters. Examples of the support provided by the UNDP to these communities included:

- Developing community disaster committees and community disaster management plans
- Providing training in basic search, rescue and first aid techniques
- Conducting mock disaster drills to illustrate basic survival techniques, such as seeking higher ground to avoid floodwaters and using empty barrels and banana stems as flotation devices,
- Promoting appropriate and low cost housing reconstruction techniques.

These initiatives are credited with enabling the governments and relief organizations to rapidly mobilize relief efforts at the local level in these countries, which were essential to overall relief and recovery operations, particularly immediately following the impact of the 2004 tsunami (Fritz Institute, 2005). One concrete example of the essential character of local preparedness can be found in the case of Samiyarpettail, one of the Indian villages with which the DRM had worked only months before the Tsunami struck in December 2004. In Samiyarpettai only 24 lives were lost due to the Tsunami, while in nearby villages, such as Pudupettai, located less than a half mile away, nearly four times this number of lives were lost. As one survivor from Samiyarpettai noted, "Many more of us would have been killed had we not done what we were trained for" (UNDP, 2005b).

Response

Private Sector Involvement (Logistics)

With massive amounts of aid being committed, United Nations Secretary-General Kofi Annan noted that the biggest challenge to the response effort was overcoming the logistical challenges of distributing aid and relief supplies to the hardest-hit areas (UN News Centre, 2004).

While logistics continued to pose a serious challenge throughout the recovery (Fritz Institute, 2005), at least one example of good practice stands out from the rest – the impact that the Disaster Response Network's Airport Emergency Team (AET)⁴⁹ had on increasing the flow of relief supplies into tsunami-afflicted areas.

Because of the destructiveness of the tsunami, the scale of the response effort overwhelmed various institutions in the affected countries. Considerable quantities of aid supplies perished at the regional coordination center in Singapore as efforts to deliver the supplies were slowed by widespread damage to roads, and delays persisted at the region's airports, which were not used to handling the high volume of flights required in the wake of the disaster. In Sri Lanka the main airport in Colombo temporarily ran out of fuel, and in Aceh (Indonesia) a runway was temporarily out of commission when an aid aircraft ran into a cow.

In an effort to improve the flow of air cargo traffic into and out of the Colombo airport, the United Nations Joint Logistics Center (UNJLC) team coordinating the delivery of relief supplies in Sri Lanka requested the assistance of the AET on December 28, only two days after the earthquake. The AET concept was developed following the earthquake in Bam (Iran) in which Disaster Response Network (DRN) representatives observed that local airport congestion was a severe constraint in the delivery of relief supplies. After considering a number of alternatives, the DRN organized companies in the air transport sector to facilitate voluntary employee involvement in the AET. By the end of 2004, DRN had recruited 60 employees from companies such as

⁴⁹ The Disaster Response Network (DRN) is a global network of companies in the engineering, construction, logistics and transportation sectors that was as an initiative of the World Economic Forum in 2001 to facilitate business contributions of talent or in-kind donations during the emergency response phase of disaster relief, including delivery of donations to humanitarian organizations (Warhurst, Anastasi, and Franklin, 2005).

Emirates Air, Aramex, Chapman Freeborn, DHL, Dnata Cargo, and TNT Air Cargo who were trained in disaster response, personal and group security, team building, first aid and survival to form and prepare AETs to provide air logistics support in future disasters.

Initially, the UNJLC had asked the AET simply to help manage the air cargo operations at the Colombo airport. Shortly after beginning their work, however, the UNJLC asked the AET to take direct control of all emergency relief cargo operations at the airport, including the direct management of the 150-employee workforce. After only two days of working to improve operations at Colombo, the UNJLC requested on December 30 that a second DRN team be dispatched to take over operations at the Banda Aceh provincial airport in Indonesia. Both instances led to a significant increase in the throughput and dissemination of humanitarian relief by as much as tenfold (Warhurst, Anastasi, and Franklin, 2005, p.39).

Key Findings

The 2004 Indian Ocean tsunami was the deadliest in recorded history. Because of this, there are surely a number of different lessons to be learned from evaluations of the response and recovery efforts. In this case, we have focused on two specific examples of good practice that have been clearly documented - the development of local disaster management capabilities and the improvement of air cargo operations through the involvement of private sector logistics expertise. These two examples identify in particular the importance of non-governmental activities in effective disaster response and the importance of their having full authority to conduct and coordinate their operations.

Local disaster management capacity: In both India and Sri Lanka, the development of local disaster management capacity is credited with saving scores of lives. As one example, only 24 lives were lost in Samiyarpettai, India, a community that had developed local disaster management plans and systems before the onset of the tsunami, while several times this number of lives were lost as a result of the tsunami in many of the nearby villages, some of which are less than a half mile away. (UNDP, 2005b).

Private sector involvement (logistics): Because of the destructiveness of the tsunami, the scale of the response effort overwhelmed various institutions in the affected countries. Considerable quantities of aid supplies perished at the regional coordination center in Singapore as efforts to deliver the supplies were slowed by widespread damage to roads, and delays persisted at the region's airports, which were not used to handling the high volume of flights required in the wake of the disaster. And, while logistics continued to pose a serious challenge throughout the recovery, the efforts of the Disaster Response Network's Airport Emergency Team (AET) made a significant contribution to increasing the flow of relief supplies into tsunami-afflicted areas.

4.7. INDONESIA - LANDSLIDES (2002-2003)

Summary Statistics	
Date:	October 2002 – April 2003
Human Consequences:	108 deaths
Economic Losses:	Unknown ⁵⁰

Indonesia, the world's largest archipelago nation, is subject to many natural and man-made disasters. Droughts, tsunamis, earthquakes, volcanic eruptions, landslides, and forest fires have all taken a significant human and economic toll on the country and its people. As many as 800 landslides occurred in Indonesia during the 1990s, killing at least 735 people. The landslides are frequently caused by monsoon rain in areas where land has been weakened by deforestation (Harvard School of Public Health Program on Humanitarian Policy and Conflict Resolution (HPCR), 2002).

Event Description

During the period of October 2002 to April 2003, there were 44 landslides on Java and the Flores Islands as a result of heavy rains. In total, 108 persons died in these landslides, with the largest number of casualties occurring in:

- Ende, East Nusatenggara - 40 casualties (April 2003)
- Pacet, East Java - 32 casualties (December 2002)
- Kadungora, West Java - 20 casualties (January 2002)

Exemplary practices Identified

Prevention/Preparedness

Early Warning

In 2002, the Minister of Research and Technology established a team of scientists and other experts from several Indonesian institutions to make

⁵⁰ Except where otherwise noted, the material for this case is drawn from "Early Warning on Landslide Affecting Rainy Season of October 2002 - April 2003 in Indonesia (Lesson to Learn)," (Effendi,).

recommendations on improving the country's prediction, early warning, and preparedness measures to better prevent and mitigate natural disasters. The team consisted of geologists, meteorologists, as well as other natural scientists and social scientists, with those from the Meteorological and Geophysical Institute (BMG) and the National Aerospace Institute (LAPAN) playing lead roles.

Beginning in August 2002, the team focused its efforts on improved methods for predicting rain intensity and distribution for the upcoming rainy season of October 2002 to April 2003. The team from the Meteorological and Geophysical Institute BMG focused on forecasting the intensity of rainfall for different parts of the country during the rainy season. BMG's forecasts suggested that the areas of West Java, central and northern East Java, South Sumatera, Jambi, South Sulawesi and Central Flores would be hardest hit, receiving more than 400 mm of rain per month during the season. Central Java and the remaining area of East Java were forecast to receive 300-400 mm/month. And, in Aceh, rainfall was forecast to be at its lowest level, at 200-300 mm/month for the season.

Meanwhile, the LAPAN, utilizing a different approach, forecast the probability of above average rainfall levels. According to LAPAN, East Java had the greatest probability of receiving above average rainfall for the region (300 millimeters per month) during the period of December-February (2002-2003), while West Java also had a significant probability of receiving more than its predicted average of 400 mm/month for the period. Central Java was forecast to most likely receive only average rainfall.

These two approaches were then combined to produce three categories of predicted high rainfall intensity:

- a) Expected rainfall of more than 400 millimeters per month (as estimated by BMG) with a probability *greater* than 50 percent that this amount would be exceeded (as estimated by LAPAN)
- b) Expected rainfall of more than 400 millimeters per month with a probability *less* than 50 percent that this amount would be exceeded

- c) A probability greater than 50 percent that the expected amount of rainfall would be exceeded in the area regardless of the expected amount.

These rainfall intensity categories were then overlaid on a map of Indonesia, produced by the Directorate of Environmental Geology (DEG), which indicated the susceptibility of the geography to landslides. Combining the rainfall intensity predictions (as categorized above) with the landslide susceptibility ratings (Very Low, Low, Medium, or High), allowed researchers to produce a composite risk assessment of regions of the country. These four composite categories of landslide risk were:

Category One: Low-High susceptibility to landslides (as estimated by DEG), and expected rainfall of more than 400 mm/month with a probability greater than 50 percent that this amount would be exceeded (as estimated by BMG and LAPAN)

Category Two: Medium-High susceptibility to landslides (as estimated by DEG), regardless of rainfall intensity

Category Three: Low susceptibility to landslides, but expected rainfall of more than 400 mm/month with a probability less than 50 percent that this amount would be exceeded

Category Four: A probability greater than 50 percent that the expected amount of rainfall would be exceeded in the area.

Regions classified in either Category One or Category Two were identified as alert areas.

After intensive review and some minor modifications, a press conference was held in December 2002 to present the map to the public along with recommendations for prevention and mitigation measures. The press conference was covered by the national television broadcaster, the national press office, the national radio broadcaster, and several local newspapers.

Following the 2002-2003 rainy season, the landslide prediction map of Indonesia for the period of October 2002 to April 2003 was seen to have provided reasonably accurate predictions of the landslide events during the season.

Key Findings

Although the 2002/2003 rainy season in Indonesia was marked by substantial devastation, the Indonesian effort sought to better inform the people of Indonesia of the risk posed to them by landslides and to make them more aware of and familiar with how to implement recommended prevention and mitigation strategies.

Early Warning: The significant efforts taken by the Indonesian government to improve its prediction and early warning system demonstrated that although it is not possible to predict with complete accuracy the likelihood of a landslide in any one area, reasonable predictions and then efforts to inform the public of these predictions can be undertaken to raise awareness of prevention and mitigation actions. This is just one example of heightening awareness, with an underlying assumption that such early warning activities can be especially valuable if they are carried out and their findings communicated in a timely and effective manner, as well as if they are better integrated with both international and community-level early warning systems.

4.8. IRAN - EARTHQUAKE (2003)

Summary Statistics	
Date:	December 26, 2003
Human Consequences:	30,000 deaths, 30,000 injuries, 75,000 to 90,000 displaced
Economic Losses:	\$1.5 billion ⁵¹

Because of its size, geographical location and climactic diversity, Iran is one of the most disaster-stricken countries in the world, suffering from tropical storms, floods, droughts and earthquakes, among other types of disaster. In terms of both human and economic losses, earthquakes are the most devastating form of natural disaster that afflicts the country - more than 950 earthquakes shook the country from 1993-2003, prior to the Bam earthquake, and killed more than 37,000 persons and injured more than 53,000 (Araghizadeh, Saghafi Nia, et al., 2003).

Bam, located in the Kerman Province of south-eastern Iran, lies along the Silk Road to the north of the Persian Gulf and the Gulf of Oman. Bam is most recognized for the World Heritage Site of Arg-é Bam, the extensive adobe citadel that is more 2,000 years old. Situated near an active seismic fault, Bam has suffered 19 major earthquakes since 1909. Between 143,000 and 178,000 persons have been reported to have died during these disasters. Before the 2003 earthquake the population of the city was estimated at 120,000 (IFRC, 2004).

Event Description

On the morning of December 26, 2003, residents of Bam, Iran, found themselves at the center of a 6.7-magnitude earthquake. Even though the quake lasted just 20 seconds, roughly 85 percent of the city's buildings

⁵¹ Except where otherwise noted, the material for this case study draws on International Federation of Red Cross and Red Crescent Societies, "Chapter 4: Bam sends warning to reduce future earthquake risks," (IFRC, 2004); *Report of the Workshop of Lessons Learnt on the National and International Response to the Bam Earthquake, Kerman, Islamic Republic of Iran*, (Calvi-Pariseti, 2004); *Health Sector Response to the Bam Earthquake: Lessons Learnt*, (WHO, 2005); and, "WHO praises Bam response but warns of Disease," (Zaracostas, 2004).

collapsed and as many as 30,000 persons died. Another 30,000 persons were injured, and practically all the survivors were left homeless. It is estimated that only 10 percent of the population remained in the city in the months after the earthquake. Total economic damage was estimated at \$1.5 billion. Losses could have been even worse if some persons had not fled after three smaller tremors that preceded the major quake (IFRC, 2004).

The destructiveness of the earthquake is attributed to the coincidence of several critical factors. Geologically, the earthquake was Iran's shallowest ever, and thus particularly damaging. Second, it struck Bam at dawn on a Friday, when residents were most likely to be still be asleep and unable to respond quickly. In particular, the traditional mud brick buildings of Bam were notably non-resilient to tremors and are believed to have disintegrated and buried victims alive under piles of dirt rather than trapping them under solid debris within which air could be trapped or through which air could pass. Similarly, in spite of Iran's 1989 adoption of building regulations regarding earthquake-resistant construction, non-traditional buildings are believed to also have been vulnerable to the earthquake due to inconsistent application of the regulations.

Exemplary practices Identified

Response

International Response Coordination

The activities of the Iranian authorities, the Iranian Red Crescent Society (IRCS) and the international community immediately following the earthquake are widely cited as a model of swift, effective and exemplary disaster response. Within the first few hours after the earthquake, the provincial government set up a six-member committee chaired by the Governor-General of Kerman to coordinate the relief efforts in the affected area, and various national governmental and nongovernmental agencies, including the Ministry of Interior and Ministry of Health, the Iranian Army, and the IRCS launched immediate rescue and relief operations. Jesper Lund, head of the United Nations Disaster Assessment and Coordination (UNDAC) team, has noted that the well-coordinated emergency teams "prevented it being a larger disaster than it already was" (Zaracostas, 2004).

In actuality, the Bam response and recovery operations were as effective as they were in large part thanks to the coordination efforts of the UNDAC team and the IRCS. In response to Iranian authorities' launching of an international appeal for aid and waiving visa requirements for foreign aid personnel, unprecedented decisions for the country, nearly 1,800 search and rescue, health and relief personnel from 44 countries arrived in the region to assist in the response. The UNDAC team along with the UN Country Team and other UN agencies supported the Iranian government's coordination of this response and mobilization of relief supplies and technical support. In total, as many as 60 countries provided in-kind and cash contributions, supporting the establishment of ten field hospitals in the area, along with broad distribution of food items, tents and blankets and other relief assistance.

Local Response Coordination

Another example of good practice was the ICRC's dividing of Bam into 13 sectors, each of which was sponsored by another Iranian province that sent medical teams to the disaster area. Altogether, more than 8,500 volunteer personnel were recruited through the sponsorship system to help in the recovery efforts. Aware of the risk of alienating the local population with the introduction of so many relief personnel, the ICRC mobilized local "notables" or "white beards" to help serve as liaisons between relief personnel and community members and to coordinate relief efforts within each community.⁵²

Emergency Medical Care

Another example of the effective response in Bam, was the significant health efforts undertaken by the Iranian government, including the massive medical evacuation efforts and disease surveillance and management efforts. Altogether, due to the response of the Iranian authorities and international relief operations, more than 12,000 seriously injured persons were airlifted

⁵² According to the IFRC (op. cit.), the Iranian Red Crescent Society's sponsorship system succeeded in attracting considerable aid, but also resulted in some disadvantages, including increased coordination challenges, inequality in the amount of aid provided to the 13 sectors, and a hampering of "municipal memory" as the 28 sponsoring provinces were rotated among the various sectors in Bam.

within the first two days following the earthquake to other areas for medical care (Zaracostas, 2004). And, as part of the active disease surveillance and management efforts, health personnel visited families tent-by-tent to document the needs of the survivors and provide such services as the replacement of lost medications for chronic illnesses.

Local Response Capacity

David Heymann, a WHO special envoy with the UN disaster-assessment team for Bam, emphasized that the swift and effective Iranian response was an example of the Iranian health ministry's successful learning from previous earthquakes (Zaracostas, 2004). For example, one of the most cited stories of success in the response effort is the Iranian Red Crescent Society's saving of 157 lives through the use of rescue dogs. This was more than seven times the number of persons saved by international search and rescue teams. This success marked a notable shift from the rescue methods used after the 1990 Gilan earthquake, when rescue dog teams were rejected by Iran because dogs are considered impure in Islam but since which the Supreme Islamic Council was convinced of the value of approving of the dogs in the interest of saving human lives.

Recovery/Redevelopment

Communications

In the aftermath of the Bam earthquake, the United Nations Development Program (UNDP) began production of a bi-weekly community newsletter for the affected community. The newsletter, which reached a circulation of 10,000, was initiated as a reliable means of disseminating critical information about the recovery activities, including critical information for families making rebuilding decisions and urgent feedback to authorities and donors about community needs and responses to proposed recovery and redevelopment initiatives. Through this effort, 52 local volunteers were trained on reporting and journalism by UNDP and were involved in the whole process of producing the newsletter from preparing reports to distributing the newsletter throughout the region. The newsletter served as a means of informing community members about the recovery and redevelopment processes, models of successful recovery activities throughout the community, lessons

learned for use by individuals and organizations involved in the recover. It also served as a means of disseminating critical information on job opportunities, shelter opportunities, victims' entitlements, recommended safety and risk reduction actions, and health care availability. Lastly, the newsletter provided a forum for community members to voice their concerns about these processes and provided a platform for cultural expression by the people. After the effectiveness of the newsletter had been established and appropriate agreements had been reached, the Bam Municipality took over its production, established an office responsible for production. The initiative also stimulated other organizations to start their own sector-specific newsletters to disseminate information on ongoing redevelopment efforts (UNDP, 2005a).

Key Findings

The effectiveness of the immediate search and rescue activities undertaken in response to the Bam earthquake can be masked by the number of lives lost. However, it should not be forgotten that many of these losses were due to the vulnerability of the mud brick-constructed buildings of the area. Among the lessons to be learned from Bam are:

International Response Coordination: While the economic and especially human consequences resulting from the earthquake were significant, the loss of human life would likely have been even higher if not for the Iranian government's swift response, including its open appeal for assistance from the international community and its effective coordination, with the assistance of the United Nations and the IRCS, of the massive international response to this appeal.

Local Response Coordination: In addition to the effective coordination at a macro-level of the efforts of the various relief organizations responding to the Bam earthquake, the IRCS was able to mobilize greater support for relief assistance throughout the affected region by matching affected sectors with sponsoring provinces from other parts of the country and by utilizing local leaders to coordinate relief efforts in affected communities.

Emergency Medical Care: Recognizing the massive emergency medical care needed in the aftermath of the Bam earthquake, the Iranian government's open appeal for international aid allowed for more than 12,000 persons to be evacuated by helicopter for emergency medical attention and for relief personnel to visit survivors in temporary shelter camps tent-by-tent as part of a comprehensive disease surveillance and management effort.

Local Response Capacity: One example of the Iranian government's efforts to develop its local response capacity prior to the Bam earthquake was its development of rescue dog teams. While the number of persons saved by the IRCS rescue dog teams pales in comparison to the total number of lives lost, the effectiveness of these teams was recognizable and demonstrates the importance of the Iranian government's learning from previous experiences to develop greater local response capacity.

Communications: Finally, the UNDP's initiation of a newsletter to keep the community of victims informed as to the ongoing and prospective recovery efforts demonstrates how relatively simple efforts can play an important role in meaningfully engaging community members in such efforts.

4.9. MEXICO – EARTHQUAKE (1985)

Summary Statistics	
Date:	September 19, 1985
Human Consequences:	9,500 deaths, 30,000 injuries, 100,000 displaced
Economic Losses:	\$4 billion ⁵³

While the country of Mexico and its capital, Mexico City, are vulnerable to a variety of natural disasters, Mexico City is particularly vulnerable to earthquakes. During the twentieth century, 35 earthquakes of magnitude greater than 7.0 occurred in the seismic zone marked by the west coast of southern Mexico and Central America, where the Cocos Plate dips beneath the North American Plate. Mexico City itself lies in a broad basin formed approximately 30 million years ago by faulting of an uplifted plateau and closed by volcanic activity. The expansion of the Mexico City and the gradual draining of Lake Texcoco upon which it is built have left the city located largely on unconsolidated lake-bed sediments that amplify seismic waves. Prior to 1985, earthquakes in 1957 and in 1979 also damaged Mexico City (John Martin & Associates, 2006).

Event Description

On September 19, 1985, at 7:19 a.m., Mexico City was struck by one of the most destructive earthquake events in the hemisphere's history. The initial earthquake, measuring 8.1 on the Richter scale and lasting 50 seconds, was followed by a number of aftershocks through the following day, the largest having a magnitude of 7.8.

Poorly-built tenements, housing low-income families in overcrowded conditions and suffering from a lack of maintenance and repair, experienced the worst damage. All told, losses related to the disaster included more than 9,500 deaths (official count, unofficial counts are up to 30,000) and

⁵³ Except where otherwise noted, the material for this case study draws on "Case Study: Housing Reconstruction in Mexico City," (Kreimer and Echeverria, 2006).

30,000 injuries, and 100,000 persons displaced from their homes (United States Geological Service, 2003). In total, 412 buildings were destroyed and more than 3,000 more were damaged (United States Geological Service, 2003). Of these damaged or destroyed buildings, more than 2,000 were residences, 340 office buildings, 1,200 small industrial workshops, and 1,200 schools. Additionally, more than 2,000 hospital beds and 1,700 hotel rooms were lost. Total economic losses were estimated by the Ministry of Finance and the Economic Commission for Latin America and the Caribbean (CEPAL) to be \$4 billion.

Exemplary practices Identified

Recovery

Designation of Lead Recovery Institution

On October 14, 1985, just three weeks after the earthquake disaster, Mexican President Miguel de la Madrid issued a presidential decree establishing Popular Housing Reconstruction (Renovación Habitacional Popular, RHP), an autonomous agency with a two-year mandate to:

- Rebuild and reorganize urban areas damaged by the earthquake, following the principles of urban renewal and social development.
- Define a policy of social development that preserves and protects the physical and social patterns of urban life, guarantees ownership of the dwellings to the beneficiaries, and provides needed urban services.
- Combat land speculation.
- Allocate in a systematic fashion the funds that would be made available through the program.

To staff the RHP on short notice, the Mexican government temporarily transferred senior planners and engineers from the Ministries of Communications and Transport, the Secretariat of Urban Development and Ecology, the Federal Electricity Commission, the Urban Transportation Commission, and many agencies of Mexico City's Federal District. Within the first five months following the quake, by the end of February 1986, the Social Development Office issued a "Handbook of Social Procedures" explaining

how disaster victims could get the replacement housing conceded to be their right.

Beneficiary Census and Identification

Also in the first months immediately following the earthquake, RHP of the number and socioeconomic characteristics of the persons affected, and matched this data with data on the physical conditions of dwellings. On the basis of this census, victims were awarded certificates validating their eligibility for housing assistance.⁵⁴

Community Involvement and Preservation

In this process, RHP also organized earthquake victims from each reconstruction or rehabilitation site into a "renovation council." These councils held regular meetings to promote the maintenance of victims' social relations and support systems, to review and revise RHP program plans, including review of site plans and prototype apartment designs, and to generally provide forums for residents to speak out regarding redevelopment. Because of the attention paid to making the planning process as inclusive as possible, for many groups this process took as long as eight to nine months, while construction could take half as long. Only after agreement was reached on reconstruction plans were beneficiaries legally formed into a condominium association, cooperative, or nonprofit organization that agreed to vacate the building so reconstruction could start.

During planning and design, five types of groups worked with the earthquake victims: political parties, university groups, technical support groups, and private voluntary and religious organizations. More than half the sites received support from one or more organizations, starting with the census survey. RHP coordinated interdisciplinary teams of persons from these groups, trained in medicine, psychology, sociology, architecture, and engineering, initially to conduct the victims survey and evaluate damages and later to provide technical support and social services at temporary shelters.

Early proposals for reconstruction focused on vacant land in outlying areas, including a site adjacent to the airport - but in response the

⁵⁴ While the certificates of residency were issued regardless of who legally owned the building, many families had abandoned their dwellings immediately after the earthquake, which made it difficult to document all displaced persons' rights to new dwellings.

preferences of many families who had lived in neighborhoods for several generations and to the influence of the World Bank, the government adopted a policy of rebuilding onsite with minimal relocation. This decision required expropriation of privately held land and the provision of temporary shelter for families in the immediate vicinity. Temporary shelters of corrugated aluminum or zinc were generally located within a block of residents' building sites, on public land wherever possible.

Rent Payment Assistance

In addition to the reconstruction effort, RHP had also administered a rent payment assistance program to help displaced households regain their economic footing. This program provided nearly 20,000 families with an average of eight months of assistance per family and included payments for moving furniture and personal possessions twice. On average, each family received 364,704 pesos (\$750), for a total outlay of \$15 million.

Rapid Completion

By the end of 1986, just over a year after the earthquake, RHP had completed the building of more than 21,000 homes, of which more than 10,000 had already been repopulated by displaced families. RHP was completing homes so quickly, more than 2,600 homes a month, that it needed to accelerate its removal of temporary shelters, which also enabled the agency to begin restoring the streets and parks that had been occupied by the temporary shelters. By July 1987, just short of two years following the earthquake, the reconstruction of 45,100 homes was completed, at an average of 3,220 dwellings per month. During the peak period of February-April 1987, RHP was completing more than 120 homes a day. In total, more than 1,200 private companies participated in the RHP redevelopment program and more than 175,000 jobs were created. On February 6 the International Union of Architects recognized the RHP with the Sir Robert Matthew Gold Medal award for "the best piece of work on human settlements carried out internationally in the previous three years."

By May 1987, the closure of RHP had begun. Most RHP personnel returned to their former agencies. Borrowed equipment and furniture were returned and prefabricated offices and warehouses dismantled. RHP donated much of its

office equipment and many computers and vehicles to the city government, which assumed all of RHP's rights and obligations on RHP's demise, as well as to other housing programs organizations. The loan portfolio for recovering the loans for 42,000 dwellings and commercial outlets and 2,745 lots (or 94 percent of the total loans issued by RHP) was handed over to the Low-Income Housing Loan Trust Fund, FIDERE. (By September 1987, the gross repayment to FIDERE - including monthly payments, advance payments, and insurance - had reached about \$10 million.)

Key Findings

Toward the end of the RHP's reconstruction efforts, Manuel Aguilera Gomez, director general of the agency, wrote, "The earthquake revealed the nakedness of part of the city center. The solution was not to hide the poor in the suburbs, but rather to provide them with appropriate housing. To achieve this aim we all learned to reconcile the desirable with the feasible. We learned to listen with care and interest to the sentiments of those affected by reconstruction. Little by little - in stages - the attitudes of the program beneficiaries changed from hostility, uncertainty, incredulity, suspicion, and doubt to hope and confidence." In this quote, Aguilera Gomez notes the most central characteristic of the RHP effort - a prioritization of the physical, socio-cultural and psychological needs of the victims in reconstruction efforts and the meaningful incorporation of these victims in the reconstruction process. In addition to this central characteristic, however, there are several other practices to highlight.

Designation of Lead Recovery Institution: Foremost amongst these is that the government played a critical leadership role in the recovery process by designating early on a lead institution to be responsible for the recovery. In this case, the Mexican government did not turn to an existing agency but demonstrated the effectiveness in particular of establishing a time-limited institution with the specific goal of promoting the recovery within a certain time period.

Beneficiary Census and Identification: Also in the first months immediately following the earthquake, RHP updated its estimates of the number and socioeconomic characteristics of the persons affected, and matched this data with data on the physical conditions of dwellings. On the basis of this

census, victims were awarded certificates validating their eligibility for housing assistance.

Community Preservation and Empowerment: In this process, RHP also organized earthquake victims from each reconstruction or rehabilitation site into a "renovation council." These councils held regular meetings to promote the maintenance of victims' social relations and support systems, to review and revise RHP

Rent payment assistance: In addition to the reconstruction effort, RHP had also administered a rent payment assistance program that helped nearly 20,000 families.

Rapid completion: By July 1987, just less than two years following the earthquake, RHP had completed building more than 45,000 homes and restored many displaced families into homes. In spite of the pace of reconstruction, the Mexican experience suggests that such rapid reconstruction does not have to come at a loss of quality. The rapidity of such quality reconstruction seems to have promoted the success of the recovery effort and have prevented the reconstruction from lagging behind expectations or becoming stalled, as well as helping victims recover psychologically from the disaster experience.

4.10. MOZAMBIQUE – FLOODS (2000 AND 2001)

Summary Statistics	
Date:	January – March 2000
Human Consequences:	700 deaths and 550,000 displaced
Economic Losses:	\$450 million (UNDP, 2004)
Date:	February – May 2001
Human Consequences:	113 deaths and 223,000 displaced
Economic Losses:	\$30 million (Republic of Mozambique, 2001)

Mozambique is characterized by great irregularity in rainfall. The country may suffer either excessive rains that cause floods in the river basins or insufficient rainfall, leading to prolonged droughts. The rainy season starts in October and ends around March, and cyclones and floods are common annual occurrences (Muñoz Leira, 2001). From 1965 to 1998, there were twelve major floods, nine major droughts, and four major cyclone disasters in Mozambique (Wiles, Selvester, et al. 2005).

Event Description

In 2000, southern Mozambique suffered from heavy rains and a series of tropical storms that simultaneously flooded, for the first time in recorded history, the Limpopo, Incomati, Umbeluzi, Save, Buze, and Pungoe rivers; an area nearly the size of Belgium and the Netherlands combined was submerged. Over half a million people were forced to leave their homes and relocate to over 200 sites.

One year later, the central provinces of Mozambique were hit hard by prolonged and intense rains that flooded the Zambezi River basin. The death toll of the 2001 floods was lower than in 2000 because of the slower onset of the disaster and because the two large dams on the Zambezi River coordinated their discharges so that water levels remained relatively stable (IFRC, 2002; Wiles, Selvester, et al., 2005).

Combined, these devastating floods killed over 800 people and displaced almost 800,000. However, the magnitude of each disaster was such that human losses could have been much higher. Even though Mozambique is one of the poorest countries in the world, it had made significant investments in

disaster preparedness plans and showed great capacity to coordinate not only its own response, but also that of the many international countries and agencies that sent response teams into Mozambique. Evidence of Mozambique's success in preparing for and responding to these floods is the fact that more than 60 people were rescued for every person who died (IFRC, 2002).

Exemplary Practices Identified

Prevention/Preparedness

Early Weather Predictions and Prevention Measures

Several months before each of the two floods, meteorologists in Africa predicted higher-than-average rainfall in Mozambique (IFRC, 2002) (Muñoz Leira, 2001). Medium-term warnings can often be inaccurate since they cover a broad area, while floods and droughts generally occur in much smaller zones; nevertheless, they played a significant role in alerting Mozambican authorities and national and international agencies, allowing them to prepare in the months prior to the floods.

In 1999, after meteorologists issued the warnings of heavy rains likely to hit southern Mozambique in early 2000, the Mozambique Red Cross (CVM) began to retrain volunteers in the areas likely to be affected. The government's National Disaster Management Institute (INGC, from the name in Portuguese) sent teams out to prepare and to warn people in vulnerable areas. January's traditional shipments of medicines by the Ministry of Health were dispatched in December to prevent possible delays due to floods. In addition, government officials cancelled their customary December/January holidays to prepare for the floods, and Mozambique renewed its contacts with the South African Air Force, which had helped in previous emergencies (IFRC, 2002).

Similarly, after the Southern African Regional Climate Outlook Forum issued its forecast in September 2000 of higher than normal rainfall in central Mozambique for the first months of 2001, the INGC and relief agencies took several steps to prepare for possible floods. Among these steps were: drafting possible scenarios to serve as the basis for a contingency plan; preparing the contingency plan in groups led by the government, the UN system, and the CVM; and dispatching a multi-sector task force to the provinces at risk to update information about them and the resources

available for emergency response. The government contingency plan detailed the required supplies and budget by sector and by province, while the UN contingency plan outlined the responsibilities of each actor before and during an emergency. By December 2000, 5100 tons of food, fuel, water and sanitation, education, and health supplies, as well as rubber boats were pre-positioned in various places judged to be at risk. Warnings were broadcast on state radio in all local languages (Muñoz Leira, 2001; UN OCHA, 2001).

Coordination with Regional Partners

Fifty-two percent of the territory is located in international river basins: Mozambique shares nine basins with other African countries and is at the downstream end of the river in eight of these. Therefore, many of the floods that occur in Mozambique originate from rainfall in the upstream countries.

Strong coordination, good communication channels, and integrated water resources management between Mozambique and its neighbors are vital parts of the region's disaster preparedness system (White, 2001). Although the Southern African Development Community (SADC), of which Mozambique is a member, has focused for a long time on developing cooperative agreements on shared river basins, only recently a process of intense regional cooperation was started to anticipate, mitigate, and respond to sudden-onset natural hazards (Pilon, 2004).

Preparedness Planning and Exercises

Mozambique's ability to prepare so well in advance for disasters is not the product of chance. It is instead the result of a restructuring of the country's disaster preparedness agencies, which occurred through the 1990s with the institution of a variety of mitigation measures, transitioning from emergency response to a more comprehensive and integrated disaster risk management approach (UNDP, 2004). This transition culminated in 1999, when the Department for Prevention and Combat of Natural Calamities (DPCCN) was replaced by the INGC, which would focus on coordinating other agencies providing disaster relief.

The DPCCN had managed relief assistance during the civil war (1977-1992) and up to the late 1990s. Since the most important problem the DPCCN had

historically faced was theft by its own personnel, the government decided the INGC would not deal directly with commodities after its creation (DEC, 2001). Rather, the INGC's post-disaster tasks are resource mobilization, ensuring the continuity between the emergency response and recovery phases, and informing the Coordinating Council for Disaster Management about the rehabilitation activities. For its part, the Mozambique Red Cross chose to concentrate on providing basic health care for displaced persons and began training volunteers in this capacity (IFRC, 2002) (Wiles, Selvester, et al., 2005). In addition to the creation of the INGC, the government established an inter-ministerial council for coordinating disaster management between fifteen ministers and a multi-sector technical committee for Disaster Management chaired by the National Director. The goal of these organizations is to ensure coordination and collaboration in multi-sector planning of disaster mitigation and response activities.

Mozambique's annual contingency planning is so well respected that it has hosted numerous missions from other countries to learn from its experience, becoming a model in the SADC region. The process for the yearly, multi-sector, and multi-level National Contingency Plan begins at the sub-regional level by establishing a consensus on climate outlook for future seasons. Communities, districts, and provinces then gather early warning information with technical support from UN agencies and NGOs, which is processed centrally by the INGC. Every year, different sectors and at-risk districts and provinces exercise the National Contingency Plan after it is reviewed to incorporate the results of the aforementioned analysis (UNDP, 2004).

In 1999, less severe floods gave the INGC and Red Cross the opportunity to train and gain experience in their new roles. The INGC launched a large training exercise that involved simulations of rescue and relief operations (Hanlon, 2005). The simulations included the police, the Mozambique Red Cross, the Mozambique Flying Club, fire brigade, and scouts. Also in that year, stockpiles of relief goods were stored in areas at risk. Local, provincial, and national flood committees were created. Well established roles of preparedness, plus some degree of readiness and practice by the response agencies meant that they were reasonably well prepared to face the 2000 and 2001 floods (IFRC, 2002).

Community Preparedness

Mozambique's local governments and NGOs have also learned that involving the community can help improve the preparedness for disaster relief efforts. During the 2001 floods, a Mozambique Red Cross official found a group of volunteers trained in the drought of 1992-93 who were working in the relief effort. Their training had been simple but included instruction in critical tasks such as how to erect tents, organize a camp, register the displaced, assess needs, chlorinate water, build latrines, and carry out first aid and boat rescues. As one report notes, the advantage of such broad community-based disaster preparedness training is that it can be applied to a range of different disasters (IFRC, 2002).

Another interesting example of community involvement in Mozambique is how civil society is involved in disaster risk management (DRM) measures in the District of Buzi through a participatory process that involves several steps: (1) establish contact in the communities with traditional chiefs and elders; (2) organize/create a local/community DRM Committee; (3) undertake risk analysis and DRM activity planning in a participatory manner; (4) train communities on DRM using their local languages; (5) facilitate good working relationship between DRM and relevant institutions on all levels; and (6) execute a flood simulation exercise before the cyclone period (Simão Renço, 2005).

Response

Evacuation and Search and Rescue

Although the floods in 2000 and 2001 were predicted several months in advance and warning was given to populations at risk, no one expected the scale of the flooding that occurred—especially in 2000. In addition, even if people believed the warnings, many families were reluctant to abandon their possessions due to fear of looting (IFRC, 2002) (Muñoz Leira, 2001).⁵⁵ Thus, in addition to advance evacuations, search and rescue operations were inevitable.

⁵⁵ Former Mozambican President Joaquim Chissano has suggested using people who are well known and respected in the communities—such as school teachers—to watch rivers and issue warnings to their communities. The advantages of involving teachers are that there are many of them and they are respected, they are underpaid and would welcome extra income for doing community disaster education and for being “on call” during the flood season.

One of the distinctive features of Mozambique's evacuation is that most people were evacuated in predetermined groups by local leaders. Temporary accommodation centers were established on high ground, but with people from particular neighborhoods all living together. For example, the city administration of Chokwe, the largest city that was totally evacuated, moved as a group and continued to administer the new accommodation (Hanlon, 2005). The humanitarian response to the 2000 floods was generally considered successful both by the media and relief organizations. After the initial loss of life in the floods themselves, the mortality rate in the temporary accommodation centers, as well as the levels of malnutrition, were relatively low (DEC, 2001).

Table A.4.10.1: Number of Persons Rescued During the 2000 and 2001 Mozambique Floods

Operator	2000			2001		
	Air	Boat	Percentage	Air	Boat	Percentage
National	0	29,095	64%	2,376	3,100	77%
Regional	16,264	0	36%	357	0	5%
International	287	0	1%	0	1,300	18%

Source: IFRC, 2002b

In the first days of the 2000 floods, before help from other countries arrived, local coordination was the key for a quick and effective response. The Mozambique Red Cross and local health workers set up emergency health posts. Local officials organized the temporary accommodation centers, and local leaders took charge of distributing tents and food, and constructing latrines and water tanks (IFRC, 2002).

Reacting to the 2001 floods, the government of Mozambique set in motion the response mechanisms contained in its contingency plan, prepared in partnership with the UN, donors, and NGOs (Muñoz Leira, 2001). Search and rescue operations began early in 2001. Civilian and military assets were mobilized including inflatable boats, aircraft, and hundreds of canoes supplied by the local population. More than 7,000 people had been rescued by February 21 (White, 2001).

Common wisdom might suggest that in Mozambique, as one of the world's poorest counties, most disaster search and rescue operations would come from outside. In fact, international agencies were responsible for only a small

proportion of rescues in 2000 and 2001, and domestic individuals or institutions were responsible for 64 and 77 percent of persons rescued in 2000 and 2001, respectively (see Table 7.1). Moreover, national and regional rescuers (including the South African and Malawian military) carried out 97 percent of all post flood rescues for the two years combined. Another interesting and revealing observation is that, although dramatic helicopter rescues were continuously broadcast internationally, in both years more than 60 percent of people were saved by boats.

Leadership and Coordination

Two days before the first 2000 floods, the government activated its flood committee. Mozambique's foreign minister led the response and a joint logistics operations center (JLOC) was established in the office of the INGC, rather than in a separate UN office. As the floods became more severe, 250 different organizations sent thousands of people to help (IFRC, 2002). One of the main lessons learned from both floods is the importance of a strong coordinating institution to make the most efficient use of the efforts and resources of the many other institutions that deal with the floods at the local and national levels (White, 2001).

Requests for transport of food, medicines, tents, and staff were submitted every day to the JLOC, approved and given proper priority, and sent to the airport, where tasks were assigned to available aircraft after daily meetings. It was unprecedented that nine military air forces accepted tasking from a civilian coordination system rather than making their own decisions of what and where to fly. The results of this coordinated endeavor were remarkable.⁵⁶ According to the 2002 World Disasters Report:

Adequate water and sanitation meant there was no cholera; sufficient health staff kept malaria under control; enough food meant there was little hunger. Overall, the death rate of displaced people was lower than if they had stayed at home (IFRC, 2002).

⁵⁶ Not everybody agrees that the coordinated effort was so effective. The UNICEF evaluation report of the 2000 floods argues that the switch from the DPCCN to the INGC actually diminished Mozambique's capabilities through the loss of institutional memory and operational and logistical capacity (UNICEF, 2000).

An even clearer indication of the importance of the joint logistics operation in 2000 is the fact that it was not sustained in 2001 and the coordination was less effective. In 2001, the JLOC was based in Beira, capital of the province of Sofala, and fewer agencies participated. Unlike in 2000, neither Mozambican military helicopters, nor the South African air force, or the aircraft hired by INGC worked through the JLOC in 2001. A Red Cross official claimed that the Beira staff was less competent than those who were based in Maputo in 2000 and allegedly there were management problems that undermined the coordination effort.

Despite the lower effectiveness of the coordinated operations in 2001, individual international agencies found that their staff's experience in dealing with prior disasters in Mozambique improved their ability to respond to the 2001 floods. The UNICEF emergency coordinator during both floods remarked, "Operations were much better in 2001 because of existing staff with experience. This was one of the lessons taken over from 2000 to 2001." (IFRC, 2002)

Similarly, the Mozambique Red Cross, which had mobilized over 600 volunteers in the 2000 floods, played a bigger role and its coordinators were given more power than in 2000. The International Federation response was managed and coordinated with the Mozambique Red Cross and in its own offices.

Recovery/Redevelopment

The underlying philosophy of Mozambique's recovery program is that reconstruction and/or construction of new infrastructure should not only restore the previous level of development in the regions affected, but it should also improve the population's ability to resist future disasters. The government's objectives and strategies for recovery after both floods have aimed to move from the relief mode to a recovery agenda, where recovery is seen as an opportunity to move parts of the country forward, acting as an engine for development (Wiles, Selvester, et al., 2005).

After the 2000 floods, 43,400 families were resettled to areas less vulnerable to floods. In addition, shelter assistance was forbidden for those who did not resettle on approved sites. This underscores one of the most important issues for the government, which is to regulate the occupation of the flood plain: any new occupation must be analyzed before being approved.

For each of the major basins, flood-zoning studies are required to base the decisions regarding the various types of occupation (White, 2001). Although the reasoning behind this policy is understandable, resettling is a complex process that raises several issues and so it is not clear whether the effects of the government's resettlement policies have been entirely positive.⁵⁷

In addition to reducing disaster vulnerability, Mozambique's government sees the process of resettling the population displaced by the floods as an opportunity to improve the living conditions of people in flood-affected zones, where the level of poverty is extremely high (UN OCHA, 2001). Thus, a great deal of the post-flood recovery work has been undertaken within the framework of previous development programs. In practice, this is achieved through the use of standard ministry drawings and specifications for schools, health centers, and hospitals, which facilitates reconstruction. Similarly, one of UNICEF/Mozambique's emergency response principles mandates

Do not establish a separate program. Expand the Country Programme's objectives and strategies to encompass the emergency response (UNICEF, 2000).

Another example of this approach is the World Bank roads program in Mozambique, which already had a disaster contingency fund built into the original budget, thus providing a shortcut to reprogramming procedures (Wiles, Selvester, et al., 2005).

Key Findings

Despite its status as one of the ten poorest countries in the world, Mozambique was able to establish the institutions and mechanisms that allowed it to successfully prepare for and respond effectively to the 2000 and 2001 floods. Although the magnitude of these natural disasters, especially in 2000, was beyond what anyone could have imagined, the loss of human life was minor when compared to the number of people who were rescued or affected by the floods.

Several important lessons can be learned from Mozambique's disaster planning and response. Some of them are:

⁵⁷ For a short list of the issues that arose in Mozambique as a result of the resettlement of families, see Wiles (2005, p.21).

Planning and Exercising: Mozambique's annual multi-sector and multi-level National Contingency Plan involves communities, districts, and provinces who gather information that is processed by a central agency. The process includes training exercises and simulations that prepare all involved agencies (local, national, and international) to respond to emergencies.

Community Involvement: Communities are involved in carrying out the National Contingency Plan. Local authorities and NGOs have learned that training local volunteers in simple disaster relief tasks and risk management measures pays off because trained communities do not depend entirely on the actions of governments or NGOs to respond to emergencies.

Early Prevention Measures: The mobilization by both authorities and NGOs once they had been warned, months in advance, of the potential for large floods allowed them to warn people to prepare for them and to make sure that proper amounts of food, fuel, water and sanitation, education, and health supplies were pre-positioned in the areas likely to be affected.

Evacuations by Group and Maintenance of Local Governance: Evacuating people in prearranged groups led by local leaders has several benefits. It not only prevents the anxiety of families being separated for long periods, but also reduces the stress of being relocated, since people are evacuated and placed in accommodations with their own neighbors. Furthermore, as was the case of the city of Chokwe in 2000, this also facilitates the administration of the temporary accommodations, since local leaders can take charge of running the centers where their communities are located.

Response before Help from Outside Arrives: In both floods, the Mozambique Red Cross and government mobilized early to respond to the floods. Recognizing that outside help may take too long to arrive was important and allowed search and rescue operations to begin early, especially in 2001.

Strong Response-coordination Institution: Establishing the Joint Logistics Operations Center in the INGC offices, where all requests for supplies and staff were received and processed, allowed for a remarkable coordinated effort that prevented disease and mortality by assuring adequate levels of water, food, and sanitation and health supplies for affected areas.

Recovery as Development: The reconstruction of infrastructure can be used to improve the level of development of the affected areas and also to increase their ability to resist future disasters.

4.11. PHILIPPINES - VOLCANIC ERUPTION (1991)

Summary Statistics	
Date:	June 1991
Human Consequences:	200-800 deaths; 100,000 displaced
Economic Losses:	\$374 million (estimated) (Mercado, Bertram, et al., 1996)

Before 1991, Mount Pinatubo was a relatively unknown volcano located 55 miles northwest of Manila on the island of Luzon. As part of a chain of volcanoes that lie along the western edge of the island, Pinatubo rose approximately 5,700 feet above sea level, but only 2,000 feet above its sloping apron and less than 700 feet above other nearby mountains that largely hid the volcano from sight (Newhall et al, 1996).

As many as one million persons lived on or around Pinatubo, which sat at the intersection of three heavily populated provinces - Pampanga, Tarlac, and Zambales. Included among these one million residents were 20,000 indigenous Aeta, who lived in dense forests found on the volcano's slopes, and 20,000 American military personnel and their dependents, who lived at two U.S. military bases - Clark Air Base, 25 kilometers to the east summit, and Subic Bay Naval Station, 40 km to the southwest (Newhall, Hendley and Stauffer 1997, pp.1-2).

While Pinatubo was a known area of mild geothermal activity, the only documented incident of volcanic activity before 1991 took place on August 3, 1990, two to three weeks after a 7.8-magnitude earthquake struck 60 miles to the northeast, when a landslide on the upper northwest flank of the volcano caused a large ground fracture and steam emission at the volcano (Newhall et al., 1996).

Event Description

On the morning of June 15, 1991, Pinatubo exploded in the second largest volcanic eruption of the twentieth century.⁵⁸ The most powerful phase of the eruption lasted more than ten hours, generating an enormous cloud of volcanic ash that grew to 22 miles high and more than 300 miles across. Falling ash

⁵⁸ The largest volcanic eruption of the 20th century was the 1912 eruption of Katmai-Novarupta (Alaska) (Rosenberg, 2001).

covered thousands of square miles, and avalanches of hot ash (pyroclastic flows) roared down the slopes of the volcano and filled deep valleys with deposits of ash as much as 600 feet thick (Newhall, Hendley and Stauffer, 1997).

Coinciding with the eruption, Tropical Storm Yunya passed within 47 miles to the northeast of Mount Pinatubo, causing a large amount of rainfall in the region. The airborne ash from the eruption mixed with the rain from Yunya and fell to the ground, covering most of Luzon. Nearly 800 square miles were covered by a four-inch thick layer of ash and other volcanic debris. The thickest cover recorded in any location was 13 inches, six miles southwest of the volcano. Most of the human and economic losses from the eruption were attributed to the debris, as the weight of the material caused buildings to collapse, killing persons inside and nearby the buildings (Rosenberg, 2001; and Wright and Pierson, 1992).

In total, an estimated 200 to 800 persons died⁵⁹ as a result of Pinatubo's eruption, and more than 100,000 persons were left homeless, as 4,979 houses were destroyed and another 70,257 partially damaged. Damage to crops, infrastructure, and personal property totaled at least \$374 million, not including damage that resulted from the drifting of ash as far as 600 miles away (Mercado et al., 1996).

Exemplary practices Identified

Prevention/Preparedness⁶⁰

Local Early Detection and Monitoring

The resurgence of seismic activity at Pinatubo in August 1990 was not noticed initially by official monitoring efforts but by the Aeta people who lived on the slopes of the volcano and reported the landslides and fissures to the Philippine Institute of Volcanology and Seismology (PHIVOLCS) (Tayag, Insauriga, et al., 1996). In response to these reports, PHIVOLCS, which had

⁵⁹ While most early sources report that 200-300 deaths resulted from the 1991 eruption Pinatubo, later sources report that the number of deaths was 800. See "Philippine Volcano Erupts, 30,000 Flee Homes," (de Castro, 2000).

⁶⁰ Except where otherwise noted, the material for this section of the case study draws on Punongbayan et al, 1996, "Eruption Hazard Assessments and Warnings."

no monitoring or warning system set up at Pinatubo, dispatched a Quick Response Team to evaluate the activity. However, because steaming and thermal activity were normal for this area, it was concluded that the activity did not suggest anything abnormal.

Then on March 15, 1991, the Aeta again began to notice tremors, which they reported after also recognizing a series of small explosions near a mile-long stretch of steam vents along a fissure on the upper north flank of the volcano on April 2, 1991. In response to these reports, PHIVOLCS once again dispatched a Quick Response Team to assess the situation. This time, in spite of initial assessments once again that the activity was not volcanic, the team set up a monitoring station. After the team recorded more than 200 small, high-frequency earthquakes during the first 24 hours of monitoring, PHIVOLCS issued a recommendation for the precautionary evacuation of areas within a ten kilometer radius of the summit. As discussed further below, roughly 5,000 Aeta evacuated their homes as a result of this early warning. PHIVOLCS then set up additional seismographs and established a base camp where visual observations could be conducted.

Spurred on by the Aeta's early detection of seismic activity at Pinatubo along with signs of activity during the same period at Taal volcano, located less than 100 miles southeast of Pinatubo, PHIVOLCS petitioned USAID/Philippines to obtain the assistance of the Volcano Disaster Assistance Program (VDAP) of the U.S. Geological Survey.⁶¹ The three-person VDAP team arrived in the Philippines on April 23. Together, PHIVOLCS and the VDAP team installed a network of seismometers on Pinatubo, established the Pinatubo Volcano Observatory (PVO) at Clark Air Base, and began to compile information about the past eruptions of Pinatubo to create a volcano-hazard map. Between 30 and 180 high-frequency earthquakes were recorded each day during the next two months (April and May) (Wolfe and Hobblitt, 1996).

⁶¹ VDAP is a joint program of the U.S. Agency for International Development's Office of Foreign Disaster Assistance (OFDA) and the United States Geological Service (USGS), which the agencies established following the 1985 eruption of the Nevado del Ruiz volcano in Colombia, which killed more than 23,000 people. VDAP consists of a small crisis-response team of scientists from the USGS Cascades Volcano Observatory (CVO) in Vancouver, Washington, that can be rapidly mobilized and deployed overseas when the U.S. State Department receives an official request from a country, along with additional USGS scientists. Equipped with portable volcano-monitoring equipment, the deployed VDAP crisis-response team works with local personnel and USGS scientists back in the U.S. to provide timely information and analysis to emergency managers and public officials about the presenting hazard. VDAP also conducts training exercises and workshops in volcano-hazards response for foreign scientists and emergency-management officials (Ewert et al., 2005).

Early Evacuation

The first evacuations in the vicinity of Pinatubo began in early April 1991, shortly after the PHIVOCLS Quick Response Team began monitoring on April 2 and recorded the more than 200 small, high-frequency earthquakes during its first 24 hours of monitoring on the volcano. In response to PHIVOLCS' recommendation for the precautionary evacuation of areas within a ten kilometer radius of the summit of the volcano, roughly 5,000 Aeta quickly moved from their homes to more safely situated evacuation camps that were set up by the Department of Social Welfare and Development with the assistance of several non-government organizations.

When data from PVO monitoring instruments finally indicated on June 9, 1991, that a large eruption was imminent,⁶² the warnings were as effective as they were because of the previous efforts of PVO, PHIOVOLCS and VDAP. In total, more than 75,000 people safely evacuated before the June 15 eruption. The USGS and PHIVOLCS estimate that these early evacuations saved at least 5,000 and perhaps as many as 20,000 lives. Many of those living in the lowlands around Mount Pinatubo, including more than 15,000 American servicemen and their dependents were evacuated from Clark Air Base, fled to towns at safer distances from the volcano or took shelter in buildings with strong roofs. In the eruption, thousands of weaker roofs, including some at Clark AFB, collapsed under the weight of ash made wet by heavy rains, yet only about 250 lowland residents are thought to have been killed as a result. Of the 20,000 indigenous Aeta highlanders who lived on the slopes of Mount Pinatubo, all but about 20 were safely evacuated before the eruption (Newhall, Hendley, et al., 1997).

In addition to the many lives saved, hundreds of millions of dollars was also protected from damage or destruction in the eruption through timely evacuation. Losses of at least \$200 million were averted at the U.S. military bases alone, while Philippine and other commercial airlines also prevented at least another \$50 to 100 million in damage. Up to \$100 million in other

⁶² On June 9, the alert level was raised directly to five from three, when the Zambales monitoring team erroneously reported signs of an eruption in progress. Punongbayan, et al, (op. cit.) note that although this determination was in error, in hindsight the raising of the alert level to five was an important factor in motivating more persons to evacuate prior to eruption, including even more Aetans than had already evacuated, and encouraging those who had already evacuated to move further away from the danger zones.

property damage was also estimated to have been averted. In comparison, the evacuation efforts, including the monitoring that made timely evacuation possible, were conservatively estimated to have cost only \$41.5 million (Newhall, Hendley, et al., 1997).

Regular Public Warnings

The highly effective evacuation of the area around Pinatubo is credited to the efforts of PVO, PHIOVOLCS and VDAP to clearly identify the threat and build awareness of the importance of evacuation among both the general public and high-ranking government officials. From April forward, PVO prepared regular bulletins of daily earthquake counts and visual observations of the volcano's activity for the preceding 24-hour period. While each bulletin also included a judgment about the overall condition of the volcano, PVO was unsure of the appropriateness of using a warning scheme previously used for other Philippine volcanoes - as such, Pinatubo's condition was initially characterized simply as "unstable." Later, volcano bulletins and special advisories included an alert level and the identification of danger zones that should be evacuated, as discussed below.

The first critical component that made the bulletins effective was the identification of alert levels regarding Pinatubo's activity (Tayag et al., 1996). While PHIVOLCS was interested in providing more definitive predictions of the likelihood of eruptive activity at Pinatubo, there was no baseline information on Pinatubo's normal activity or the precursors of its eruptions and relatively little information about the precursors of eruptions as large as those of historic Pinatubo that would enable them to do so. As such, they instead developed a five-level alert system to grade the unrest of the volcano and provide an assessment of the corresponding lack of assurance that an eruption would not occur within a specified time period. The system was derived from similar schemes used at Rabaul caldera, Redoubt Volcano (Alaska), and Long Valley caldera (California), and generalized by the Office of the United Nations Disaster Relief Coordinator and the United Nations Educational, Scientific and Cultural Organization (Punongbayan, Newhall, et al., 1996). This scheme of alert levels that was released on May 13, 1991, is shown in Table 8.1.

Table A.4.11.1: Pinatubo Volcano Observatory (PVO) Alert Levels as Established on May 13, 1991⁶³

Alert Level	Criteria	Interpretation
No alert	Background; quiet.	No eruption in foreseeable future.
1	Low-level seismicity, other unrest.	Magmatic, tectonic, or hydrothermal disturbance; no eruption imminent.
2	Moderate level of seismicity, other unrest with positive evidence for involvement of magma.	Probable magmatic intrusion; could eventually lead to an eruption.
3	Relatively high and increasing unrest including numerous b-type earthquakes; accelerating ground deformation, increased vigor of fumaroles, gas emissions.	If trend of increasing unrest continues, eruption possible within 2 weeks.
4	Intense unrest, including harmonic tremor and/or many "long-period" (low-frequency) earthquakes.	Eruption possible within 24 hours.
5	Eruption in progress.	Eruption in progress.

*Stand-down procedure for Alert Levels 3 and 4:
In order to protect against "lull before the storm" phenomena, Alert Levels 3 and 4 will be maintained for the following periods after activity decreases to the next level:
Alert Level 3 – 72 hours
Alert Level 4 – One week*

Source: Tayag et al, 1996

The second component of information that made the PVO bulletins effective was the identification of danger zones. These danger zones were derived from the hazard zone maps that PHIVOLCS began disseminating on May 23, 1991. These maps identified the areas likely to be affected by hot ash flows (pyroclastic flows), ash fall (tephar), and debris flows (lahars) that would be generated in the eruption of Pinatubo, as well as delineating those "danger zones" for which evacuation was recommended. The preliminary hazard zone map was initially presented to President Corazon C. Aquino and her cabinet on May 23, and then presented to officials of the surrounding provincial governments in the following days, including officials from Pampanga (May 23), Tarlac (May 27), and Zambales (May 28). The map was also presented to municipal officials in Iba on May 28 and in Angeles City on June

⁶³ PHIVOLCS revised the definitions of Alert Levels in December 1992 to reflect the differences in the quality of Pinatubo's activity in that year, which was characterized by more quiet effusion of lava and dome building punctuated by minor explosions and as such was not as hazardous as in 1991. In this revision, the first three Alert Levels were retained with only a slight change in Alert Level 3 (Interpretation), and Alert Levels 4 and 5 were substantially modified (Tayag et al., 1996).

3, and disseminated in Disaster Coordinating Council meetings from the regional down to the barangay levels. Finally, the map was also printed in the Philippine Star national newspaper. These hazard maps were regularly updated before and after Pinatubo's major eruption, with particular attention paid to the mapping of lahar hazards following the eruption.⁶⁴

Drafts of the bulletins developed by PVO in the field were radioed to the PHIVOLCS central office for review, which then released them to the National Disaster Coordinating Council via the Office of Civil Defense, the Departments of Science and Technology and National Defense, and the Office of the President. PHIVOLCS also radioed the bulletins back to volcano monitoring field stations for dissemination to sub-national Disaster Coordinating Councils or local government officials to use in issuing evacuation orders. These regular bulletins released by PVO helped to keep the populace around Pinatubo informed as to the state of the volcano and the potential risk of eruption. The dates of changes in either the alert level or the danger zone specified in the PVO bulletins are shown in the table below.

⁶⁴ Punongbayan (1996) note that the PVO mapping effort was likely not as effective as it could have been due to the dissemination of two versions of the hazard map and the inclusion of overly technical detail. First, the authors note that the dissemination of a hand-drawn version of the map to local and regional audiences and a more carefully drafted map to national audiences, including to the national media, confused the map's users. And second, the authors also suggest that the asymmetric representation of danger zones on a hazard map to reflect statistically probable yet uncertain events, such as prevailing winds, can also unnecessarily confuse the map's users and lead them to overstate their safety due to their reading of the map as definitive.

Table A.4.11.2: PVO-Specified Alert Levels and Danger Zones, 1991

Date	Alert Level	Danger Zone (radius from summit)
April 7	Condition "unstable"	10 km
May 13	2	10 km
June 5	3	10 km
June 7	4	20 km
June 9	5	20 km
June 14	5	30 km
June 15	5	40 km
June 18	5	20 km
September 4	3	10 km
December 4	2	10 km

Source: Tayag et al, 1996

Community Awareness Building

The effective evacuation of the region around Pinatubo was also facilitated significantly by the efforts undertaken to build the awareness of the general population and national leaders about the significance of the threat posed by the potential eruption of Pinatubo and the need for early evacuation in the case of significant volcanic activity. For this purpose, PVO utilized a video entitled "Understanding Volcanic Hazards," produced by the late Maurice Krafft for the International Association on Volcanology and Chemistry of the Earth's Interior. The video, made after the 1985 eruption of Nevado del Ruiz (Colombia) that killed 25,000 people, shows graphic examples of hot ash flows, ash fall, volcanic mudflows, large volcanic landslides, volcanogenic tsunamis, lava flows, and volcanic gases.

In their efforts to raise awareness of the seriousness of the threat posed by Pinatubo, PVO personnel showed sections of the video on hot ash flows, ash fall, and mudflows to as many audiences as they could reach - including President Aquino and her cabinet, provincial governors, the chief of the Regional Disaster Coordinating Council, military base commanders, local officials, students, teachers, religious leaders, and barangay residents. In addition to screening the video for these groups, the PVO personnel left a copy of the tape with each group that was briefed.⁶⁵ PVO

⁶⁵ While PVO personnel did express concern that the video might have overstated the potential hazards associated with Pinatubo's eruption, they also expressed the belief that strong

personnel also made photocopies of technical reports about the potential impacts of ash on agriculture, public health, electrical power systems, and other activities or equipment, which they distributed to various groups as well.

To reach further, the education campaign enlisted the national and local media. PHIVOLCS staff in the main office and the PHIVOLCS field team in Zambales were regularly followed by radio, print, and TV reporters. Two television interviews featuring PVO staff are identified as having been particularly effective. One, on the Far East Network on May 27, was aimed at U.S. military personnel and their dependents but was also widely viewed by Filipinos throughout the area. The second interview, on Manila TV on May 28, reached an even wider audience. In each of these interviews, PVO personnel described the causes of the volcano's activity, the associated potential hazards and the PVO monitoring program, and sought to reassure viewers that they would be warned if the situation became critical while noting that the situation was not yet critical. When Pinatubo's level of activity began to increase only a few days later, Manila TV also carried updated interviews with PHIVOLCS scientists.

Response⁶⁶

Disease Surveillance and Control

When the Philippines Department of Health received news of the impending eruption of Mount Pinatubo, epidemiologists from the department immediately recognized that the hundreds of thousands of evacuees arriving at makeshift shelters in congested centers would represent a potential breeding ground for communicable diseases. In order to prepare for this event, officials from DOH met with local officials and the staff of other government agencies and dispatched health teams to evacuation centers.

images were necessary to move persons from complacency. Nevertheless, the concern about overstating the hazards and losing credibility led the PVO personnel to only show the sections of the film that were considered relevant to the Pinatubo situation as well as to refrain from showing the video on broadcast television.

⁶⁶ Except where otherwise noted, the material for this section of the case study draws on "Surveillance: Present and Future, Proceedings of the 1992 International Symposium on Public Health Surveillance," (Periquet, 1992).

Among the tasks undertaken by the Department Of Health teams was surveillance of outbreak-prone infectious diseases. Equipped with a pre-prepared, easy-to-use form for the diagnosis of persons arriving for health care, the health workers were able to monitor for such diseases as measles, diarrhea, pneumonia, malaria, and typhoid. Deaths from all causes were subjected to close scrutiny. This data was collected, consolidated at the provincial health office, and transmitted by telephone to the central office in Manila on a daily basis. During the first few weeks following the eruption, this data was also analyzed and reported to the Secretary of Health on a daily basis.

In addition to allowing the Department of Health to identify areas in which further action was needed, the surveillance data also allowed the Department of Health to avoid committing resources to unnecessary interventions. For example, surveillance of the evacuation centers showed no signs of large outbreaks of diarrhea or other acute infections, indicating that the food, water and sanitation measures that had been taken were adequate.

Finally, the surveillance data also proved to be useful in guiding USAID's efforts to provide relief and rehabilitation assistance during the months following the eruption.

One example of how this surveillance was used can be seen in the identification and treatment of a potential measles outbreak. During the weeks following the eruption, the number of people in the evacuation centers soared from approximately 10,000 to over 100,000, and the number of cases of measles began to increase in the shelters. In response, the Department of Health established the policy that every child under the age of six years would be required to receive a measles vaccine. Many of the Aeta did not vaccinate their children, however, which resulted in an identifiable increase in the number of measles cases and even deaths among these children. In an effort to address this situation before it got worse, the DOH set up special health teams to work with this population, and anthropologists were recruited to assist the teams in surmounting the cultural barriers that had previously prevented the health care workers from delivering the needed health services to the Aetas.

Key Findings

The activities undertaken in preparation for the Mount Pinatubo eruption in 1991 provide an example of how local early detection and monitoring, regular public warnings, and the building of public awareness can save lives and curtail economic losses by encouraging early evacuation by populations at risk.

Local early detection: The resurgence of seismic activity at Pinatubo in August 1990 was not noticed initially by official monitoring efforts but by the Aeta people who lived on the slopes of the volcano. Then after noticing tremors and small explosions on March 15, 1991, and April 2, 1991, respectively, the Aeta again reported this activity, in spite of government authorities' dismissal of their earlier reports.

Monitoring: After the Aeta's early detection of seismic activity at Pinatubo in April 1991, along with the identification of volcanic activity during the same period at Taal volcano, Philippine Institute of Volcanology and Seismology (PHIVOLCS) and the Volcano Disaster Assistance Program (VDAP) of the U.S. Geological Survey installed a network of seismometers on Pinatubo, established the Pinatubo Volcano Observatory (PVO) at Clark Air Base, to regularly monitor the volcano's activity - an activity they undertook for more than two months, up through the eruption of Pinatubo in June 1991.

Regular public warnings and building of public awareness: The Pinatubo Volcano Observatory (PVO) developed a clear and understandable public warning system and mobilized both public officials and private citizens to take seriously these warnings and calls for evacuation.

Early evacuation: The first evacuations of approximately 5,000 persons from Pinatubo began in early April 1991, shortly after the PHIVOLCS Quick Response Team recorded the more than 200 small, high-frequency earthquakes during its first 24 hours of monitoring on Pinatubo. Then, an additional 75,000 persons safely evacuated before the June 15 eruption. Of the 20,000 indigenous Aeta highlanders who lived on the slopes of Mount Pinatubo, all but about 20 were safely evacuated before the eruption. As many as 5,000-20,000 lives and \$250 million in property damage are conservatively estimated to have been saved as a result of the early evacuation.

Health Surveillance and Disease Control: In addition to these more commonly recognized preparedness efforts, the case of the 1991 eruption of Pintaubo also presents a notable example of the benefit of implementing effective health surveillance systems and disease control interventions in the aftermath of a disaster. The surveillance system implemented by the Department of Health not only allowed emergency medical resources to be used most effectively to control the potential outbreaks of various communicable diseases, but also provided for the improved direction of longer-term response and recovery assistance.

4.12. VIETNAM – FLOODS (1998 AND 1999)

Summary Statistics	
Date:	November-December 1998
Human Consequences:	397 deaths
Economic Losses:	\$188 million
Date:	November – December 1999
Human Consequences:	800 deaths, 55,000 displaced, 1.7 million affected
Economic Losses:	\$290 million ⁶⁷

The physical and human geography of Vietnam make it one of the most disaster-prone countries in the Asia-Pacific region. Vietnam's long coastline is hit each year by an average of four typhoons and several other storms that can breach sea dykes and cause damage to houses, crops and aquaculture (IFRC, 2002). Moreover, two factors of human behavior are contributing to the increasing vulnerability of the population to flooding. The first is that as Vietnam's population grows, more and more of the country's residents are moving into exposed coastal areas. And, second, the felling of Vietnam's forests to grow rice and provide domestic fuel and construction material is eliminating the country's natural barriers to flash floods.

Event Description

From November to December 1998, Tropical Storms Babs, Chip, Dawn, Elvis and Faith struck the central and central highlands provinces of Vietnam. The storms combined with a cold front from the north to produce heavy rain in coastal provinces and in the Central Highlands. Water levels on rivers from Quang Tri Province to Khanh Hoa Province rose above Alarm Level Three, the highest Vietnamese flood-disaster Alarm Level designation, with water levels on some rivers rising 0.8 to 2.8 m above Alarm Level Three. The flooding was the worst in the country in over two decades and was compared to the worst flooding on record up until then, which occurred in 1964 (Ngoc Dong, 2006).

⁶⁷ Except where otherwise noted, the material for this case study is drawn from "Chapter 5: Post-flood recovery in Vietnam" (IFRC, 2001).

One year later, from November to December 1999, tropical storms dumped the equivalent of two years of rain on Vietnam's central provinces, causing all of the country's rivers to overflow their banks, some rising as fast as one meter per hour, and resulting in the worst flooding of the century. By some estimates, the flood wiped out ten years of development. Nearly 800 people died and 55,000 were left homeless. In all, 1.7 million persons were directly affected. The agricultural sector, the main employment sector, was hit especially hard, as 60,000 hectares of paddies, hundreds of fishing boats, and entire herds of livestock were lost. Damage, including lost infrastructure, was estimated at \$290 million.

Exemplary practices Identified

Recovery/Redevelopment

Disaster-Resistant Housing

While Vietnam's traditional hardwood buildings resisted typhoons and flooding, more modern houses have increasingly been constructed of less disaster-resistant materials, ranging from brick to corrugated iron, in part due to the rapid rate of deforestation. Moreover, many of the same families, who cannot afford to rebuild quickly enough or with adequately strong materials after a disaster, are most vulnerable to losing their homes along with their limited physical capital with each subsequent disaster. As such, thousands of Vietnamese find themselves in a vicious cycle of being unable to recover from one disaster before having their lives and their livelihoods put at risk by the next one.

In response to this decline in the disaster-readiness of housing in the country, the VNRC and the IFRC initiated a project following the 1998 floods to introduce more disaster-resistant house-building practices to the country. Among the design features of these houses are concrete foundations, strong roof bracing, a fixed steel frame, and good connections between frame and roof. These new designs can better protect the lives of residents and their livelihoods (e.g., food and valuable belongings, such as seeds and tools, can be stored on a

gallery floor above flood levels). Between the 1998 and 1999 floods, the Vietnamese Red Cross and IFRC built nearly 2,500 new homes using the disaster-resistant building practices, and allocated them to the most vulnerable victims.

Of the 2,450 stronger houses built after the 1998 floods, only one collapsed in the 1999 floods, leading the Vietnamese to refer to them as 'little mountains'. By August 2000, 7,400 "little mountains" had been built at a cost of only \$500 each. One ambassador said it proved emergency aid could be durable and "not money which pours down the drain at the next flood". By mid-2001, the Red Cross and the Vietnamese government had built over 2,000 more flood-resistant houses in 16 provinces.

The program also sparked a debate within Vietnam as to how best to respond to future disasters in a way that is both lifesaving and sustainable. While the "little mountain" houses had seemingly demonstrated their value in the 1999 floods, they were not welcomed completely, as some groups recommended that reconstruction efforts make use of local materials. In an effort to extend this work on housing, the Vietnamese Red Cross and IFRC sponsored in 2000 a housing competition to identify the best locally developed designs for disaster-resistant housing in Vietnam. The competition attracted 15 major local companies, and was adjudicated by experts from government, engineers and aid workers. The competition recognized a design similar to that of the "little mountains," combining steel frames and concrete foundations, as the best design for emergency housing, citing the quality of the homes as well as the speed and ease with which persons could build their own homes. For reconstruction efforts by development programs rather than by inhabitants themselves, a method using locally produced, high-quality concrete blocks was the winner. No design submitted used bamboo or wood, which were noted as being too weak, too expensive, not durable enough, or in too short supply to be the most desirable materials.

In addition to the effectiveness of the "little mountain" houses, their introduction also spurred further efforts to redress the need for more disaster-resistant housing in Vietnam. For example, one locally-

based non-governmental organization, Development Workshop (DW), now offers training to communities in disaster-resistant construction and assists inhabitants of these communities in strengthening their houses. Their two-tier approach combines practical demonstrations with attitude-influencing activities in an attempt to promote greater awareness among the Vietnamese of the importance of considering disaster-readiness when building.

Key Findings

In Vietnam, as in other nations recurrently victimized by disasters, relief that does not help reduce future vulnerability can do little to ameliorate chronic insecurity and underdevelopment. In these circumstances, the provision of disaster-resistant housing as part of efforts in response to one disaster may be a highly effective means of saving lives and livelihoods in future disasters.

Disaster-Resistant Housing: The efforts of the IFRC and the Vietnamese Red Cross are a notable example of this lesson, as their provision of disaster-resistant homes following the 1998 floods saved innumerable lives and livelihoods in 1999. Complementing their own provision of disaster-resistant housing, these groups also sparked greater awareness of disaster-resistant housing through their sponsorship of a national *housing design competition*. These efforts, along with the effect they had of encouraging other NGOs to pay greater attention to the need for disaster-resistant housing, *raised awareness throughout Vietnam about how to best respond to emergency housing needs in a way that is both lifesaving and sustainable.*

4.13. VIETNAM – TYPHOON (2005)

Summary Statistics

Date:	September 27, 2005
Human Consequences:	68 deaths, 22 injured, 10,000+ displaced
Economic Losses:	\$209 million

Each year, Vietnam's long coastline is hit by an average of four typhoons and several other storms that can breach sea dykes and cause damage to houses, crops and aquaculture. As sea temperatures and levels rise, it is expected that the frequency and scale of typhoons and flooding in Vietnam will rise.⁶⁸ Moreover, the vulnerability of Vietnam's population to typhoons is increasing as more of the country's residents move into exposed coastal areas and deforestation decreases the country's natural protection from the storm (IFRC, 2001).

Event Description

On September 27 and 28, 2005, Typhoon Damrey, which means "elephant" in Khmer, hit Vietnam's coastline from Quang Ninh into Da Nang, sending heavy rain and high winds over large parts of the country. The rains and wind caused mudslides and flooding in the northern provinces of Yen Bai, Lao Cai and Phu Tho as well as the collapse of a sea dyke. A total of 68 people were killed and 22 injured in the northern and central regions affected by the typhoon. Tens of thousands more were left homeless as the flooding destroyed at least 1,194 houses and damaged another 11,576. Property losses were estimated at \$209 million, representing a particular setback to Vietnam's agricultural sector. Some 200,000 people faced food shortages, and salt water intrusion into wells made drinking water unavailable in most areas. The affected provinces are home to some 22 million people, including 11 indigenous minority groups, the majority of which live below the poverty level (IFRC, 2006).

⁶⁸ Except where otherwise noted, the material for this case study is drawn from "Box 4.4: Mangrove planting saves lives and money in Vietnam," (IFRC, 2002a).

Exemplary practices Identified

Prevention/Preparedness

Beginning in 1994, the Vietnam Red Cross (VNRC) has planted and protected submerged mangrove forests along Vietnam's east coast to protect 110km of the country's 3,200-km sea dyke system. The mangroves can grow to a height of 1.5m after three years, which can dampen 1.5-metre waves into harmless, centimeter-high ripples.

While the planning and protection of the 18,434 hectares of mangrove forests in eight Vietnamese provinces has cost \$4.35 million, supported by the Japanese and Danish Red Cross (Minh Ha, 2004), it has reduced the cost of dyke maintenance by as much as \$7.3 million per year.

In terms of lives saved, the dykes with mangroves were not damaged by Typhoon Damrey (North, 2005). This has been the case repeatedly since at least 2000, when Typhoon Wukong in October 2000 left no damage to the dykes behind regenerated mangroves, and resulted in no deaths inland of the protected dykes. Coincident with their ability to actually save lives, inhabitants of the regions protected by the mangrove forests report a reduced sense of vulnerability and greater sense of physical security vis-à-vis potentially dangerous storms (Minh Ha, 2004).

In addition to protecting the lives and livelihoods of tens of thousands of Vietnamese, the VNRC estimates that 7,750 families have benefited from the mangrove forests' providing a habitat for crabs, shrimps and mollusks, which the families can use to supplement their diet as well as farm for income.

Key Findings

Natural disasters pose a constant threat to Vietnam's efforts to reduce poverty. Although the Vietnamese government, with the help of international organizations, is targeting poverty reduction projects at vulnerable populations throughout the country, large-scale and sudden-onset natural disasters such as Typhoon Damrey or other storms can undermine any progress made through these projects.

Prevention/Preparedness: As such, the efforts to enhance the protection of the sea dykes that act as the final wall between thousands of Vietnamese and the ocean has helped to protect the lives and livelihoods of these people, as well as contributing to the conservation of the country's coastal land, the improvement of nutritional and occupational prospects for many of the regions' residents, and their sense of security.

APPENDIX 5: SELECTED ONLINE RESOURCES FOR DATA ON NATURAL DISASTERS

A fairly comprehensive list of online natural hazard and disaster information resources can be found at the website of the Natural Hazards Center, University of Colorado (<http://www.colorado.edu/hazards/>). Many of the sources listed below were taken from this website. This is not designed to be an exhaustive list of resources, but rather a list of useful sites for additional information.

WORLDWIDE ONLINE RESOURCES

The Centre for Research on the Epidemiology of Disasters (CRED) Database (EM-DAT)

<http://www.cred.be>
<http://www.em-dat.net>

The Disaster Center

<http://www.disastercenter.com>

Disaster Deaths by Ilan Kelman (National Center for Atmospheric Research)

<http://www.ilankelman.org/disasterdeaths.html>

IRIN News, Natural Disasters

[http://www.irinnews.org/frontpage.asp?SelectTheme=Natural Disasters](http://www.irinnews.org/frontpage.asp?SelectTheme=Natural%20Disasters)

Munich Reinsurance, National Catastrophes and Risks

http://www.munichre.com/pages/03/georisks/geo_disasters/default_en.aspx

National Geophysical Data Center Natural Hazards Data

<http://www.ngdc.noaa.gov/seg/hazard/hazards.shtml>

Relief Web

<http://www.reliefweb.org>

Swiss Reinsurance

<http://www.swissre.com>

The World Disasters Report, International Federation of Red Cross and Red Crescent Societies (IFRC)

<http://www.ifrc.org/publicat/wdr/index.asp>

UNITED STATES ONLINE RESOURCES

The Institute of Business and Home Safety (IBHS)

<http://www.ibhs.org>

The National Climatic Data Center (NCDC) Extreme Weather and Climate Events

<http://www.ncdc.noaa.gov/ol/climate/severeweather/extremes.html>

National Weather Service Hydrologic Information Center, Flood Impacts

http://www.nws.noaa.gov/oh/hic/flood_stats/index.html

National Weather Service Summary of Natural Hazards Statistics

<http://www.nws.noaa.gov/om/hazstats.shtml>

Societal Aspects of Weather, Center for Science and Technology Policy Research, University of Colorado-Boulder

http://sciencepolicy.colorado.edu/socasp/toc_img.html

The U.S. National Hurricane Center

<http://www.nhc.noaa.gov/index.shtml>

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