PART I

General aspects

2. The nature of emergencies and disasters

2.1 Environmental health and disasters

Environmental health hazards—threats to human health from exposure to disease-causing agents—are closely associated with disasters and emergencies in a variety of ways. A broad range of activities can be designed to enable the health sector to prevent, mitigate and respond to such hazards.

Disasters and development are connected in ways that necessarily involve the contributions of environmental health professionals. Through better education and higher incomes, development can improve people's capacity to cope with environmental health hazards. On the other hand, certain types of development can create new hazards or new groups of people vulnerable to them. Disasters can set back development, but they can also provide new development opportunities. Strategic planning to increase the capacity of people to withstand disaster hazards must therefore include concerns for environmental health.

Environmental health activities are interdisciplinary, involving engineering, health sciences, chemistry and biology, together with a variety of social, management and information sciences. In times of disaster and recovery, people from many backgrounds engage in activities designed to monitor, restore and maintain public health. Likewise, health workers find themselves cooperating with others to help with non-health-related work, such as search-and-rescue, or work that is only indirectly related to health, such as public education.

2.2 Disasters and emergencies

2.2.1 Hazards and extreme events

A hazard is any phenomenon that has the potential to cause disruption or damage to humans and their environment. Hazards are the potential for an event, not the event itself. Extreme events are natural or man-made processes operating at the extremes of their range of energy, productivity, etc. For example, mudslides, floods, coastal storms, locust or rat invasions are all natural, but extreme events, and to some extent the likelihood of them occurring, may be estimated. Many extreme events, such as severe floods, have been monitored and recorded over many years and have a known probability of occurrence. Man-made hazards, such as the potential for leaks of dangerous chemicals or radiation, also exist and many so-called natural hazards become events or are exacerbated by human activity. For instance, flooding in Bangladesh during the 1990s was made worse because large numbers of discarded plastic bags blocked drainage systems.

Extreme events create stress in human systems and structures because the forces involved are greater than those with which the systems and structures normally cope. For instance, all houses will withstand some wind, but beyond a certain wind speed all will fail. Many farming communities are able to cope with mild and occasional drought, but are overwhelmed by severe and repeated drought.

Extreme events often occur in complex "cascades". Earthquakes may trigger mud or rock slides. Debris may dam a river, producing an artificial lake that threatens down-

stream settlements with flooding if the dam is breached. Forest fires can produce barren slopes more prone to erosion and flash flooding. Earthquakes may cause electrical fires or explosions of natural gas. Where urban water supplies are stored in reservoirs, earthquakes can damage them, causing flooding and reducing the quantity of water available to fight fires.

The statistical probabilities of such extreme events occurring can be estimated with different degrees of confidence. Some events, such as floods and cyclones, are clustered seasonally. The recurrence of major rainfall and floods can be calculated, but specific floods are harder to predict. Worldwide, the numbers of people affected by natural disasters are strongly associated with the El Niño Southern Oscillation (Bouma et al., 1997). For reasons that are not yet understood, volcanic eruptions seem to be associated with El Niño events (Berlage, 1966; Nicholls, 1988), but it is currently impossible to predict accurately the occurrence of earthquakes.

Some natural events, such as the emergence of a fatal cloud of carbon dioxide and hydrogen sulfide from the depths of Lake Nyos in Cameroon in August 1986, are unexpected and are not amenable to preparedness measures.

2.2.2 Disasters

Disasters are events that occur when significant numbers of people are exposed to extreme events to which they are vulnerable, with resulting injury and loss of life, often combined with damage to property and livelihoods.

Disasters, commonly leading to emergency situations, occur in diverse situations in all parts of the world, in both sparsely populated rural and densely populated urban regions, as well as in situations involving natural and man-made hazards. Disasters are often classified according to their speed of onset (sudden or slow), their cause (natural or man-made), or their scale (major or minor). Various international and national agencies that keep track of disasters employ definitions that involve the minimum number of casualties, the monetary value of property lost, etc. Other definitions are used by countries for legal or diplomatic purposes, e.g. in deciding when to officially declare a region a "disaster area". The terminology used here is less precise so as to cover a broad range of situations. The forces that bring vulnerable people and natural hazards together are often man-made (conflict, economic development, overpopulation, etc.).

An example of natural and technological hazards combining in surprising ways was seen in Egypt in 1994. Heavy rain near the town of Dronka weakened railway lines. A train carrying fuel was derailed and leaking fuel was ignited by electrical cables, causing an explosion. Finally, burning fuel was carried by flood waters through the town, killing hundreds of people (Parker & Mitchell, 1995).

2.2.3 Conflict

Conflict is not considered in detail in this book. However, some of the most serious disasters and emergencies are created or further complicated by conflict and the forced movement of large numbers of people. Conflict is a major cause of direct and indirect land degradation, leading to greater risk of environmental disasters, and also consumes resources that could be used by society to reduce vulnerability to extremes in natural and technological hazards. Conflict also imposes the greatest demands on environmental health personnel, equipment, supplies and supporting services, thus calling for the most skilful use of relief resources. The secondary impact of conflict, in terms of the public health problems it creates and the disruption of environmental health services it causes, are of major importance.

2.2.4 The effects of disasters on environmental health facilities and services

One way in which disasters may cause, or worsen, emergency situations is through the damage they do to environmental health facilities and services. Table 2.1 summarizes the common effects of various natural disasters on environmental health services (Pan American Health Organization, 1982, 1995; Hanna, 1995). Flooding, power failures, broken pipes and blocked roads can all disrupt water, waste and food-handling services

Table 2.1 **Common levels of impact of natural disasters on environmental health services[1]**

	Most common effects on environmental health	Earthquake	Cyclone	Flood	Tsunami	Volcanic eruption
Water supply and wastewater disposal	Damage to civil engineering structures	1	1	1	3	1
	Broken mains	1	2	2	1	1
	Damage to water sources	1	2	2	3	1
	Power outages	1	1	2	2	1
	Contamination (biological or chemical)	2	1	1	1	1
	Transportation failures	1	1	1	2	1
	Personnel shortages	1	2	2	3	1
	System overload (due to population shifts)	3	1	1	3	1
	Equipment, parts, and supply shortages	1	1	1	2	1
Solid waste handling	Damage to civil engineering structures	1	2	2	3	1
	Transportation failures	1	1	1	2	1
	Equipment shortages	1	1	1	2	1
	Personnel shortages	1	1	1	3	1
	Water, soil, and air pollution	1	1	1	2	1
Food handling	Spoilage of refrigerated foods	1	1	2	2	1
	Damage to food preparation facilities	1	1	2	3	1
	Transportation failures	1	1	1	2	1
	Power outages	1	1	1	3	1
	Flooding of facilities	3	1	1	1	3
	Contamination/degradation of relief supplies	2	1	1	2	1
Vector control	Proliferation of vector breeding sites	1	1	1	1	3
	Increase in human/vector contacts	1	1	1	2	1
	Disruption of vector-borne disease control programmes	1	1	1	1	1
Home sanitation	Destruction or damage to structures	1	1	1	1	1
	Contamination of water and food	2	2	1	2	1
	Disruption of power, heating fuel, water supply or waste disposal services	1	1	1	2	1
	Overcrowding	3	3	3	3	2

[1] Source: Pan American Health Organization (2000).
1 - Severe possible effect.
2 - Less severe possible effect.
3 - Least or no possible effect.

for hours or days. More severe damage to civil engineering structures, from bridges to water mains, can cause disruptions lasting days or weeks. In all such cases, contingency plans for temporary repairs and, when necessary, alternative water supplies and sanitation arrangements, are required.

Transportation difficulties and shortage of personnel may cause disruption of vector-control programmes. Some conditions, such as flooding, may result in the proliferation of vector breeding sites which local vector-control programmes cannot deal with.

Droughts may produce a series of problems for water-supply and sewage-treatment systems as a result of low flow from intakes and clogging of intakes; and electricity supplies may be unreliable if power generation is affected.

2.2.5 Emergencies

An emergency is a situation or state characterized by a clear and marked reduction in the abilities of people to sustain their normal living conditions, with resulting damage or risks to health, life and livelihoods. Disasters commonly cause emergency situations, both directly and indirectly. Evacuation or other necessary steps taken to avoid or flee from a disaster, for example, can cause disruption of normal life on a scale calling for emergency action. Sudden, large-scale movements of people within and between countries often produce emergency conditions. Dramatic loss of livelihoods and increased spending needs due to drought or flooding may place people in a very vulnerable situation. A cholera epidemic may overwhelm the capacity of a city's under-resourced health service, creating an urgent need for support. In such emergency situations, local coping mechanisms are overwhelmed and so collective, specialized and often external action is required.

During an emergency, it is common to see primary effects of the disaster followed by secondary effects. For instance, the primary effect of a mudslide might be that many people are injured and need urgent medical attention. A secondary effect might be that blocked sewers and broken water mains lead to an outbreak of water- and sanitation-related disease some weeks later, or that the loss of livelihoods through the destruction of vegetable gardens and workshops leads to reduced food intake and a nutrition emergency some months later. Human needs for non-material things, such as security and cultural identity can also be affected, and the psychological and social impacts of a disaster may be felt many years after the event.

Emergency situations are often described in public health terms, with the crude mortality rate (CMR) being widely accepted as a global measure of their severity. A CMR which is significantly higher than the rate in the affected population before the disaster, or which is above 1 death per 10 000 population per day (or 3 deaths per 1000 population per month) indicates an emergency situation (Centers for Disease Control and Prevention, 1992; Sphere Project, 2000). CMRs in the emergency phase following various types of disaster may be many times the background rate for the region or the affected population. Many more deaths may occur during the post-disaster emergency phase than as a direct result of the disaster itself. However, mortality rates are trailing indicators, that is they do not indicate problems before people die as a result of them, and do not indicate the nature of the problems. Therefore, other indicators concerning health, environmental, social and economic factors are important for understanding the nature of the emergency and how it is likely to change over time, and for understanding how to react effectively.

The term complex emergencies is used to describe situations of disrupted livelihoods and threats to life produced by warfare, civil disturbance and large-scale movements of people, in which any emergency response has to be conducted in a difficult political and security environment. A combination of complex disasters and natural hazards (e.g. mil-

itary and political problems combined with severe winter weather, coastal storms and flooding, drought and a cholera epidemic) was particularly devastating in the 1990s in such countries as Bosnia and Herzegovina, Iraq, Myanmar, Peru and Somalia.

2.3 Vulnerability to disasters and emergencies

2.3.1 The concept of vulnerability

Vulnerability is the degree to which a population, individual or organization is unable to anticipate, cope with, resist and recover from the impacts of disasters (Blaikie et al. 1994).

Some disasters may involve extreme events that affect a vulnerable population directly, such that their livelihoods and lifelines that support their basic needs are disrupted for a significant period of time. However, the disruption of livelihoods may also be indirect and, even though an emergency situation may not develop, people's vulnerability to future disasters can be increased. An explosion and fire in an industrial quarter of a city might not kill or injure anyone directly, but the employment and income of large numbers of workers and their families may be interrupted. Indirectly, then, there may be an additional threat to the satisfaction of basic needs, since the unemployed workers may not be able to afford an adequate diet, pay rent or pay for health care. These are precisely the kinds of circumstances that can increase a family's vulnerability to future disasters.

Vulnerability is a function of susceptibility (the factors that allow a hazard to cause a disaster) and resilience (the ability to withstand the damage caused by emergencies and disasters and then to recover). See the glossary in Section 1.6 for definitions of terms.

The concept of vulnerability helps to identify those members of a population who are most likely to suffer directly and indirectly from a hazard. It is also useful in identifying those who are more likely to suffer longer-term disruptions of livelihoods and lifelines, as well as those who will find it more difficult to re-establish their accustomed patterns of living. Poverty (and its common consequences, malnutrition, homelessness or poor housing, and destitution) is a major contributor to vulnerability. In many situations, women and children are most vulnerable to disaster emergencies. This has important implications in defining priorities for vulnerability reduction. Some of the main indicators of vulnerability are discussed below.

2.3.2 High susceptibility

Residence or employment in or near a known hazard zone is easy to map. Communities covered would include those living on flood plains, on unprotected coasts or low-lying islands prone to severe storms, on the slopes of an active volcano, or near industries that use or discharge radioactive substances or dangerous chemicals. In urban areas where spontaneous settlement has occurred, self-built housing may be sited on steep, unstable slopes (as in Rio de Janeiro) or in ravines in zones subject to earthquakes (as in San Salvador). In December 2000, heavy rainfall caused mudslides that killed 30 000 people in Venezuela, largely due to unplanned settlements on steep slopes, combined with deforestation.

Some occupations carry a heightened susceptibility to certain extreme events. For instance, those employed in forest industries (in both the formal and informal sectors) may be more susceptible to large fires. Populations that rely on fishing may be more susceptible to storms. Landless and land-poor people are sometimes forced by circumstances to inhabit hazardous zones in order to find arable land, as in Bangladesh.

2.3.3 Low resilience

Communities with a high prevalence of environmental health-related disease may be more at risk to a disaster than others. Malnutrition, which commonly has a seasonal pattern, predisposes people to disease and reduces their resilience. People with disabilities and frail elderly people are less mobile and harder to evacuate. Children and pregnant women are more prone to serious illness from exposure to some industrial chemicals. People in the lowest socioeconomic groups in a population may be the most difficult to warn of dangers because they do not own radios.

In the longer term, people with few financial and social resources, such as recent migrants to cities, elderly people living alone and homeless children, are likely to find it more difficult to recover from a disaster. An increasing number of homeless urban children also fall into this category.

Anderson & Woodrow (1989) identified the following capacities that determine resilience to disasters and which themselves can be diminished by disasters:
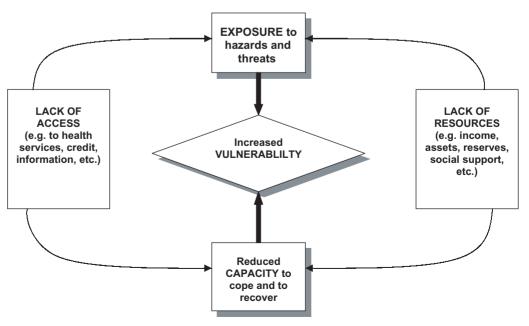
— physical/material capacity—command over physical and financial resources;
— social/organizational capacity—support networks in the community and extended family, and access to support by social and political institutions, such as churches and the government;
— attitudinal/motivational/psychological capacity—how people feel about their ability to cope (e.g. whether they feel isolated, connected to others, capable or weak).

Figure 2.1 shows disaster vulnerability as a function of hazards and threats (susceptibility), and capacity to cope and recover (resilience).

2.3.4 The impact of disasters at national level

At a national level, repeated major disasters have a significant effect on development, through their economic and social costs, and may create a vicious cycle as underdevel-

Figure. 2.1 **Disaster vulnerability as a function of exposure to hazards and threats, and reduced capacity to cope and recover**

opment increases the vulnerability of people and society to disasters. Box 2.1 illustrates this.

2.4 Human actions that increase vulnerability to disasters

2.4.1 Improper resource management

There are important links between the physical and social processes that determine vulnerability to disasters. Improper land use and land development can increase the physical magnitude of hazards. Deforestation provides a classic example. Many rural people with low incomes convert trees into charcoal. Denuded of vegetation, the land is less able to absorb rainfall, becomes increasingly prone to drought and, because of the increased run-off of water and soil erosion, flooding may be increased downstream. Reservoirs may be silted up more quickly, so that water storage for the next period of drought is reduced, thus increasing the same people's vulnerability.

Disposal of solid wastes in the steep hillside *favelas* (squatter settlements) of Rio de Janeiro provides a similar example in an urban setting. Run-off from rain can build up behind "dams" created by such wastes, and the resulting saturated soil becomes unstable and subject to landslides.

Even self-help initiatives can have tragic, unintended results. Inadequate drainage of self-built water supplies and poorly maintained septic tanks may have contributed to reducing the stability of a hill in Mameyes, Puerto Rico, where a mudslide buried hundreds of people in 1986.

2.4.2 Urbanization and vulnerability to disasters

One of the most striking features of the last few decades has been the rapid rate of urbanization. Currently, more than half of the world's people live in cities and, by the year 2025, almost two-thirds may be urban dwellers (World Health Organization, 2000a). Not only do an increasing percentage of all people live in cities, but the number of so-called mega-cities is increasing. This rapid urbanization poses a challenge to environmental health because it creates conditions that increase human vulnerability to disaster. Table 2.2 lists some of the major agglomerations and cities known to be sited in hazard zones.

Many people live in these cities in spontaneous or informal settlements with little or no access to municipal services. Sometimes there are not even fire lanes for use by emergency services. Refuse collection is sporadic, if it occurs at all, while the provision of water and sanitation facilities generally lags far behind urban population growth.

Informal settlement often takes place in highly dangerous locations, such as steep hillsides, urban flood plains and near dangerous factories. People often live in these

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Box 2.1 The disaster–development connection[1]

The economic and human costs of disasters continue to retard economic and social development. For example, in the Philippines in 1986–1991, an average of 2377 people died annually from both natural and technological disasters. For the same period, the estimated annual cost of damage from these disasters averaged more than P10.78 billion. Natural disasters included the 1990 earthquake in Northern Luzon that killed 1283 and displaced over a million people, and flash floods and landslides that killed 8000 in Ormoc City in 1991.

In 1990 alone, disasters resulted in direct damage equal to about 3% of the country's GNP. Such losses reduce economic growth, aggravate the country's underdevelopment and increase the vulnerability of the people and society to disasters.

[1] Source: The Citizen Disaster Response Centre (1992).

Table 2.2 **Selected cities exposed to natural hazards[1]**

City	Estimated population in 2002 (millions)	Principal hazards
Beijing	9.2	Earthquake, dust storm
Cairo/Al-Jiza/Shubra al-Khayma	15.1	Flooding
Calcutta/Haora	14.6	Cyclone, flooding
Delhi/Faridabad/Ghaziabad	17.2	Flooding
Dhaka	10.4	Flooding, cyclone
Jakarta/Bekasi/Bogor/Depak	15.9	Earthquake, volcano
Lagos	9.3	Flooding
Los Angeles/Riverside/Anaheim	16.8	Earthquake, wildfire
Manila/Kalookan/Quezon City	13.5	Earthquake, flooding
Mexico City incl. Nezahualcóyotl, Ecatepec, Naucalpan	20.8	Earthquake
Moscow	13.2	Blizzard
New York/Newark/Paterson	21.6	Blizzard, flooding
Rio de Janeiro/Nova Iguaçu/Sao Gonçalo	12.3	Landslide, flooding
São Paulo/Guarulhos	20.3	Landslide, flooding
Shanghai	12.2	Flooding, typhoon
Tehran/Karaj	11.1	Earthquake
Tianjin	5.6	Earthquake
Tokyo/Kawasaki/Yokohama	34.9	Earthquake

[1] Sources: Angotti (1993); Brinkhoff: Principal agglomerations and cities of the world, http://www.citypopulation.de, 11.05.2002.

areas because of poverty, and low income and lack of tenure may prevent them from improving the safety of their homes or the sanitary conditions of their environment. Such families experience stress during "normal" times and therefore have few physiological or financial resources to sustain themselves in a disaster. Urban areas also contain large numbers of homeless people—families who live on the streets and street children, who are among the most vulnerable of all.

Even in wealthy countries with well-designed and constructed infrastructure, the high population density in cities means that large numbers of people may be vulnerable to hazards that would have little impact in a scattered rural community.

Countries and cities are also running out of water. According to one estimate presented to the United Nations Conference on Human Settlement (Habitat II) conference in Istanbul in 1996, most cities in developing countries will face severe water shortages by 2010.

2.4.3 Rural/urban connections

Disaster vulnerabilities in rural and urban areas are connected in an important way. A sizeable proportion of recent urban migrants report leaving rural areas because of disasters from which they have been unable to recover. This emphasizes the importance of including the process of recovery (or failure of recovery) within the concept of the disaster cycle, as survivors of one disaster who do not recover are less resilient and more vulnerable to the next disaster. The converse also appears to be true, providing a unique opportunity to planners and policy-makers. Disasters can offer an opportunity to improve housing, locate housing more safely and lay the foundations for later improvements in environmental health through community mobilization.

2.4.4 Global environmental change

In addition to the local changes in ecosystems previously discussed, there is increasing evidence of global climatic change (e.g. Watson et al., 1996). Although the long-range consequences are hard to predict, more severe cyclonic storms, an increase in both flooding and drought, and a trend towards desertification cannot be ruled out.

The secondary consequences of global climatic change could well result in new hazards. Wildfires and mudslides may become more frequent in the wake of increased drought and flooding. The genetic diversity of food plants may be reduced as climatic zones shift more rapidly than plants can move or adapt. Primary productivity in the oceans may be affected. New disease habitats may be produced; for example, algal blooms are now appearing more frequently in many coastal waters and have been found to harbor *Vibrio cholerae*, the causative organism of cholera. Because of stratospheric ozone depletion—another global environmental change that humans have brought about—the immune systems of people and animals may be weakened by additional ultraviolet radiation.

All of these hazards—some well established and others less so—need to be on the long-term planning agenda of national counter-disaster planners and others concerned with environmental health.

For the possible health effects of global environmental change, see Box 2.2.

2.5 The disaster-management cycle

2.5.1 Disaster management—a developmental approach

As indicated in Chapter 1, the disaster-management cycle is a core concept in environmental health management in disasters and emergencies, and several variations of the cycle have been used effectively (Carter, 1991; United Nations Office of the Disaster Relief Coordinator, 1991; Natural Disasters Organization, 1992; World Health Organization, 1999a).

Appropriate actions at all points in the cycle lead to greater preparedness, better warnings, reduced vulnerability or the prevention of disasters during the next iteration of the cycle. The objectives of such a development-oriented approach are to reduce hazards, prevent disasters and prepare for emergencies. Inappropriate humanitarian action and development processes can lead to increased vulnerability to disasters and loss of preparedness for emergency situations.

Although the disaster-management cycle can be entered at any point, many governments and institutions focus their attention on the steps to take when disaster strikes. As shown in Figure 2.1 (see section 2.3.3), the disaster impact is often followed by an emer-

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Box 2.2 **Health effects of global environmental change**[1]

Global warming may cause increased heat-wave-related illness and death, the spread of vector-borne infections, and more frequent cyclones, floods, landslides and fires. The resulting rise in sea levels may lead to health problems associated with deteriorating water supply and sanitation, loss of agricultural land and fishing grounds, and flooding.

Increased ultraviolet radiation resulting from stratospheric ozone depletion will lead to greater risks of skin cancer, ocular effects such as cataracts, and suppression of the immune system with the consequent increased risk of infection. Increased ultraviolet radiation may also cause indirect effects on human health through deleterious effects at lower levels of the food chain, particularly in marine ecosystems.

[1] Sources: McMichael (1993), McMichael et al. (1996).

gency situation calling for a series of immediate and rapid responses. These include initial rapid assessment, search and rescue, and emergency relief to stabilize the situation, followed swiftly by more detailed damage, needs and capacities assessment, leading to short-term interventions to safeguard life, health and livelihoods in the medium term. In the postemergency recovery phase, people's livelihoods should be restored and the infrastructure and housing repaired through rehabilitation and reconstruction. Ideally, there should be a smooth transition from recovery to on-going development, as represented by the common thread that runs through Figure 2.2, uniting its elements. The result should be the enhancement of people's capacity to withstand and recover from future disasters. Enhanced capacity on the part of individuals, communities and institutions is the focus of prevention and mitigation. Preparedness on the part of the emergency services and society as a whole, including better warning systems, completes the cycle. Figure 2.3 adds more detail and provides a sense of timing.

A central message of this book is that the lessons of disasters should be remembered even if complete recovery takes years. Only in this way can the full potential for preparedness, prevention and mitigation be achieved. For an example of the relief–development transition, see Box 2.3.

Box 2.3 The relief–development transition following drought and floods in the Sudan[1]

Operations by the Sudanese Red Crescent Society (SRCS) following drought in 1984–1985 and the flooding of Khartoum in 1988 are a good example of planning a smooth transition from emergency response through relief and recovery to normal development activities. Many people fleeing drought and war settled themselves spontaneously around Khartoum beginning in 1984–1985. In this period, at least 120 000 refugees arrived from drought-affected rural areas, adding nearly 10% to Greater Khartoum's 1983 population of 1.5 million. At first, 60 000 people were supplied by tanker trucks with water on a daily basis. These people were later affected by floods in 1988, further complicating attempts to satisfy their needs. A second phase called for the rehabilitation of existing boreholes and the construction of new public water points. Finally, commercial well-drilling contractors were engaged to increase the capacity of Khartoum's urban water system while fitting in with the long-term water resource development plans of Greater Khartoum, using equipment that was within the Government's ability to maintain and to operate. IFRC provided general management and technical support and coordinated input from member societies, while the SRCS supervised operations on the ground in liaison with the Government.

[1] Sources: Acheson (1993); International Federation of Red Cross and Red Crescent Societies (1993a).

2.5.2 Sustainable livelihoods and disaster management

One of the major goals of disaster management, and one of its strongest links with development, is the promotion of sustainable livelihoods and their protection and recovery during disasters and emergencies. Where this goal is achieved, people have a greater capacity to deal with disasters and their recovery is more rapid and more durable.

2.5.3 Limitations in complex emergencies

Large-scale movements of people often create emergency situations. The disaster-management cycle may apply to such cases, but with limitations. Although there may be some warning of refugee movements, it is often so little that a handful of care-providers are confronted by a large number of people with urgent needs and the care-providers

have insufficient resources to respond promptly and appropriately to prevent or miti-gate secondary disasters, such as outbreaks of disease, famine and the dispersal of fam-ilies. Repatriation of the refugees, their integration within the host community, or asylum in a third country provide the conditions for long-term recovery and development.

Figure. 2.2 **Developmental considerations contributing to all elements of the disaster-management cycle**
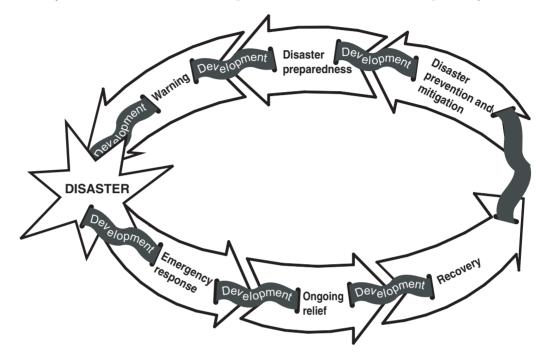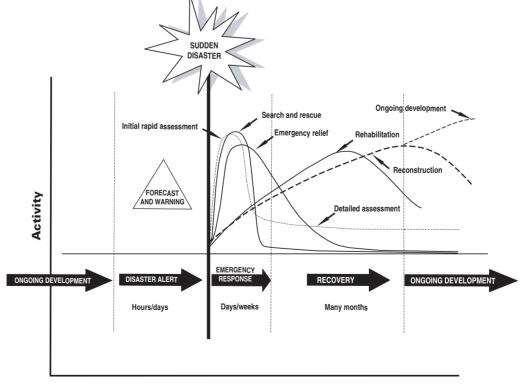

Figure. 2.3 **Development temporarily interrupted by sudden disaster**

However, refugees and displaced people may spend years away from their homes, in situations where opportunities for development are limited and complete recovery is postponed.

In long-term conflicts people may suffer repeated violence and displacement, so that getting back onto any sort of development path becomes virtually impossible. However, people's ability to learn from every experience increases their capacity to deal with new disasters. Rwandan refugees on the move in eastern Democratic Republic of the Congo in 1996 and 1997 were able to organize basic environmental health services partly because of their experience of doing so in camps for two years since leaving Rwanda in 1994.

2.6 Steps in disaster management

2.6.1 Vulnerability assessment

Using the disaster-management approach involves carrying out a number of pro-active steps—as well as reacting to disasters and emergencies when they occur—the first of which is vulnerability assessment. This provides the basis for reducing vulnerability through work in two areas: disaster prevention/mitigation (to reduce susceptibility) and emergency preparedness (to increase resilience).

Vulnerability assessment makes it possible to anticipate problems that specific groups will face in the event of a disaster and during the period of recovery. The process of vulnerability assessment involves determining the spatial proximity of population subgroups to potential hazards (an assessment of susceptibility), according to personal and socioeconomic characteristics that may influence the immediate and long-term impact of hazards on them (an assessment of resilience).

See Section 3.3 for more detail on vulnerability assessment.

2.6.2 Prevention and mitigation

Complete prevention of disasters is feasible only if it is possible to eliminate people's susceptibility to hazards by moving populations away from hazard zones, providing complete protection from hazards, or preventing the physical hazard altogether. This has occasionally been achieved, e.g. the virus responsible for smallpox was eradicated, and cities have been protected from flooding by diverting rivers to alternative courses. However, to survive or improve well-being, humans are prepared to take risks and will even resettle in areas previously affected by natural disasters.

The best that can usually be done is therefore to reduce the potential impact of emergencies and disasters. Mitigation—actions aimed at reducing (but not eliminating) the impact of future hazard events—and reduction of the susceptibility of high-risk groups are then the goals. The construction of riverbank levees and upstream storage reservoirs are examples of measures for mitigating and reducing the hazard of flooding by rivers.

Efforts to reduce the impact of emergencies or disasters may focus on the extreme event, the humans who are at risk of being affected, or both. For instance, the impact of flooding can also be mitigated by preserving wetlands that can absorb and spread flood waters. On the other hand, improved urban land tenure allows urban residents to invest in making their houses more secure in earthquakes or high winds.

For further detail on disaster prevention and mitigation, see section 3.4.

2.6.3 Emergency preparedness

Emergency preparedness is "a programme of long-term development activities whose goals are to strengthen the overall capacity and capability of a country to manage efficiently all types of emergency and bring about a transition from relief through recovery, and back to sustained development" (World Health Organization, 1995a).

The goal of emergency-preparedness programmes is to achieve a satisfactory level of readiness to respond to any emergency situation through programmes that strengthen the technical and managerial capacity of governments, organizations, institutions and communities. Such programmes are concerned with:

- National legislation and national policy for disaster management.
- Plans and procedures for disaster management and the coordination of emergency response at international, national and subnational levels.
- The strengthening of institutional and human resources for disaster management.
- The establishment and management of stocks of relief supplies and equipment and the identification of transportation options.
- Public education, public awareness and community participation in disaster management.
- The collection, analysis and dissemination of information related to emergencies and disasters that are likely to occur in the region.

Activities in each of these areas will be needed to achieve emergency preparedness.

For further information on emergency preparedness, see section 3.5.

2.6.4 Planning, policy and capacity building

Planning is required at all levels, from the community level to national and international levels, to ensure that programmes for disaster prevention and mitigation are carried out according to clear objectives, with adequate resources and management arrangements, and to ensure that strategies, resources, management structures, roles and resources for emergency response and recovery are determined and understood by key actors. Effective emergency planning can only take place once roles and responsibilities have been agreed.

Emergency and disaster prevention, mitigation, preparedness and response will depend on the incorporation of appropriate measures in national development planning and in the sectoral plans and programmes of the various ministries. They will also depend on the availability of information on hazards, emergency risks and the countermeasures to be taken and on the degree to which government agencies, nongovernmental organizations and the general public are able to make use of this information. The complete disaster-management cycle includes the shaping of public policies and plans that either modify the causes of disasters or mitigate their effects on people, property, assets and infrastructure. Institutional capacity should also be increased through organizational innovation and training. Experience has shown that the result can be a more resilient, less vulnerable population, with fewer disruptions of essential services, such as water and power supplies, improved early warning ability, and better advance planning for evacuations and emergency response.

Health managers, as well as front-line community-based professionals and volunteers who deal with environmental health, can contribute to these longer-term efforts.

For further discussion of emergency planning, see Section 3.5.

2.6.5 Emergency response

The appropriate response will depend on the nature of the emergency or disaster and the effectiveness of mitigation measures, but is also very much conditioned by the degree of preparedness achieved.

In a crisis, the environmental health agencies are usually called upon to deal with the immediate problems. To be able to respond effectively, these agencies must have experienced leaders, trained personnel, adequate transport and logistic support, appropriate communications, and rules and guidelines for working in emergencies. If the nec-

essary preparations have not been made, the agencies concerned will not be able to meet the immediate environmental health needs of the people. It is completely unrealistic to expect an effective response to take place spontaneously, without planning or preparation. It calls for foresight, anticipation and prior effort.

The aim of emergency response is to provide immediate assistance to maintain life, improve health and support the morale of the affected population. Such assistance may range from providing specific but limited aid, such as assisting refugees with transport, temporary shelter, and food, to establishing semipermanent settlement in camps and other locations. It also may involve initial repairs to damaged infrastructure, e.g. flooded sanitation systems, and the control of chemical hazards. Much of the technical literature devoted to emergencies and disasters deals with the actions to be taken in the relief phase.

The emphasis in the relief phase is on removing the immediate environmental hazards to health and meeting the basic needs of the people until more permanent and sustainable solutions to their problems can be found. The philosophy advocated in this book is one of incremental, but continuous, improvement. Over time, the relief phase often merges with long-term recovery and development.

For further information on emergency response, see Chapter 4.

2.6.6 Rehabilitation, reconstruction and recovery

As the emergency is brought under control, the affected population is capable of undertaking a growing number of activities aimed at restoring their lives and the infrastructure that supports them. This may be a slow process and one in which the capacity for such efforts must be carefully nurtured and built up over a period of time, but the process should start early in the emergency phase.

There is no distinct point at which immediate relief changes into recovery and then into long-term sustainable development. Progress in some areas will probably be quicker than in others. Physical rehabilitation and reconstruction can sometimes take place more quickly than social or psychological rehabilitation. Both are necessary, however, if full recovery is to be attained. This phase therefore involves a maturing process in which all of the key elements of environmental health may be involved. Essentially, the process includes the restoration of community life, the participation of the people in the recovery and development activities, and provision of the appropriate environmental health infrastructure (shelter, water supply, sanitation, etc.). There will be many opportunities during the recovery period to enhance prevention and increase preparedness, thus reducing vulnerability. Environmental health activities have an important role in recovery. They can contribute to the long-term reduction of people's vulnerability to hazards by increasing their capacity to cope with, and recover from, future disasters. Examples include the reconstruction of housing with improved local drainage and built-in roof water-catchment systems, the reconstruction of markets with adequate facilities for personal and food hygiene, and the repair and deepening of rural wells and boreholes. There will be many such opportunities for long-term improvements in environmental health during the recovery period, depending on the local situation.

For further information on rehabilitation, reconstruction, and recovery, see Chapter 5.

2.7 Further information

For further information on:

— development, environment and disasters, see: Chen (1973), Kanji, Kanji & Manji (1991), Kreimer & Munasinghe (1991);

— women in disasters, see: Jiggins (1986), Rivers (1987), Drèze & Sen (1989), Agarwal (1990), Gibbs (1990), International Federation of Red Cross and Red Crescent Societies (1991), Martin (1992), Begum (1993), Walker (1994), Ikeda (1995), and Bari (1998);

— reducing vulnerability, see: Anderson & Woodrow (1989), Maskrey (1989), Carter (1991), International Federation of Red Cross and Red Crescent Societies (1993b), Blaikie et al. (1994), Anderson (1995), von Kotze & Holloway (1996), and Pan American Health Organization (1998);

— urban hazards, see: Richards & Thomson (1984), Hardoy & Satterthwaite (1989), Hardoy et al. (1990), and Black (1994);

— disaster management and disaster definitions, see: United Nations Department of Humanitarian Affairs (1992), Neal & Phillips (1995), World Health Organization (1999a), International Federation of Red Cross and Red Crescent Societies (2000), and International Federation of Red Cross and Red Crescent Societies (2001).