Social and Spiritual Development Strand
Social Science

Unit 4: Contemporary Issues

Module 4.3: Disaster Management

Lecturer Support Material

Acknowledgements

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Unit outline

Unit 4 **Contemporary Issues**	**4.1**	**Framework For Studying Issues (Core)**
	4.2	**Population Studies (Optional)**
	4.3	**Disaster Management (Optional)**
	4.4	**Women and Equity (Optional)**
	4.5	**Crime, Punishment and Justice (Optional)**

Icons

 Read or research

 Write or summarise

 Activity or discussion

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Module 4.3: Disaster Management

Objectives

Natural disasters occur all over the world and impact on large and small populations and land areas. This topic examines very briefly the nature of disasters, but more importantly the impact and consequences of such disasters on people and the environment. It also examines the need to manage not only rescue and salvage operations but also development and reconstruction.

By the end of this module students should be able to:

- Collate, analyse and respond to the range of information
- Predict consequences
- Debate issues critically
- Analyse cause and effects of events / issues
- Think critically to come up with alternatives and solutions to problems
- Change a situation because they have the knowledge and skills to work towards solutions
- Discuss and make others aware of problems and issues

Teaching Module 4.3: Disaster Management

- It is important to read through the module first, to decide what materials you will use, and what tasks and activities you will set for the students. It is also important to see how this module fits within the complete unit. Refer to the sample programs in your Unit guide for ideas on blending this module with others in the Unit.
- The material is written as a resource for the teaching of this module.
- Do not expect students to work through the total module alone. There may be too much material and they will need assistance in determining the tasks required.
- Many of the activities have a number of questions to discuss and tasks to do. They are included to provide some ideas and stimulus, not necessarily to complete every part of each activity.
- The activities provide a focus for learning, and some may be suitable for developing into assessment tasks, but the activities are not written to be used as the assessment program.
- The Lecturer Support Material is the same as the Student Support Material, with additional notes included in the text boxes.
- Materials included as an appendix are included as additional information for lecturers. These may be photocopied for students where appropriate.
- Assessment tasks should be developed at unit level, recognising the development of knowledge, skills and attitudes across this module and others which make up the unit.

ⓘ The focus of this module is the response to hazards and disasters, rather than what causes them. Key skills to be emphasised during the study of this module include:

- Analysis
- Planning
- Problem-solving

Module 4.3: Content

Introduction

More disasters – natural and non-natural – were reported for 2000 than in any year over the last decade. Fortunately these disasters proved less deadly than in previous years: around 20,000 people lost their lives worldwide, compared to the decade's average of 75,250 deaths per year. However, last year 256 million people were reported affected by disasters, well above the decade's average of 211 million.

From 1991-2000, natural catastrophes reportedly cost an estimated US$ 78.7 billion per annum (2000 prices). The estimated cost of 1999's Turkish earthquake was equivalent to 7 to 9 per cent of annual GDP. The impact of Hurricane Mitch in 1998 on the Honduran economy was estimated at equivalent to three-quarters of annual GDP.

However, the full economic cost of a disaster is often even. Estimated costs are based on 'direct' physical losses of buildings, infrastructure, industrial plants, crops and materials. Meanwhile, 'indirect' and 'secondary' effects on economic activity go unreported. Indirect costs refer to damage to the flow of goods and services – for example, lower output from damaged or destroyed assets and infrastructure. Secondary effects concern both the short- and long-term impacts of a disaster on overall economic performance, such as on external and government sector balances, levels of debt and government monetary policies. Indirect and secondary costs may be substantially higher than direct damage.

Topic 1: Types of disasters

ⓘ Because of their future role in the community, pre-service teachers need a thorough understanding of likely risks and management strategies. Take time to discuss their beliefs about hazards in PNG.

Hazard perception

Each of us 'sees' or perceives the world differently, depending on factors such as our age, background, previous experiences, circumstances and occupation. For example, one person might consider the Highlands a place of great interest and natural beauty, another may find it violent and undeveloped, while a third person may see it as having great potential for the development of tourism. Similarly, hazards are perceived

Figure 1: Hazard warning. Source: NDO

differently by different people. The study of the perception of hazards looks at the way that people view a potential hazard and how this influences their ability to prepare, cope and respond. There are a number of reasons why people have different perceptions of hazards.

Attitude

Some people are willing to take risks, while others are more conservative. Amongst people living in high-risk locations, optimism is common. This might be expressed in comments such as 'it won't happen to me' or 'it won't happen again'.

Knowledge

Many people may be unaware of the hazard potential of their area, and so do not perceive any significant risk. For example, before 1952, the people of Oro knew little about the possibility of a major eruption in their province, and so did not feel they were in any danger. On the other hand, Californians living along the San Andreas fault are fully aware of the fact that they live in an active earthquake zone, and so are able to make preparations for 'the big one'.

Experience

Hazard perception may be greatly altered by experiencing a major natural disaster. Suffering property damage in a flood or cyclone may prompt people to rebuild in a way that better resists future damage. An extended drought may prompt farmers to alter their land practice in preparation for future dry years.

The nature of the hazard

Different hazards are perceived differently. For example, people will respond to the slow onset and less visible effects of drought much differently than to the rapid and destructive impact of a cyclone or tornado.

Customs and beliefs

Behaviour is often guided by established ways of doing things. Aboriginal Australians, for example, traditionally use controlled burning as a way to flush out their food supply. At the same time, this practise reduces the long-term risk of major bushfires. The Kalahari Bushmen of southern Africa follow a strict pattern of movement and group divisions developed over many centuries in response to frequent drought. Religious beliefs also influence hazard perception. Most of the people living along the Ganges River believe that the devastation caused by frequent flooding is an act of God, about which very little can be done.

Wealth

The different abilities of rich and poor countries to cope with major hazards are an important influence on hazard perception. A hazard such as a major flood, for example, may be perceived as life-threatening in Bangladesh, while a similar event in a richer country may be seen only as a threat to land and property.

Competing factors

Just as Californians live with the threat of a major earthquake, so many other people accept the risk of living in a potential hazard zone, because of the advantages the area offers. Often these advantages are related to the hazard itself. For example, most Hawaiian's living in volcanically active areas see the advantages of farming fertile volcanic soils as far outweighing the risk of a major hazard. Egyptian farmers along the Nile River, for centuries used the annual floodwaters to irrigate and deposit new topsoil, fully accepting the risk of disastrous floods.

The table following lists a number of hazards which occur because of natural and human elements. Many of these hazards have the potential to become disasters.

Aeronautical and space debris	Asteroid/comet impact
Avalanche	Blizzard/snowstorm
Bomb threat	Bridge collapse
Building collapse	Bushfire
Carcinogens/mutagens/pathogens	Civil disturbance or riot
Cyclone, hurricane, typhoon	Dam collapse/overflow
Desertification	Drought
Drugs	Earthquake
Economic recession/depression	Electromagnetic radiation
Epidemic • human (e.g. AIDS, influenza, malaria) • animal (e.g. foot and mouth, rabies) • plant (e.g. dieback)	Erosion • soil • coastal
Famine	Fire (residential, office, factory)
Flood	Fog
Frost/extreme cold/sea ice	Hailstorm
Heatwave	Industrial accident/explosion
Landslide/rock fall/mudflow	Mine accident
Nuclear hazards • War • Power-station accident	Plague • animal (e.g. rabbit, mouse) • insect (e.g. locust, sirex wasp) • plant (e.g. prickly pear)
Oil spill	Ozone depletion
Pollution (water, air or land) • chemical • oil • toxic waste • gas	Severe storm • electrical (lightning) • extreme wind • torrential rain
Resource shortage/depletion	Salination
Sea-level rise	Storm surge
Subsidence	Terrorism
Tornado/waterspout	Transport accident - air rail road sea
Tsunami	Volcano
Utility failure • power • pipeline burst (gas/oil) • water • communication • gas/fuel	Warfare • nuclear • convectional • chemical/biological

Source: Dolan (1999) ***Hazard Geography****.*

☞ 4.3 Activity 1

Brainstorm (whole class)

- Which of these hazards have caused disasters in PNG?
- Which of the others are quite likely to occur in PNG and what are the likely consequences?

Group work

- Select two types of hazards and state what could be done to reduce the likelihood of occurrence.
- Select one hazard and draw up a spider map showing its effects and related hazards.

Recent disasters

Following are just a few examples of disasters which occurred around the world in 2000 and early 2001.

- In February and March, 2000, floods killed 650 people and left more than half a million homeless in Mozambique. The heavy rains also affected Botswana, Swaziland and Zimbabwe.
- Cyclones Eline (mid-February) and Gloria (early-March) caused serious damage in Madagascar and left 184,000 people in need of immediate relief support out of a total of 737,000 affected. In early April, 2000, a third cyclone, Hudah, hit the north of the islands.
- Central and South Asia suffered from severe drought. The countries most affected were Afghanistan, Iran, Pakistan, Tajikistan and Uzbekistan as well as Armenia, Azerbaijan and Georgia. The drought resulted in significant losses of livestock and crops, and rapid deterioration of health and sanitary conditions caused large population displacements. Drought also severely affected the Horn of Africa and Eastern Europe.
- In early June 2000 a series of earthquakes, measuring up to 7.9 on the Richter scale affected the island of Sumatra, Indonesia. The earthquakes killed nearly 130 people and caused 6 million US$ damage.
- From May to August, 2000, wildfires swept across the USA. The damages are estimated at over 1 billion US$.
- A massive oil slick threatened the sensitive environment of the Galapagos Islands, fouling the archipelago's beaches. These islands are home to 10,000 giant tortoises. The spill occurred when a tanker ran aground on January 16 on rocks off San Cristobal, the easternmost island in the Galapagos.

- In January 2001 an earthquake in San Salvador killed more than 400 where a massive mudslide engulfed as many as 500 middleclass homes. Rescue work was hampered by up to 500 aftershocks.
- An Australian record of 26,200 lighting strikes was recorded in one hour across a region of north Queensland as violent storms lashed the area causing millions of dollars in damage.
- Other disasters in 2001 included the sinking of a giant oilrig in the Atlantic Ocean which sparked fears of a massive oil spill and the outbreak of foot and mouth disease in Britain necessitating the slaughter of millions of animals.

Disasters in PNG

Over the years, there have been many natural events which have caused deaths or damage in PNG. These include:

1888 Tidal waves kill many coastal villages near Dampier Strait after the collapse of Ritter Island volcano, Morobe.	**1920** Smallpox epidemic at East Nakanai, WNB.
1923 Fire from Lamhaga to Dawadawa River, MBP.	**1926-27** Cyclone along coastal Central.
1933 Earthquake at Finschhafen, Morobe.	**1935** Earthquake at Aitape, WSP (Sandaun).
1937 Volcano eruptions kill 507 at Rabaul, ENB; drought, Milne Bay; earthquake and tidal waves, Aitape.	**1939** Cyclone at Alotau, MBP.
1941 Yellow butterfly plague in Madang; earthquake, Josephstaal, Madang.	**1941-42** Droughts in Southern Highlands and Madang.
1944 Dysentery epidemic in Lai Valley, Enga.	**1945** Dysentery epidemic at Kaiapit, Morobe.
1948 Earthquakes in East New Britain.	**1949** Polio epidemic in Milne Bay; earthquake, Aitape.
1951 Volcanic eruptions kill 2942 people at Mt Lamington, Oro.	**1952** Cyclone at Losuia, MBP.
1957 Volcanic eruptions force evacuations from Manam Is, Madang; polio epidemic, East Sepik.	**1965** Droughts in Western and Morobe.
1966 Floods on the Sepik River at Angoram, ESP.	**1967** Cyclone Annie at Mine Bay.
1968 Earthquakes at Wewak and Maprik, ESP.	**1970** Earthquake kills 18 in Madang.
1971 Landslides kills 11 at Telefomin, WSP (Sandaun); earthquake, East New Britain.	**1972** Heavy frost caused famine in Enga and Southern Highlands; Cyclone Hannah, Tufi, Oro; Cyclone Hilda, Bougainville, NSP; drought and famine, Western and Morobe.
1973 Floods at Angoram; beginning of 4-year plague of locusts in Markham and Memeng valleys, Morobe, and Ramu valley, Madang.	**1975** Earthquake causes heavy damage, Torokina, NSP.
1977 Floods after 55 cm of rain in 8 hours, Pomiop, ENB.	**1981** Earthquakes in East New Britain, East Sepik, North Solomons, and West Sepik (Sandaun).

1982 Volcanic eruptions cause evacuations from Manam Is.	**1983** One landslide kills 45 and another kills 8 in Western Highlands; floods, Busu River, Lae, Morobe.
1984 Floods in Lake Kopiago area, SHP; famines, Gulf, Southern Highlands, and Western Highlands; earthquake, Karkar Is, Madang**.**	**1985** Floods in Markham Valley, Central, and Oro; earthquakes, West New Britain and New Ireland.
1986 Cyclone Namu in Milne Bay; earthquakes, Western Highlands and East Sepik; droughts, Western and Milne Bay; floods, Bumbu River, Morobe, and Baiyer River, WHP.	**1987** Earth, Umboi Is, Morobe; mudslide kills 11, Goroka, EHP; widespread drought.
1988 Locust plague in Markham and Ramu valleys; landslides kill 75, Kaiapit, Morobe.	

Source: Rannells: A Fact Book on Modern PNG

☞ 4.3 Activity 2

Bring the PNG table up –to-date by adding at least five more recent disasters.

Oral history: In pairs talk to older inhabitants in your region about their experience of disasters.

ⓘ Older members of the community are a valuable source of information and traditional wisdom about events.

Impact of disasters

Many of the world's regions at risk from disasters simply fail to recover before another catastrophe strikes. Shattered families, homes, schools, roads, livelihoods take years to repair, let alone to rebuild and recover in a way more resilient to the next disaster.

The effects of a disaster are long lasting. Disaster-affected countries deplete many of their financial and material resources in the immediate post-impact phase. The bulk of the need for external assistance is in the restoration of normal primary health care services, water systems, housing and income-producing work. Social and mental health problems appear when the acute crisis has subsided and the victims feel (and often are) abandoned to their own means.

Too much relief delivered too fast overwhelms disaster survivors. Well-targeted relief, however, can begin the slow process of recovery. Following 1999's super-cyclone which devastated India's coastal state of Orissa, aid was often indiscriminately dumped in areas enjoying the greatest media coverage. Aid workers spoke of 'relief supermarkets' creating expectations which made subsequent efforts to encourage community-based disaster preparedness very difficult. Red Cross 'developmental relief' in Orissa, however, included distributing saline-resistant seeds (plus the tools, fertilizers and agricultural training needed to make them grow) and promoting disaster-resistant housing for the most vulnerable.

Topic 2: Disaster case studies

Papua New Guinea country case study: impacts and responses to the 1997-98 El Niño event

(www.esig.ucar.edu/un/png.html)

ⓘ Most students should have a clear recollection of this event. Have them relate their experiences before reading the case study.

El Niño and Papua New Guinea

Situated close to the normal warm water pool of the southwest Pacific, Papua New Guinea can be seriously, and quickly, affected by El Niño events. Historically, the most common direct effect of the eastward movement of the warm water pool appears to be reduced cloud cover. This results in lower rainfall over much of the country and this can cause drought in the worst affected areas. Reduced cloud cover also allows faster cooling of the land overnight. In the highlands, this increases the number of frost days above 2,200 metres and allows the frosts to extend to lower altitude areas that rarely experience frost conditions. The reduced rainfall and higher frost rate can lead to water shortages, crop losses and famine. These increase the vulnerability of the human population to disease and dry the vegetation making it more vulnerable to fire. Surviving vegetation is weakened and, in turn, becomes vulnerable to pest and disease attacks. The longer the impact lasts, the longer the recovery period appears to be.

The 1997-98 El Niño event

Drought. - The first measurable effect on Papua New Guinea of the 1997-98 El Niño event appears to have been in March 1997 when there was low rainfall at nine of the twelve official weather stations, including all those situated on mainland New Guinea. Above-average rainfall was recorded at a few stations during July (reportedly as a result of short-term events) and in one station in August but this was not enough to relieve the developing drought, which continued for the rest of the year. Notable examples include Tabubil, with one of the highest rainfalls in the country, which received 78.6 mm in August compared to an average of 684.3 mm; and Port Moresby which recorded no rain in August, October and November and only 7.8 mm in September (compared with an average of about 164 mm for this period).

Frost - Subsequent research indicates that frosts occurred above 2,200 meters in the Western Highlands as early as June 1997 and were experienced in every month until at least October. At Tabubil in September 1997, there were eight successive nights of frost in an area that normally experiences only occasional frosts.

Fire - A secondary result of the El Niño drought and frost was the increased incidence of bush fires in mainland New Guinea. The first fires were probably started by landowners burning off vegetation to clear land for new crops when rain returned. Some of these fires got out of control in the unusually dry conditions and spread far beyond the originally planned areas. Later fires were lighted by landowners who believed that smoke would bring clouds, which would bring rain. By the time these fires were lit, the vegetation was even drier, so they

often spread further and the calm atmospheric conditions left much of mainland covered in smoke and haze.

Initial impact reports - The Papua New Guinea government became alarmed in early August 1997. By September 1997, reports from the Departments of Health, Provincial Affairs and Local Government, provincial authorities, churches and the media covering all nineteen provinces revealed food and water shortages, power rationing, school and health clinic closures, and outbreaks of disease linked to the use of brackish or untreated water or to dust and smoke inhalation. Subsistence farmers were already searching for "famine" foods in some areas, and people were travelling long distances to obtain water for drinking and cooking.

Thirteen assessment teams, made up mainly of staff from the Department of Agriculture and Livestock, carried out the assessment between 25 September and 11 October. The teams visited a representative selection of villages in all provinces and returned a total of 638 questionnaires. To provide a measure of standardization, teams were asked to complete the questionnaire by making an objective assessment of the situation in each village and by allocating a category based on a five-point scale. The scale was as follows:

- Unusually dry, but no major food supply, drinking water or health problems.
- Some inconvenience - staple food is short but other food available; must travel further to collect drinking water but health is okay
- Difficult, with food short and some famine food being eaten, water available at a distance, some babies and old people unwell. No lives at risk.
- No food in gardens, famine food only being eaten, water in short supply and possibly polluted, increasing sickness, the lives of small children and old people at risk
- Extreme situation - no food available at all, water very short, many people ill, small children and old people dying

The assessment indicated that about 77,000 people were in a life-threatening situation due to food shortages and a further 100,000 were expected to be in that situation by the end of October 1997. A second assessment was conducted between 25 November and 12 December 1997. This assessment indicated that almost 1.24 million people, 40% of the rural population, had little or no food available while about 410,000 people either had very limited supplies of contaminated water or had to collect water of variable quality for long distances.

Urban communities were not subject to the same food shortages, but the variety of fresh produce available in markets was significantly reduced and prices increased. The prices of domestically sourced goods in trade stores also increased. Urban dwellers were obliged to send food or money to their rural "wantoks" to help them through the drought. This had an economic impact on urban-dwellers but reduced the effects of the drought on recipients.

Power restrictions - A major impact on urban populations, particularly in the capital, Port Moresby, was the extent of power restrictions caused by a shortage of water for hydroelectric purposes. To reduce water use, load-shedding measures began in August 1997 but from 17 November the city was divided into two supply areas and each had power cut off for half of each working weekday. This significantly reduced water usage and made it unnecessary to ration domestic water use.

Economic impacts - On March 4 1998 the Treasury Minister advised Parliament that the country had lost 500 Million Kina (US$ 278 million) in foreign exchange reserves as a result of

the prolonged drought. This was approximately 62% of the previous 800 million Kina reserve and left the country with only enough funds to cover the cost of two months of imports. The Minister highlighted the impact of the drought-induced closures of mines and stated that the minimal currency inflow from traditional export sources and the downturn in the timber industry had also contributed to the loss. Coffee exports fell by 11.8%, cocoa exports by 32.9%, copra exports by 35.7% and palm oil exports by 22.6%.

The drought had a more direct effect on mineral exports. The most dramatic impact was the fall in the level of the Fly River, which is normally navigable for about 800 km up to the port of Kiunga, the supply port for the huge Ok Tedi mine in Western Province. The level fell so far in August 1997 that only canoes could move on the river. Not only could no ore be carried down to the river mouth for export but also supplies for the mine could not be brought in.

Social impacts - The people worst affected by the drought and frosts were subsistence farmers living a semi-subsistence lifestyle in the highland or island provinces. During the drought, many of these families survived on so-called "famine" foods, wild leaves, roots and animals that are not normally eaten.

National response - In early September the Papua New Guinea government allocated 4 million kina in 1997 to provincial administrations to fund immediate relief to the worst affected areas. On 17 September, the government made a further K 20 million available for relief. As the results of the first assessment were examined, it was clear that it would be impossible to assist all affected people. The government agreed to give supplementary rations to those in areas assessed as being in Categories 4 and 5, i.e., whose lives were considered to be at risk. The scale of relief agreed upon was 8 kg of rice, 2 kg of wheat flour and 1 litre of oil per person per month to be delivered through provincial authorities to district authorities who would be responsible for distribution through village and community leaders.

International response - The international response to the developing crisis was substantial. Australia, as the previous colonial power, made the largest contribution and had the highest profile but a wide range of donors (including France and Japan) contributed to the relief operation. Australia deployed aircraft and helicopters as well as naval landing craft to deliver assistance. Deliveries continued from late October 1997 to April 1998. Australia also contributed technical assistance, staff and medical support, consultancy services, non-government organization support and seeds and planting materials for recovery. By June 1998, a total of AU$30 million had been provided.

Recovery operations - As rain began to fall and vegetation recovered from the effects of El Niño, the priority was to obtain seeds and planting materials (usually tubers and cuttings) to enable people to start planting staple crops as quickly as possible. In drought-affected areas, most or all of the tubers and seeds that would normally have been saved for planting had been eaten or had been destroyed by bush fires, drought or frost. Some planting materials were located elsewhere in the country and more obtained from overseas. Frost and drought resistant varieties of the major staples that would be acceptable to the local communities were also sought.

Lessons learned

Major lessons learned include the need for the following:

Emergency management

- An emergency management structure with agreed roles and responsibilities that extend from Cabinet level down through national, provincial and district to village level that encompasses not only the official sector but also the non-government organization and the business sector
- Comprehensive updated national disaster plans that are regularly exercised, tested and reviewed to meet changing threats, administrative arrangements and requirements.
- A comprehensive training program for all those involved in emergency and disaster management
- A standardized, trustworthy and auditable approach to dealing with funds donated by the public and by donors after a disaster
- A standardized disaster impact assessment system with teams trained in its use
- Arrangements under which funds for response operations can be made available quickly in an emergency

Hazard monitoring

- A review of current hazard-monitoring capabilities and procedures and development of improved systems that will provide early warning of developing threats and regularly updated information on their characteristics and progress
- A system that ensures that the warnings reach the right people in a timely manner
- Agreed to and widely known arrangements for communicating threat information to the general public accompanied by appropriate background information and action recommendations

Public information and education

- Public education about the hazards that threaten Papua New Guinea, their origins, causes and characteristics
- Community education programs, using a variety of channels, that advise the population of the appropriate protective measures to take to protect itself from the hazards that may threaten it

Disaster prevention and mitigation

- National hazard and vulnerability analysis followed by a risk management process that identifies the most appropriate management strategies to reduce the impact of the various threats
- Collection of baseline information that will enable the impact of hazards to be forecast and, if necessary, monitored to enable the most appropriate prevention, mitigation, preparedness, response and recovery actions to be taken
- Greater attention to be paid to the maintenance of existing infrastructure so that it is better able to meet the requirements of the population in an emergency

- A coordinated approach to dealing with the water supply needs of both rural and urban populations
- Supplementing the existing power-generation arrangements to keep pace with increasing public and commercial needs in all population centres

Information management

- Definition of channels for collection, organization, analysis and distribution of information and the delegation of appropriate responsibilities

Improved communications systems between national, provincial and district level disaster managers that will continue to be available in an emergency

ⓘ Below is a practical activity which introduces students to the problem of supply and logistics during an emergency.

☞ 4.3 Activity 3

For the purpose of this activity assume that you are a Volunteer working for CARE Australia. You have just been sent to PNG for 6 months. Your agency, which is working with rural communities between Mt Hagen and Lae, has just received funds for drought relief work there. What activities could be funded to deal with the problems of:

- *Lack of water*
- *Lack of food*
- *Replanting of crops*

Suggest how relief supplies could be delivered from Laeto the following locations East Cape in Milne Bay, Kokoda and Telefomin.

Case study: housing reconstruction in Mexico City

Alcira Kreimer and Edward Echeverria

During the 1990s, Mexico City - located more than 2,000 metres high, on an enormous lakebed - has become one of the largest metropolises in the world. Home to more than 15 million Mexicans (about 19 percent of the country's population) who live in the Federal District and 17 surrounding municipalities, the city is a disjointed assembly of mixed urban habitats. These habitats—located in the Valley of Mexico, surrounded by volcanos and mountain chains, differ in their subsoil, altitude, and degree of modernization. Their major infrastructure and service systems are not integrated, and a complex network of regulations and overlapping

administrative jurisdictions operate in isolation, with no sense of metropolitan unity. The metropolitan area now covers nearly 1,500 square kilometres.

On September 19, 1985, at 7:19 a.m., Mexico City was struck by an earthquake that measured 8.1 on the Richter scale and lasted more than a minute and a half. The next day there were a number of lesser quakes, the strongest of which measured 7.8 degrees. The catastrophe took more than 5,000 lives, caused 16,000 injuries, and damaged or destroyed 12,700 buildings—65 percent of them residential. The housing of about 180,000 families was damaged and 50,000 people had to be temporarily rehoused. Also affected were 340 office buildings in which 145,000 government workers were employed, plus 1,200 small industrial workshops, 1,700 hotel rooms, 1,200 schools, and 2,000 hospital beds.

The government of Mexico asked the World Bank for assistance for the reconstruction of hospitals, schools, and low-income housing and for research into revised building codes, zoning, and regulatory measures to reduce the city's vulnerability to earthquakes. RHP (Popular Housing Reconstruction) was set up three weeks later by presidential decree as an autonomous agency with a life of two years. RHP is a textbook example of successful reconstruction. By July 1987, only 14 months later, RHP had rebuilt 45,100 dwellings - an average of 3,220 dwellings a month. Today one of every seven families living in the city's historic centre has a new or rehabilitated RHP dwelling. This was one of the largest reconstruction programs since the recovery from World War II.

Early proposals for reconstruction focused on vacant land in outlying areas, including a site adjacent to the airport. But World Bank financing was contingent on rebuilding onsite with minimal relocation, a policy based on negative experiences the Bank had had with large-scale relocation in other disaster areas. Most families had lived in their neighbourhoods for a generation or more and wanted to remain there, so the government adopted a policy of reconstruction onsite.

☞ 4.3 Activity 4

Compare the redevelopment in Mexico with redevelopment in East New Britain after the 1994 volcanic eruptions. Research or discuss the work of the Gazelle Restoration Authority.

Topic 3: Disaster management

Early warnings

Early warning is the means by which a potential danger is detected or forecast and an alert issued. Warning systems are only as good as their weakest link. They can, and frequently do, fail in both developing and developed countries. Adequate human, material and technical resources are needed to establish and operate early-warning systems properly.

Disasters happen when a natural phenomenon or unplanned occurrence of great force strikes a population that is vulnerable to its effects. During the latter half of the twentieth century, the results of scientific endeavours have provided a much better understanding about the natural forces which shape hazards and determine their behaviour. Major advances have been made in the capacity to anticipate potentially destructive natural phenomena and in the use of communication media to channel this knowledge to the people concerned.

Figure 2: Flooding in Bangladesh. Source: Kleeman et el (1998).

At the same time, rapid population growth has increased social and economic pressures on the natural environment in many countries. Natural features which previously provided protection from hazards have been uprooted or altered. The growing tendency of people to live on marginal or fragile landscapes or in conditions of urban poverty has increased their vulnerability to hazards. With the exception of earthquakes, it has become technically possible to anticipate the occurrence of most disasters arising from natural hazards, although the time of forewarning and the range of appropriate responses to the risk varies with the individual hazard.

It should be noted that one type of disaster could trigger others, as in the case of an earthquake resulting in flooding, urban fire or technological emergencies. The users of warning systems need to be aware of the possibility for multiple hazards and their compound effects.

Declaration of the Potsdam Early Warning Conference - September 1998

(www.unisdr.org/unisdr/declarwarning.htm)

"The frequency and severity of natural disasters have increased in recent years, and these trends are expected to continue well into the next century. There is therefore a strong need to strengthen disaster reduction policies around the world to ensure that natural hazards do not result in economic and social disasters. Natural disasters have significant impacts on the economic development, physical sustainability and social well being of all countries, particularly developing countries. They cause the loss of lives and human resources and threaten individual livelihoods. Disasters interrupt economic activity and destroy economic assets and financial investment. They also reduce private and corporate income, diminish job opportunities, cause declines in trade and commerce, and disrupt markets and business continuity. Disasters can

result in the reorientation of public investment from economic development to the needs of urgent rehabilitation of infrastructure and other immediate emergency requirements. Consequently, disaster reduction measures, including effective early warning, contribute to the creation of a low risk environment, thereby becoming a positive factor in international economic competitiveness and the maintenance of productive partnerships. Economic losses can be reduced considerably if a culture of prevention is introduced within a society at all levels -- and particularly when local communities understand that response is not the only strategy when disaster strikes. Many tragic events in recent years have demonstrated the cost of inadequate warning systems. By contrast, the successful application of local preparedness initiatives, such as those made possible by the effective communication of scientific analysis prior to the eruption of Mt. Pinatubo in the Philippines in 1991, among others, emphasizes both the feasibility and the value of early warning."

Early warning in PNG and the Pacific (tsunamis)

The International Tsunami Information Centre, based in Honolulu, Hawaii, can provide warnings of some tsunamis for the entire Pacific region because tsunamis may take many hours to travel from one part of the Pacific to another and their passage across the ocean can be calculated and tracked in advance. However, this task is very much more difficult within a small country such as Papua New Guinea because tsunamis (like the Sissano one) may take only minutes to travel to a vulnerable shoreline from the point where they originate within that country. An early-warning system might be technically feasible and would be useful for obtaining scientific information on tsunamis, but there remain severe practical problems for disaster-mitigation purposes:

- The high costs of establishing and maintaining an effective system
- How quickly people would be able to respond to a warning of only a few minutes
- Where they would be able to escape to if they did respond quickly

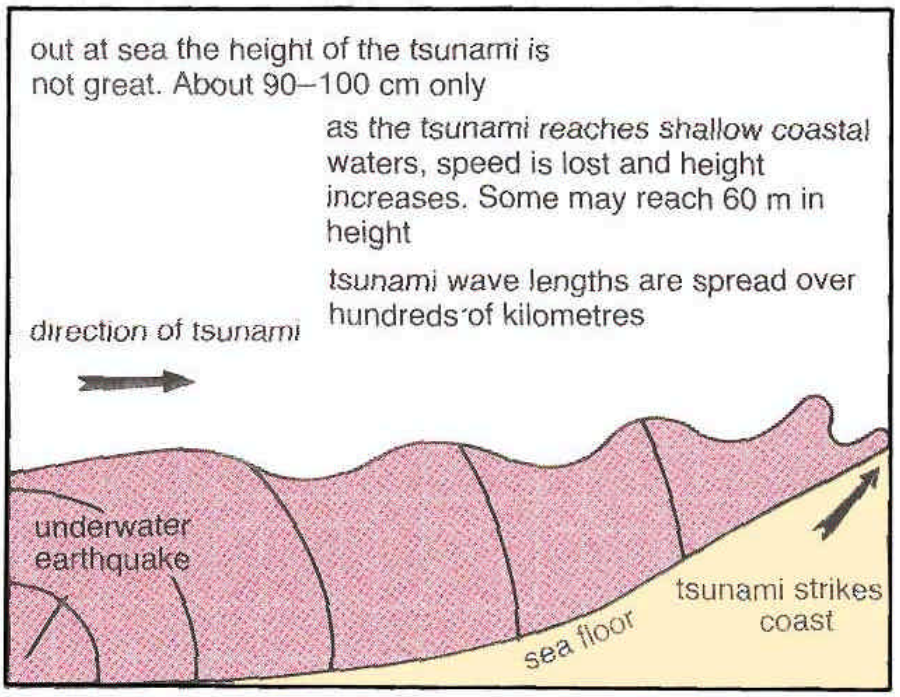

Figure 3: Tsunami creation. Source: Dolan (1999).

The key to mitigating tsunami disasters in these cases is a combination of:

- Public awareness and education of the communities likely to be affected about the nature of tsunamis and how vulnerable they are to them, with a view to communities settling away from at-risk areas
- Warning systems that do not necessarily have to depend on technologies that are expensive and difficult to maintain and sustain - for example, warning bells on beaches that could be rung by hand by people who saw approaching tsunamis, might be useful in some rare circumstances where tsunamis can be seen (in daylight) breaking a long way off-shore
- Introduction of basic disaster-prevention measures, including identification of escape routes and refuge

Low-lying coastal areas in the southwest Pacific have attracted people to them because of the proximity of water and for the purposes of fishing and coastal trade. Persuading people not to live within a few hundred metres of the coastline or lower than, say, 10 metres above sea-level is no easy task for authorities. Yet these are the areas most at risk to the impact of tsunamis. Most of the population of West New Britain lives close to the coast and at heights of less than 10 metres above sea level. Archaeologists have evidence that people in New Britain in ancient times used to build their villages on hills away from the coast. This may have been because higher places are healthier than coastal ones, or because people there could defend themselves better from attacks by invading groups. But another possibility is that they were aware that tsunamis could destroy coastal settlements.

To make early warning more successful education of at-risk populations throughout the southwest Pacific region is recommended so that they can react swiftly to warnings of possible tsunamis, including those of both volcanic cone collapse and earthquake origin.

How to save your life before a tsunami comes

Read this pamphlet and be prepared now!

Talk with family and friends about tsunami safety. This could save their lives.

Know the warnings signs: *shake… drop… roar… run!*

When you are near the sea think ahead:

What would I do if a tsunami came?

Where would I run to?

If you become aware of any of the warning signs

Run to a safe place, immediately!

If trapped on low ground near the sea, climb a tree; you may be safe.

Stay at the safe area for several hours. Remember more waves may come.

Do not stay in a car near the sea. The wave can carry the car along, like another piece of debris.

If you are on a boat:

If you are at sea, do not return to the coast until the waves have ceased.

Stay out in the open sea. There you are safe.

If you are on a ship at a wharf or jetty, and there is no time to take the ship out to sea, leave the ship and run to a safe place.

If you are caught by a tsunami wave

Swim as strongly as you can!

Find something that floats and hang on to it.

Figure 4: Tsunami Warning. Source: NDO

Risk management

Natural disasters are a tragic interruption to the development process. Lives are lost; social networks are disrupted; and capital investments are destroyed. This has created a growing realization that, in addition to post-disaster relief and recovery measures, greater attention is needed on pre-disaster measures to prevent negative impacts from hazard events and to be better prepared for those that are not prevented. Community preparedness is the only practical solution for poor countries located in high-risk areas. The local population brings any effective help in the first few hours and it is their capacity that has to be strengthened.

Hazard and risk identification

Any effective strategy to manage disaster risk must begin with an identification of the hazards and what is vulnerable to them. Hazard mapping and the utilization of GIS systems are among the ways in which risk information may be organized for the benefit of potential users.

Risk reduction

Effective risk reduction involves measures such as land use planning, structural design and construction practices, and disaster warning systems. In addition to employing scientific and technical knowledge, risk reduction may also involve overcoming the socio-economic, institutional and political barriers to the adoption of effective risk reduction strategies and measures in developing countries. This may be accomplished through local and regional workshops and conferences aimed at heightening the awareness of stakeholders to the threat of natural disasters and what can be done about it, and educational and training activities that increase the understanding of policy makers, decision makers and practitioners about disaster management.

International Strategy for Disaster Reduction (ISDR)

Just over ten years ago, the General Assembly of the United Nations declared the 1990's as the International Decade for Natural Disaster Reduction (IDNDR). For several years, economic losses stemming from natural disasters had been dramatically increasing, the result of a combination of several global trends, including:

- Climatic changes, leading to an increase in hydrometeorological hazards worldwide
- Demographic shifts, exposing more and more people to natural hazards such as earthquakes, floods and typhoons
- A substantial increase in the density – and thus vulnerability – of the built environment
- Insufficient land use planning, due to difficulties in undertaking long-term policies in this field

Protecting populations from natural hazards has always been extremely important. However, it is imperative for communities to move beyond this mindset, and study the possibilities they have to prevent hazards from becoming disasters – i.e. to focus on risk management. Prevention and risk management imply taking time today to think about the "what if's" of tomorrow. This means understanding and assessing probabilities, studying options and, together with political leaders, putting workable management plans into place.

Emergency management strategies in PNG

Papua New Guinea is at risk from a wide range of natural hazards all of which can have a significant impact on the daily life of the population and on the economy. The rural population accepts the impact of the hazards as part of daily life in a culture in which the struggle for existence is often difficult. The major meteorological hazards are severe storms and floods (which may also cause landslides), drought, tropical cyclones and frost. The country is also prone to geological hazards, including earthquakes, tsunamis and volcanoes, of which 14 are currently considered active. The common developing country disease and transport hazards also exist, as do industrial and mining hazards and there are risks to crops from pests and plant diseases.

Figure 5: Major towns in PNG

Volcanic eruptions, earthquakes, tsunamis, and other natural hazards cause major disasters that must be anticipated, and prepared for, by emergency management authorities in order to save lives and property. Emergency or 'disaster' plans are therefore an essential part of an emergency management system. These need to be established at the local, provincial, and national level to cover both prevention/preparedness and response/recovery.

The Disaster Management Act is the basic disaster management document in Papua New Guinea. It describes the basic disaster management structure and responsibilities and requires disaster plans to be prepared. The National Disaster Committee meets regularly, and since 1997 has been paying increased attention to disaster preparedness and mitigation matters. Provincial disaster committees exist in all provinces, although some are only marginally effective.

The National Disaster Management Office has the only full-time disaster management staff in the country. The office performs secretariat and administrative activities on behalf of the National Disaster Management Committee and runs the National Emergency Operations Centre. It also coordinates disaster preparedness measures and prepares and distributes the National Disaster Plan.

Papua New Guinea lacks an effective system for collecting, organizing, analyzing and disseminating disaster management information between the government, the public or external agencies. In 1997, the only hazard warnings were for tropical cyclones; there was no formal system for reporting hazard impacts on any part of the country, and there was irregular contact between the key disaster management agencies and departments. Little baseline information is collected so comparisons with normal times are difficult. Even records of past disasters are poor and hard to trace.

An integrated, national, **disaster (or emergency) management plan** is highly desirable for Papua New Guinea in order that effective emergency-management practices can be encouraged and coordinated at local, provincial, and national levels. The importance of a PNG Disaster Management Plan was stressed as a result of a national emergency-management workshop held in Goroka in August 1995, partly in response to lessons learnt, and experience gained, during and after the disastrous volcanic eruption at Rabaul in September 1994. A draft

project proposal was written for consideration by international development-assistance agencies as a result of the Goroka meeting, but unfortunately, this did not develop into an operational project. The need for a PNG Disaster Management Plan again became obvious following response and recovery operations after the Sissano Lagoon tsunami disaster in July 1998.

ⓘ You may need to contact local authorities to obtain relevant information for these activities.

Drawing up an evacuation plan is an important practical planning activity. Different groups could plan for a different disaster e.g., earthquake, civil unrest or fire.

☞ 4.3 Activity 5

Find out what emergency plans exist for your local area

Identify the emergency organizations which operate in PNG

Obtain details of Disaster Management program supported by AusAID

In groups, draw up a plan for the evacuation of your college in the event of a disaster.

Design a poster which illustrates actions which could be taken by individuals to minimise the impact of a disaster.

	What it involves	Flood example
HAZARD ANALYSIS	Identifying the hazard Providing warning of a developing threat Working out community vulnerability	Studying flood history and behaviour Installing instruments to monitor river levels and rainfall Drawing up flood-risk maps
PREVENTION or MITIGATION	Preventing the threat eventuating Minimising the impact of the event	Construction of dams and levees Flood-proofing of buildings Diverting of rivers and streams
RESPONSE PREPARATION	Alerting people to the threats Raising awareness of preparation needs Allocating responsibilities Stockpiling food and essential equipment	Preparation of emergency, evacuation kit Stockpiling of sandbags Activation of warning systems Rehearsal of plans
THE EMERGENCY EVENT	Eg eruption, flood, earthquake, oil spill	
RESPONSE	Combating the cause and effect of the hazard Assisting people affected Minimising effect of repeated events	Relocation of valuables, equipment and livestock Search, rescue and evacuation operations Sandbagging Fodder drops to livestock Medical attention, food and shelter for affected people
RECOVERY	Cleaning up and repairing damage Ongoing medical treatment Counselling to victims Financial, legal and other support Revision of hazard analysis Evaluation of prevention and mitigation measures	Restoring utilities, community services Repairing buildings Supporting victims Investigating behaviour of flood and comparing it to past events.

The steps in emergency management. Source: Dolan (1999).

☞ 4.3 Activity 6

Prepare a similar table of analysis for an emergency which has occurred in PNG e.g., the Rabaul eruptions, the El Niño drought, the Aitape tsunami.

Case study - emergency planning and volcanic eruptions

The lowest levels of alert are good opportunities for making sure that emergency-response plans are up-to-date and emergency resources are available. Early planning and preparation at these levels pay their greatest rewards at times of crises later on.

Figure 6: Rabaul ash and mud flow. Source: Lauer (1995)

Volcanic crises begin when a volcano shows signs of becoming 'restless' and volcanologists and local communities become concerned about the possibility of a volcanic eruption. For example, earthquakes may be felt on and near the volcano, or rumblings may be heard. New areas of hot ground and emissions of water vapour may appear; areas of vegetation may die back; streams may turn muddy. Small landslips may be seen on crater walls. Parts of the volcano may be pushed up, or subside. These situations may be perilous to the communities concerned if the signs are ignored and not reported to authorities. About 3000 people were killed by an eruption in 1951 at Lamington volcano, Papua New Guinea. There were certainly warning signs at Lamington, but they were not reported to relevant authorities and indeed many people appeared to be unaware that the mountain was even a volcano. The 'crisis' did not begin until the eruption had started. This, of course, was too late for assessing the situation and evacuating the population at risk.

Figure 7: Rabaul road washout. Source: Lauer (1995)

Some volcanoes may show signs of coming to life again, but the signs die away and so the crisis fades away too. Rabaul volcano (Papua New Guinea) showed signs between 1971 and 1985 of becoming active again (it had been in eruption previously in 1878 and 1937-43), and there was great concern particularly between 1983 and 1985 when Rabaul town was partly evacuated. However, the signs died away and many people thought the threat had passed. Then, nine years later, in 1994, eruptions began with only 27 hours of warning. Some eruptions therefore can take place with relatively little immediate warning.

There are fives concepts to consider in developing volcano-emergency plans:

Volcano alert system - A nationally accepted and well-understood system of volcanic-alert levels is the key tool for emergency managers to use when making a response associated with a volcanic crisis. The volcanic-alert system should provide clear messages to the affected community and to emergency-management agencies concerning the level of threat on the

volcano. The changes in volcanic activity may be gradual or take place very quickly, so the plans must be simple and flexible and should always be at hand and ready for use.

Hazard and risk mapping - Volcanic hazard maps are based on geological mapping of volcanic deposits from ancient eruptions and on historical records of volcanic eruptions. They define volcanic hazard zones on and around a volcano; identify areas at risk from any future volcanic events; and help to develop evacuation plans to protect the people identified as being at risk from the volcanic activity. Risk maps may also be used in development and land-use planning by local and provincial authorities. These show where people, investment, and agricultural lands are most at risk and what would be lost if a volcanic eruption were to take place.

Volcanic monitoring and warnings - Adequate volcano monitoring systems must be established at dangerous volcanoes, as they always give some indication of an impending eruption. These indications commonly may be taken as warning signs that lead to evacuation of the people at risk. The agency monitoring the volcano should issue regular bulletins containing information about the current status of the eruption and predictions about increasing or decreasing volcanic trends. These should be made available to the public and media.

Education and awareness - People will be more inclined to respond to warnings of an eruption if they understand the risk associated with a volcano. Education must include (1) local communities who may be affected by an eruption, (2) community leaders and managers who will be required to respond to eruption on behalf of the communities, (3) the media. An informed population is an important part of any emergency management plan, and major efforts must be made to provide the population with factual information about the volcano, the hazards facing them, and the efforts being made to mitigate them.

Response planning - Emergency (or disaster) plans must identify who is involved in the response and recovery stages of a volcanic eruption, what their respective roles and relationships are, and the resources that will be required to carry out the plans. They also need to consider the training of those people who will be involved, and they must be exercised to see that they work properly.

Figure 8: Turvurvur Volcano, Rabaul. Source: Rick Frost

☞ 4.3 Activity 7

Study the newspaper clippings below. Discuss the attitude towards hazards and/or disasters displayed by those involved. What are the consequences for disaster management?

Landslips worries highway motorists

FIVE landslides occurred at the weekend on the Highlands Highway between Goroka in the Eastern Highlands Province and Kundiawa in Chimbu Province.

A senior works officer in Goroka said two landslides occurred at Daulo Pass while another two took place at nearby Watabung government station, 48kin from Goroka.

The fifth landslide, which was a "major one", occurred at Mangiro on the Chimbu Province border. The officer said they had requested their national headquarters to provide emergency funds to clear the debris. But, the Gomia people of Mangiro said unless the Government responded to their K600, 000 compensation demand, they would not allow the Works Department to clear the landslide.

Bodies left on beach for over six hours, say divers

FOUR badly decomposed bodies retrieved from the sunken MV Feni on Feb 4, were left lying on the beach at Namatanai from 3pm to 9.30pm and health officers in Namatanai or those that came in from Kavieng were nowhere to be seen, it was claimed. The claim was made by two divers who helped retrieve the bodies. They said they could see the body bags lying on the beach from the nearby guest house where they were staying.

Albert Dominic Wong said he was disgusted by what he saw and described those responsible as disorganised and incompetent. This is lack of proper organisation and people responsible did not know what to do."

Muddy water after quake

PEOPLE living in Samberigi and nearby villages in the Southern Highlands Province have called for an investigation into foul smelling water they have been forced to drink since an earthquake struck the area two weeks ago. The earthquake, assessed at 6.2 on the Richter scale, caused landslides in the area. Since the earthquake on March 4, minor tremors were still being felt and more than 50 houses had collapsed as a result.

Chris McKee from the Geophysical Observatory in Port Moresby said rocks and soil from the landslide caused by the earthquake caused the murky water. Mr McKee said this was normal and it would take some time for the water to be clear again. He said there was nothing to worry about as this was the effect of the landslide. He advised the villagers to collect the murky water and let it stand for a while before drinking.

The National Disaster Management Office reported it had not received any assessment report from the Southern Highlands Disaster office, but it had received one from officers at the Gobe oilfield.

Mumeng people make K3.7m claim

The compensation demand for destruction to homes and property brought about by the flooding in December is expected to be presented at a rally at Mumeng to provincial authorities.

“Those that have lost or have had properties destroyed should be assisted or compensated… A claim of K3, 675,000 will be given to the Australian, National and Morobe provincial governments," Councillor David Gedisa said yesterday. Mr Gedisa, who is spearheading the move to demand compensation for the destruction, said the whole of Mumeng was in ruins, which could have been avoided had the colonial administration and the PNG authorities, after independence, seen the threat posed by the Kumala river.

Volunteers

"Too much help made a mess here," explained one spontaneous helper who drove to Golcuk, Turkey, following 1999's massive earthquake which killed 17,000 people. Hoping to bring relief, thousands of 'volunteers' created a 20-mile traffic jam obstructing rescue vehicles and equipment. Four years earlier, an earthquake destroyed much of Kobe in Japan, killing 6,400. The quake prompted over 1 million Japanese to spontaneously volunteer.

Do disaster volunteers do more harm than good? Kobe's volunteers organized themselves. However, the flood of Turkish helpers overwhelmed emergency services. Coordinating volunteers is a key challenge in rapid-onset disasters.

Some experts call these disorganized crowds 'spontaneous helpers' – they only become volunteers when organized. Either way, successful disaster response depends on agencies and authorities integrating them quickly into a coordinated strategy. Successful disaster response

depends on good volunteer management systems, which should include identification, recruitment, retention, involvement and recognition.

The idea that volunteering is about richer people helping the poor is out of date. In Bangladesh, volunteering means communities taking responsibility for everything from micro-finance to disaster prevention. Volunteering is a means of building 'social capital'. Volunteer organizations can contribute by training leaders within communities to manage risk and become agents of their own development.

☞ 4.3 Activity 8

Describe the role of volunteers during a disaster. Give specific examples of their work in PNG.

What volunteer organizations operate in PNG?

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