CHAPTER 3

Linking disasters and development[1]

Introduction

This training module provides a new conceptualization of the relationship between disasters and development. This new conceptualization has been growing in the development community over the last few years and is a major philosophical underpinning of the United Nations Disaster Management Training Programme. Rarely a week goes by when a major disaster is not reported in the media—a disaster that results in death and destruction—a disaster that frequently wipes out years of development programming and sets the slow course of improvement in third world countries further behind, wasting precious resources.

For a long time the cause and effect relationship between disasters and social and economic development was ignored. Ministries of Planning and Finance and other development planners did not concern themselves with disasters. At best, development planners hoped that disasters would not occur and, if they did, were most effectively handled by relief from donor countries and relief organizations. Development programs were not assessed in the context of disasters, neither from the effect of the disaster on the development program nor from the point of whether the development programs increased either the likelihood of a disaster or increased the potential damaging effects of a disaster.

Disasters were seen in the context of emergency response—not as a part of long term development programming. When a disaster did occur, the response was directed to emergency needs and cleaning up. Communities under disaster distress were seen as unlikely places to institute development. The post-disaster environment was seen as too turbulent to promote institutional changes aimed at promoting long term development.

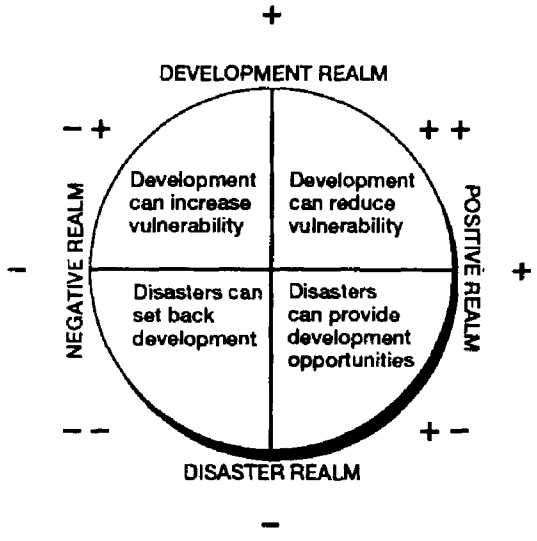


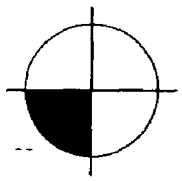
Figure 3.1

This figure charts aspects of a community's development and vulnerability to disaster. It shows the various "orientations" with which you may analyze the "field" of development and disaster vulnerability.

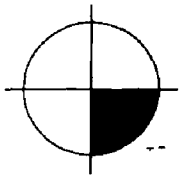
The field is divided into positive and negative aspects of the disaster/development relationship by the vertical axis. The right half reflects the positive or optimistic side of the relationship and the left side of the diagram deals with the negative aspects of the relationship. The statement in each quadrant sums up the basic concept derived from the overlap of the two realms.

[1] Sources for this chapter are **Disasters and Development**, a UNDP/UNDRO training module prepared by R S Stephenson and **Disasters and Development: a study in institution-building** prepared for UNDP by INTERTECT, January 1991

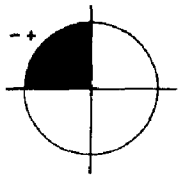
The growing body of knowledge on the relationships between disasters and development indicates four basic themes. The themes presented in the preceeding figure may be expanded as follows:



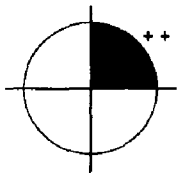
1. Disasters set back development programming destroying years of development initiatives.
   - Infrastructure improvement e.g. transport and utility systems are destroyed by a flood.



2. Rebuilding after a disaster provides significant opportunities to initiate development programs.
   - A self-help housing program to rebuild housing destroyed by an earthquake teaches new skills, strengthens community pride and leadership and retains development dollars that otherwise would be exported to large construction companies.



3. Development programs can increase an area's susceptibility to disasters
   - A major increase in livestock development leads to overgrazing, which contributes to desertification and increases vulnerability to famine.



4. Development programs can be designed to decrease the susceptibility to disasters and their negative consequences.
   - Housing projects constructed under building codes designed to withstand high winds result in less destruction during the next tropical storm.

Decision-makers who ignore these relationships between disasters and development do a disservice to the people who place their trust in them. Increasingly, around the world, forward thinking Ministries of Planning and Finance with the support of United Nations and Non-Governmental Organization (NGO) officials are assessing development projects in the context of disaster mitigation and are designing disaster recovery programs with long term development needs in mind.

Disruption of development by disasters

Disasters can seriously disrupt development initiatives in several ways, including:

- Loss of resources
- Interruption of programs
- Impact on investment climate
- Impact on the non-formal sector
- Political destabilization

Loss of resources

Development resources are lost when a disaster wipes out the products of investment — it shortens the life of development investments. The disasters affect development through.

- Impact on capital stock and inventory
- Loss of production and provision of services due to disruption and increased cost of goods and services
- The secondary effects of the disaster include inflation, balance of payment problems, increase in fiscal expenditure, decreases in monetary reserves
- Other indirect losses, for example: the impact on a country's debt position could be that as the debt service burden increases, the country has less resources available to invest in productive enterprises
- The outcome of these losses of resources include: loss of economic growth, delays to development programs, cancellation of programmes, and disincentives to new investment
- There may also be a shift in skilled human resources toward high visibility recovery activity—a diversion from long-term to short-term needs.

Interruption of programs

Disasters interrupt ongoing programs and divert resources from originally planned uses.

Impact on investment climate

Disasters, especially when they have occurred repeatedly within a short period of time, have a negative impact on the incentive for further investment. Investors need a climate of stability and certainty to be encouraged to risk their money. The disaster further clouds the investment picture when it has caused loss of employment, thereby depressing market demand, and resulting in a stagnation which limits overall growth.

Impact on non-formal sector

Disasters have special negative impacts on the non-formal sector where approximate costs of disasters are often underestimated. Disasters depress the non-formal economy through the direct costs of lost equipment and housing (which often also serves as business sites). The indirect costs of disasters include lost employment, and lost income. Sometimes the importation of relief items creates disincentives to producers.

Political destabilization

The stress to a country caused by a disaster often results in the destabilization of the government. This may occur for several reasons. For example, the government may have mismanaged the disaster relief and recovery, leading to discontent on the part of affected communities. Or the survivors may have had unmet expectations which, for whatever reason, translate into some form of protest. The government could also become the scapegoat for problems beyond its control, again leading to its possible downfall. In fact, it is very common for a government to collapse or be overthrown within two or three years of a major disaster.

Q. Recall the most recent disaster with which you are familiar. Based on that experience, respond to the following.

A.

1. Identify a facility critical to the local economy that was knocked out of service.

   _____

2. Name one development project that was interrupted.

   _____

3. Identify one case of an investment that was withdrawn or reduced because of the disaster.

   _____

4. Identify one case of non-formal sector employment that was lost because disaster relief displaced the need for it.

   _____

5. Describe an example of how the government may have been destabilized by the disaster.

   _____

How development may cause disasters

The side effects of well-meaning development efforts sometimes have disastrous consequences. Development projects implemented without taking into account existing environmental hazards may increase vulnerability to natural disasters. For example, projects designed to increase employment opportunities, and thus income, usually attract additional population growth. Low-income people may then have to seek housing in areas previously avoided, on hillsides or in floodplains. The costs of relief assistance after a landslide or flood can easily outweigh the benefits to the economy of more jobs. Similarly, development projects may lead to negative political consequences that increase the vulnerability to civil conflict.

Some types of development projects commence without fully assessing their impact on the environment. This can occur even in programmes resulting from a disaster, such as reconstruction projects that increase demand for wood to fortify houses. The resulting deforestation can then bring increased vulnerability to mudslides and possibly long-term environmental changes.

Development projects may even consciously force a choice between reducing disaster vulnerability and economic vulnerability. A project's design may require a trade-off between the two and force a decision between the lesser of two evils.

Q. Can you describe how development can contribute to vulnerability based on the following examples of negative consequences?

A.

Watershed erosion

Deforestation

Loss of biological diversity

Lack of soil and land management

Air and water pollution

Inadequate urban sanitation and waste disposal

Marine and coastal zone development

See table on the next page for examples of answers to this question

Development opportunities afforded by disasters

Despite an increasing disaster awareness in the international community, and the recognition of the importance of developing coherent plans for relief activities, it often takes the actual or imminent occurrence of a large-scale destructive event to stimulate individual governments to think about a developmental approach. Thus, a disaster can serve as a catalyst for introducing mitigation activities.

Few development workers realize the opportunities that disasters can provide in the development field. Disasters often create a political and economic atmosphere wherein extensive changes can be made more rapidly than under normal circumstances. For example, in the aftermath of a disaster, there may be major opportunities to execute land reform programmes, to improve the overall housing stock, to create new jobs and job skills, and to expand and modernize the economic base of the community — opportunities that would not otherwise be possible. The collective will to take action is an advantage that should not be wasted.

Disasters can also highlight high-risk areas where action must be taken before another disaster strikes. The realization of vulnerability can motivate policy-makers and the public to participate in mitigation activities. Disasters may also serve to highlight the fact that the country is seriously under-developed. They can thus bring in funding and the attention of donor communities to apply to long-term development needs. *(Henderson, 1990)*

Table 3.1
Examples of development leading to disasters or increased vulnerability

From *Disasters and Development. A Study in Institution Building*, Intertect, January, 1991

Sector	Development activity	Results
Industry	Construction of chemical plant generating employment	Deaths due to inadvertent release of chemicals, increased health problems, hazardous or toxic waste accidents
Agriculture, forestry and fisheries	Introduction of new species to control pests	Uncontrolled expansion of new species into environment, bringing crop failure
	Irrigation schemes	Flooding where canals counter natural water flow
	Increase in pesticide or fertiliser use to augment crop yields	Contamination of potable water supplies
Natural resources	Construction of hydroelectric dam	Displacement, salinization
	Drilling of water wells in marginal areas	Desertification due to population clustering around wells
Transportation, communications Education	Road building in rain forests	Landslides, deforestation
	School construction on earthquake fault line	Deaths/injuries due to structural failure
Development issues, policy and planning	Centralisation of planning process	Famine due to lack of organisation of local governments
	Concentration of tourist facilities on vulnerable coast-lines, unstable hills	Exposure of large populations to risk of death/injury/loss in storm surge, high wind storms, tsunami, landslides

CHAPTER 4

Natural hazards

In earlier chapters, the discussion about disasters and emergencies resulting from natural and human-made hazards has been developed in general terms. However, each hazard has its own characteristics To understand the significance and implications of a particular type of disaster we must have a basic understanding about the nature, causes and effects of each hazard type.

The list of hazard types is very long. Many occur infrequently or impact a very small population. Other hazards, such as severe snowstorms, often occur in areas that are prepared to deal with them and seldom become disasters. However, from the perspective of a disaster victim it is not particularly useful to distinguish between minor and major disasters. Some disasters are now of limited interest to the international community. These include avalanches, fog, frost, hail, lightning, snowstorms, and tornadoes. The international interest is less for these hazards because their impacts affect relatively few people and the countries in which they normally occur have sufficient resources and systems in place to respond without external assistance.

There are several hazard types for which there is widespread concern. They can be categorized as follows.

Sudden onset hazards — (geological and climatic hazards) earthquakes, tsunamis, floods, tropical storms, volcanic eruptions, landslides

Slow onset hazards — (environmental hazards) drought, famine, environmental degradation, desertification, deforestation, pest infestation

Industrial/technological — system failures/accidents, spillages, explosions, fires

Wars and civil strife — armed agression, insurgency, terrorism, and other actions leading to displaced persons and refugees

Epidemics — water and/or food-borne diseases, person-to-person diseases (contact and respiratory spread), vector-borne diseases and complications from wounds

These hazard types are highlighted in this training material. The international community has an interest in them because they frequently affect large populations and the need for outside assistance is evident. Many disasters are themselves international events and have an impact on entire regions.

A brief description of each hazard type is presented below. It will be your responsibility to determine which hazards are of concern to your country and then to read the material about them.

Q. *Which hazards are of concern to your country?*

A. List the most important hazards in order of their severity of impact.

1. _____
2. _____
3. _____
4. _____

Now learn more about each of these hazards in the material that follows.

Geological Hazards

- Earthquakes
- Tsunamis
- Volcanic eruptions
- Landslides

Climatic Hazards

- Tropical cyclones
- Floods
- Drought

Environmental Hazards

- Environmental pollution
- Deforestation
- Desertification
- Pest Infestation

Epidemics

Industrial Accidents

Characteristics of particular hazards and disasters[1]

This section provides an indication of the general characteristics of each of the hazard types listed and the kinds of counter-disaster measures which may be required. You should note that disasters have collateral or indirect effects that may endure even after a particular type of disaster has been directly addressed. The problem of displaced people after a sudden onset disaster, such as a cyclone, may continue well after immediate relief, recovery and even rehabilitation programmes have been implemented. Such collateral impact can turn a seemingly rapid onset disaster into a continuing emergency situation.

[1] The following material on hazards and population displacements is drawn from the **UNDP/UNDRO Disaster Management Manual.**

A further issue that must be borne in mind concerns the consequence of a sudden onset disaster when relief assistance is stymied because civil conflict makes access impossible. In other words, the perverse permutations are many. Nevertheless, the basic characteristics of certain types of disasters and emergencies and appropriate response measures can be structured as follows:

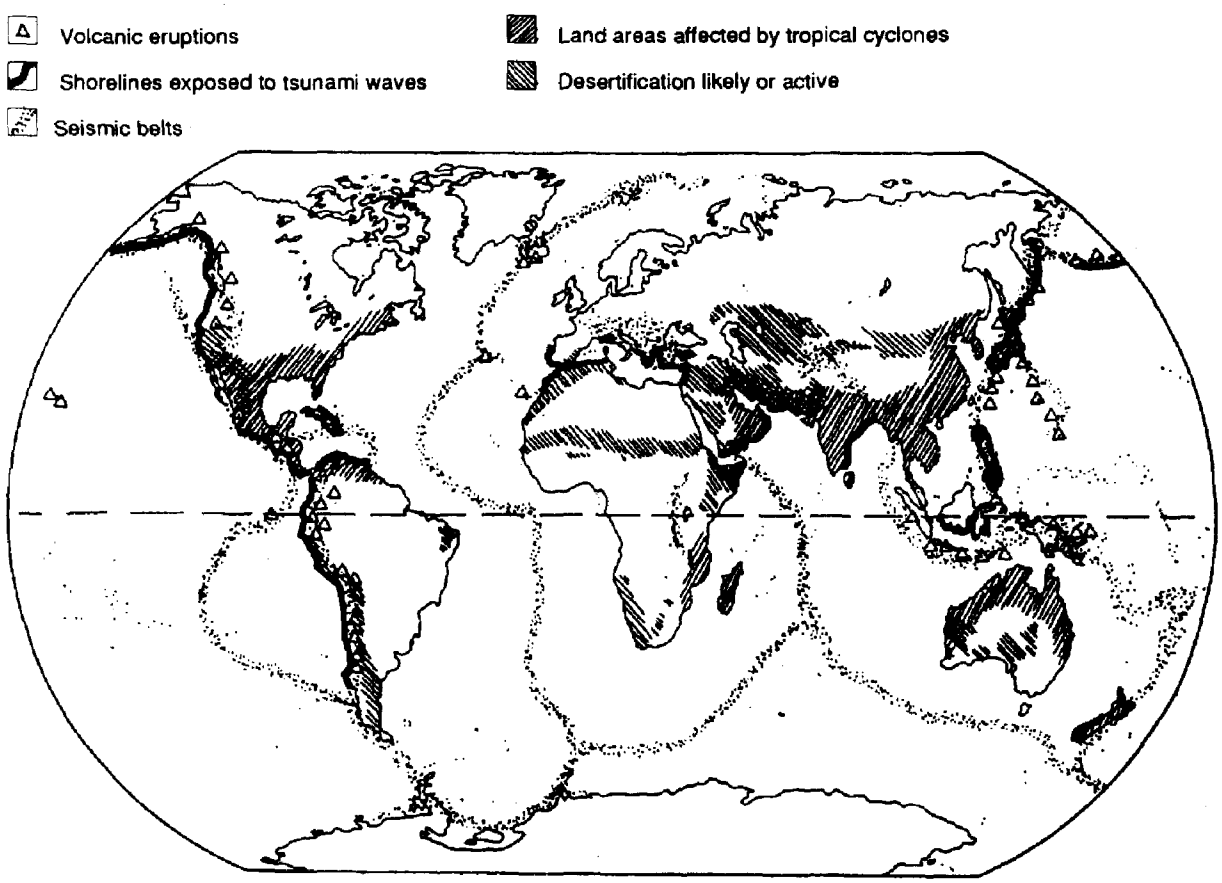
- Causal phenomena
- General characteristics
- Predictability
- Factors contributing to vulnerability
- Typical effects
- Possible risk reduction measures
- Specific preparedness measures
- Typical post-disaster needs

Different types of disasters have characteristic effects while retaining unique aspects. Risk reduction and preparedness measures, and emergency and post-disaster response can all be facilitated by some "rules of thumb" — as outlined in this section — but must also be tailored to the specificity of local conditions. Remember:

(a) where different types of disaster occur in combination — e.g. floods accompanying tropical storms — the combined effects must be considered; and where one disaster leads to another (for example a famine leading to civil strife) the compound effects must be anticipated

(b) the severity of the actual impact on the society depends on human and organizational factors as well as natural and topographical ones.

Figure 4.1
World map of selected hazards



Earthquakes

Causal phenomena	Slippage of crustal rock along a fault or area of strain and rebound to new alignment.
General characteristics and effects	Shaking of earth caused by waves on and below the earth's surface causing:. Surface faulting Aftershocks Tsunamis Tremors, vibrations Liquefaction Landslides
Predictability	Probability of occurrence can be determined but not exact timing. Forecasting is based on monitoring of seismic activity, historical incidence, and observations.
Factors contributing to vulnerability	Location of settlements in seismic areas. Structures which are not resistant to ground motion. Dense collections of buildings with high occupancy. Lack of access to information about earthquake risks.
Typical adverse effects	*Physical damage* — Damage or loss of structures or infrastructure. Fires, dam failures, landslides, flooding may occur. *Casualties* — Often high, particularly near epicenter or in highly populated areas or where buildings not resistant. *Public health* — Fracture injuries most widespread problem. Secondary threats due to flooding, contaminated water supply, or breakdown in sanitary conditions. *Water supply* — Severe problems likely due to damage of water systems, pollution of open wells and changes in water table.
Possible risk reduction measures	Hazard mapping Public awareness programs and training Assessing and reducing structural vulnerability Land use control or zoning, building codes Insurance
Specific preparedness measures	Earthquake warning and preparedness programs
Typical post-disaster needs	Search and rescue Emergency medical assistance Damage needs and assessment survey Relief assistance Repair and reconstruction Economic recovery
Impact assessment tools	Earthquake scales (Modified Mercalli, MSK), earthquake damage and usability forms.

Tsunamis

Causal phenomena	Fault movement on sea floor, accompanied by an earthquake A landslide occurring underwater or above the sea, then plunging into the water. Volcanic activity either underwater or near the shore.
General characteristics	Tsunami waves are barely perceptible in deep water and may measure 160 km between wave crests May consist of ten or more wave crests Move up to 800 km per hour in deep water of ocean, diminishing in speed as the wave approaches shore May strike shore in crashing waves or may innundate the land Flooding effect depends on shape of shoreline and tides
Predictability	Tsunami Warning System in Pacific monitors seismic activity and declares watches and warnings. Waves generated by local earthquakes may strike nearby shores within minutes and warnings to public may not be possible.
Factors contributing to vulnerability	Location of settlements in low lying coastal regions Lack of tsunami resistant buildings Lack of timely warning systems and evacuation plans Unawareness of public to destructive forces of tsunamis
Typical adverse effects	*Physical damage* — The force of water can raze everything in its path but the majority of damage to structure and infrastructure results from flooding. Withdrawal of the wave from shore scours out sediment and can collapse ports and buildings and batter boats. *Casualties and public health* — Deaths occur principally by drowning and injuries from battering by debris. *Water supply* — Contamination by salt water and debris or sewage may make clean drinking water unavailable. *Crops and food supplies* — Harvests, food stocks, livestock farm implements and fishing boats may be lost. Land may be rendered infertile due to salt water incursion.
Possible risk reduction measures	Protection of buildings along coast, houses on stilts Building barriers such as breakwaters
Specific preparedness measures	Hazard mapping, planning evacuation routes Establish warning systems Community education
Typical post-disaster needs	Warning and evacuation; search and rescue; medical assistance; conduct disaster assessment, provide food, water and shelter
Impact assessment tools	Aerial surveys of coastal areas, damage surveys, evaluation of warning systems and evacuation plans.

Volcanoes

Causal phenomena	Magma pushed upward through volcanic vent by pressure and effervescence of dissolved gases.
General characteristics	Types of volcanoes are cindercones, shield volcanoes, composite volcanoes and lava domes. Magma flowing out onto surface is lava and all solid particles ejected are tephra. Damage results from type of material ejected such as ash, pyroclastic flows (blasts of gas containing ash and fragments), mud, debris, and lava flows.
Predictability	Study of the geological history of volcanoes mainly located in a clearly defined volcanic belt, along with seismic activity and other observations, may indicate an impending volcano. No reliable indicator has been discovered and precursory signs do not always occur.
Factors contributing to vulnerability	Settlements on the flanks of volcanoes Settlements in the historical paths of mud or lava flows Structures with roof designs not resistant to ash accumulation Presence of combustible materials Lack of evacuation plan or warning systems
Typical adverse effects	*Casualties and health* — Death from pyroclastic flows, mud flows and possibly lava flows and toxic gases. Injuries from falling rock, burns; respiratory difficulties from gas and ash. *Settlements, infrastructure and agriculture* — Complete destruction of everything in the path of pyroclastic, mud or lava flows; collapse of structures under weight of wet ash, flooding, blockage of roads or communication systems *Crops and food supplies* — Destruction of crops in path of flows, ash may break tree branches, livestock may inhale toxic gas or ash; grazing lands may be contaminated.
Possible risk reduction measures	Land use planning for settlements around volcanoes Protective structural measures
Specific preparedness measures	National volcanic emergency plans Volcano monitoring and warning system Training for government officials and community participation in search and rescue, fire fighting
Typical post-disaster needs	Warning and evacuation; medical assistance, search and rescue; provide food, water and shelter; relocate victims; provide financial assistance
Impact assessment tools	Aerial and ground surveys to assess damage; evaluation of evacuation plan and emergency response

Landslides

Causal phenomena	Downslope transport of soil and rock resulting from naturally occurring vibrations, changes in direct water content, removal of lateral support, loading with weight, and weathering, or human manipulation of water courses and slope composition.
General characteristics	Landslides vary in types of movement (falls, slides, topples, lateral spread, flows), and may be secondary effects of heavy storms, earthquakes, and volcanic eruptions. Landslides are more widespread than any other geological event.
Predictability	Frequency of occurrence, extent and consequences of landslides may be estimated and areas of high risk determined by use of information on area geology, geomorphology, hydrology and climatology and vegetation.
Factors contributing to vulnerability	Settlements built on steep slopes, softer soils, cliff tops Settlements built at the base of steep slopes, on mouths of streams from mountain valleys Roads, communication lines in mountain areas Buildings with weak foundations Buried pipelines, brittle pipes Lack of understanding of landslide hazard
Typical adverse effects	*Physical damage* — Anything on top of or in path of landslide will suffer damage. Rubble may block roads, lines of communication or waterways. Indirect effects may include loss of productivity of agricultural or forest lands, flooding, reduced property values. *Casualties* — Fatalities have occurred due to slope failure. Catastrophic debris slides or mudflows have killed many thousands.
Possible risk reduction measures	Hazard mapping Legislation and land use regulation Insurance
Specific preparedness measures	Community education Monitoring, warning and evacuation systems
Typical post-disaster needs	Search and rescue (use of earth removal equipment); medical assistance; emergency shelter for homeless
Impact assessment tools	Damage assessment forms

Tropical cyclones

Causal phenomena	Mixture of heat and miosture forms a low pressure center over oceans in tropical latitudes where water temperatures are over 26 degrees C. Wind currents spin and organize around deepening low pressure over accelerating toward the center and moving along track pushed by trade winds Depression becomes a tropical cyclone when winds reach gale force or 117 km per hour
General characteristics	When the cyclone strikes land, high winds, exceptional rainfall and storm surges cause damage with secondary flooding and landslides.
Predictability	Tropical cyclones can be tracked from their development but accurate landfall forecasts are usually possible only a few hours before as unpredictable changes in course can occur.
Factors contributing to vulnerability	Settlements located in low lying coastal areas (direct impact) Settlements in adjacent areas (heavy rains, floods) Poor communications or warning systems Lightweight structures, older construction, poor quality masonry Infrastructural elements, fishing boats and maritime industries
Typical adverse effects	*Physical damage* — Structures lost and damaged by wind force, flooding, storm surge and landslides. *Casualties and public health* — May be caused by flying debris, or flooding. Contamination of water supplies may lead to viral outbreaks and malaria. *Water supplies* — Ground water may be contaminated by flood waters. *Crops and food supplies* — High winds and rains can ruin standing crops, tree plantations and food stocks. *Communications and logistics* — Severe disruption is possible as wind brings down telephone lines, antennas and satellite disks. Transport may be curtailed.
Possible risk reduction measures	Risk assessment and hazard mapping Land use control and flood plain management Reduction of structural vulnerability Improvement of vegetation cover
Specific preparedness measures	Public warning systems Evacuation plans Training and community participation
Typical post-disaster needs	Evacuation and emergency shelter, search and rescue; medical assistance; water purification; reestablish logistical and communication networks; disaster assessment; provision of seeds for planting.
Impact assessment tools	Damage assessment forms, aerial surveys

Floods

Causal phenomena	Naturally occurring flash, river and coastal flooding from intense rainfall or innundation associated with seasonal weather patterns Human manipulation of watersheds, drainage basins and floodplains
General characteristics	*Flash floods* — Accelerated runoff, dam failure, breakup of ice jam *River floods* — Slow buildup, usually seasonal in river systems *Coastal floods* — Associated with tropical cyclones, tsunami waves, storm surges Factors affecting degree of danger: depth of water, duration, velocity, rate of rise, frequency of occurrence, seasonality
Predictability	Flood forecasting depends on seasonal patterns, capacity of drainage basin, flood plain mapping, surveys by air and land. Warning possible well in advance for seasonal floods, but only minutes before in case of storm surge, flash flood, or tsunami.
Factors contributing to vulnerability	Location of settlements on floodplains Lack of awareness of flooding hazard Reduction of absorptive capacity of land (erosion, concrete) Non-resistant buildings and foundations High risk infrastructural elements Unprotected food stocks and standing crops, livestock Fishing boats and maritime industries
Typical adverse effects	*Physical damage* — Structures damaged by washing away, becoming inundated, collapsing, impact of floating debris. Landslides from saturated soils. Damage greater in valleys than open areas. *Casualties* and public health — Deaths from drowning but few serious injuries. Possible outbreaks of malaria, diarrhea and viral infections. *Water supplies* — Contamination of wells and groundwater possible. Clean water may be unavailable. *Crops and food supplies* — Harvests and food stocks may be lost to innundation. Animals, farm tools and seeds might be lost.Floodplain mapping, Land use control
Possible risk reduction measures	Flood control (channels, dikes, dams, flood-proofing, erosion control)
Specific preparedness measures	Flood detection and warning systems Community participation and education Development of master plan for floodplain management
Typical post-disaster needs	Search and rescue; medical assistance; disaster assessment; short term food and water supplies; water purification; epidemiological surveillance; temporary shelter
Impact assessment tools	Damage survey forms; aerial surveys

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Drought

[illegible]	[illegible] cause — Rainfall deficit [illegible] causes — El Niño (incursion of warm surface waters into the [illegible] of South American Pacific); human induced changes in [illegible] surface and soil; higher sea surface temperatures; increase of [illegible] carbon dioxide and greenhouse gases.
[illegible] characteristics	[illegible] reduction of water or moisture availability is temporary and significant in relation to the norm. [illegible] drought is the reduction in rainfall and hydrological drought is the reduction in water resources. [illegible] drought is the impact of drought on human activity influenced by [illegible] factors; the presence of irrigation systems, moisture retention capacity of the soil, the timing of the rainfall and adaptive behavior of the farmers.
Predictability	[illegible] of unusual dryness are normal in all weather systems. Rainfall and [illegible] data must be carefully analyzed with influencing factors in predicting drought, however, advance warning is usually possible.
[illegible] contributing to vulnerability	Location in an arid area where dry conditions are increased by drought Farming on marginal lands, subsistence farming Lack of agricultural inputs to improve yields Lack of seed reserves Areas dependent on other weather systems for water resources Areas of low soil moisture retention Lack of recognition and allocation of resources to drought hazard
[illegible] effects	Reduced income for farmers; reduction of spending from agricultural sector; increase in price of staple foods, increased inflation rates, deterioration of nutritional status, famine, illness, death, reduction of drinking water sources, migration, breakup of communities, loss of livestock.
[illegible] reduction measures	Drought and famine early warning systems
[illegible] preparedness measures	Development of inter-institutional response plan
[illegible] post-disaster needs	Measures to maintain food security: price stabilization, food subsidies, employment creation programs, general food distribution, supplementary feeding programs, special programs for livestock and pastoralists, complementary water and health programs; rehabilitation
Impact assessment tools	Nutritional surveys, socioeconomic surveys, monitoring of rainfall and hydrological data, satellite imagery.

Environmental pollution

Causal phenomena	*Air pollution* — pollutants such as sulphur dioxide, nitrogen oxides, particulates, carbon monoxide, and lead from industry and transport. *Marine pollution* — Sewage, industrial effluents, marine litter, petroleum spills and dumped radioactive substances. *Fresh water pollution* — Discharge of human waste and domestic wastewaters into lakes and rivers, industrial effluents, use of irrigation and pesticides, runoff of nitrogen from fertilizers. Increased runoff from deforestation causing sedimentation. *Possible global warming* — Accumulation of Carbon dioxide from combustion of fossil fuels, deforestation, and methane from livestock. *Ozone depletion* — Chloroflorocarbons (CFCs) released into the atmosphere deplete ozone shield against ultraviolet light.
Predictability	Pollution is related to per capita consumption so, as countries develop, pollution will also tend to increase. Deforestation is increasing in some countries.
Factors contributing to vulnerability	High levels of industrialization and per capita consumption Lack of regulation of pollutants Insufficient resources to counter the impact of pollution
Typical adverse effects	*Air pollution* — Damages agricultural crops, forests, aquatic systems, structural materials and human health. *Water pollution* — Spread of pathogens, injury to marine animals, spread of chemicals to the environment effecting the health of humans, animals and sealife. *Global warming* — Sea level rise, climate change, temperature rise *Ozone depletion* — Increase in skin cancer, cataracts, reduction in immune system functions, damage to marine life.
Possible risk reduction measures	Set ambient air quality standards Set emission limits for every pollutant Establish protection policies for water supplies Reduce the use of pesticides by integrated management Reduce the rate of deforestation and increase planting of trees Promote energy efficiency Regulate use of aerosols and disposal of refrigeration units Prohibit manufacture and use of CFCs
Specific preparedness measures	Establish a national environmental safety and protection plan Create education programs for environmental awareness Training of government personnel as part of development programs
Impact assessment tools	Aerial, remote sensing and ground surveys Air, water and soils testing Comparison of climatic data Socioeconomic surveys

Deforestation

Causal phenomena	The spread of farming and grazing Firewood collection Timber harvesting
General characteristics	Contributes to other hazards by – removing root systems which stabilize soil, acting as a filter and buffer, allowing percolation of water into soil and retaining moisture in soil. – removal of leaf biomass and forest products – burning and decay of dead wood.
Predictability	An increase in global focus on the hazard is expanding data base leading to an increased awareness of the problem and to identifying where the problem exists. Overall, the global trend is decreasing as conservation measures are enacted but destruction of forests is rising at alarming rates in some countries.
Factors contributing to vulnerability	Underdevelopment Dependence on wood for fuel and income Unregulated logging and land clearance Rapid population growth Rapid expansion of settled or industrialized areas
Typical adverse effects	Deforestation results in loss of free products from the forest such as fruits and medicines, and decline in traditional cultures. It stresses economies which import forest products and are dependent on wood products. It contributes to other hazards, such as: *Flooding* — Deforestation of watersheds can increase severity of flooding, reduce streamflows, dry up springs in dry seasons and increase sediment entering waterways. *Drought* — Removal of roots and leaf canopy can alter moisture levels drying soil and decreasing precipitation. *Famine* — Decrease in agricultural production due to erosion of topsoil and collapse of hillsides may lead to food shortages. *Desertification* — Deforestation and removal of vegetation lead to soil compaction and reduction of land productivity. *Environmental pollution* — Increases contamination of soil and water and reduces carbon dioxide absorption capacity. Burning of forests and decay of trees releases carbon dioxide to the air, possibly contributing to global warming.
Possible risk reduction measures	Protection of forests through management, legislation, conservancies Reforestation
Specific preparedness measures	Education of the communities Promoting alternatives to fuelwood Soil conservation measures
Impact assessment tools	Forest mapping by use of aerial or remote sensing or ground surveys. Monitoring of reforestation programs.

Desertification

Causal phenomena	Basic conducive climatic conditions such as low or uncertain rainfall and higher temperatures as found in dryland areas. Poor land use management practices particularly overcultivation, overgrazing, deforestation and poor irrigation practices.
General characteristics	*Soil degradation* by water erosion, wind erosion, soil compaction and waterlogging (salinization and alkalinization) *Degradation of vegetation* initially by reduction in density of biomass and then by change of vegetation types to less productive forms.
Predictability	Global surveillance of drylands can be achieved through remote sensing and aerial surveys. As land use increases without measures to conserve soil and vegetation, desertification will likely increase. One estimate claims 202,000 square km are desertified each year.
Factors contributing to vulnerability	Low rainfall and high temperatures Heavy land use Deforested areas Poor irrigation management Lack of conservation measures Poverty and lack of appropriate agricultural technologies
Typical adverse effects	Desertification contributes to other hazards by reducing the productivity of the land. These include drought and famine. Reduced productivity has socioeconomic impacts and may reduce standards of living.
Possible risk reduction measures	Establish community programs to meet needs and improve practices and institutions. Increase monitoring of desertification Develop policies for sustainable agricultural systems Develop agricultural institutions and train personnel
Specific preparedness measures	Promote projects to improve agricultural and livestock production Promote soil and water conservation
Impact assessment tools	Socioeconomic surveys are needed to ascertain needs of people and for agricultural development. Aerial and remote sensing surveys will help determine the rate and scope of desertification.

Pest infestations

Causal phenomena	Increase in pest numbers due to one or a combination of ecological factors including temperature, monoculture of crops, introduction of plants to new locations, introduction of pest species, overcoming genetic resistance in host, overcoming pesticide effects, conducive weather patterns, migration.
General characteristics	Plants can be damaged in various ways such as consumption of parts, tunnelling in stems, attack of root systems, injection of toxins.
Predictability	Pest forecasting determines whether application of a pesticide will be cost effective, by examining the stages of development of the crop and the pest and by determining the economic threshold.
Factors contributing to vulnerability	Large numbers and varieties of pests Lack of controls on imported plant products Constraints on resources to predict and treat pest infestations Insufficient crop yields in normal times Areas inaccessible to surveillance for pests Underdevelopment of agricultural technologies
Typical adverse effects	Crop losses could lead to food shortages, even famine, and stress economic systems.
Possible risk reduction measures	Integrated pest management employing appropriate methods of physical control, cultural control, crop plant resistance, biological control, legislation, chemical control and possibly eradication.
Specific preparedness measures	Establishing a national plan for pest control Training for government personnel and extension to farmers
Typical post-disaster needs	National or international control efforts Provide needed food supplies
Impact assessment tools	Assessment of incidence and severity of infestation Aerial and ground surveys of damage to crops

Epidemics

Definition: Exposure to a toxin resulting in pronounced rise in number of cases of parasitic or infectious origin.

Causal phenomena	Unsanitary conditions, crowding, poverty Ecological changes that favor breeding of vector Non-immune persons migrate to endemic disease area Decline in nutritional status Contamination of water or food supply
General characteristics	Risk of introduction or spread of the disease Possible large number of cases Severe disease leading to disability or death Risk of social or economic disruption Lack of adequate professional personnel, needed supplies Danger of international transmission
Predictability	Epidemics may increase due to rise in travel or migration and long-term dormant symptoms of sexually transmitted diseases. Reports of epidemics may increase due to better medical coverage. Prediction is assisted by epidemiological studies but may be constrained in newly formed settlements or emergency camps.
Factors contributing to vulnerability	Poverty Lack of immunity (or vaccination) to diseases Poor nutrition, poor sanitation, poor water quality, crowding Poorly organized health care delivery Drug resistant diseases
Typical adverse effects	Illness and death Social and political disruption, economic loss Increased trauma in emergency settlements
Possible risk reduction measures	Structuring an emergency health service Preparing a contingency plan with inventory of required resources Establishing an early warning system through routine surveillance Training of national staff in emergency operations
Specific preparedness measures	*Intervention measures* — Verify and confirm diagnosis; identify cases; find source of epidemic; treat cases and control spread; write report. *Community health education*
Typical post-disaster needs	Emergency medical assistance; international aid, if outbreak uncontained
Impact assessment tools	Epidemiological surveys; evaluation of health care systems and emergency response

Chemical and industrial accidents

Causal phenomena	Disaster/explosion in a plant or storage facilities handling toxic substances Accidents during the transportation of chemicals Contamination of food or the environment by misuse of chemicals Improper waste management of toxic chemicals Technological system failures Failures of plant safety design or components Natural hazards such as fire, earthquake or landslides Arson or sabotage
Predictability	Incidences of chemical and industrial accidents are expected to increase as industrialization increases in developing countries.
Factors contributing to vulnerability	Those persons, structures, livestock, crops, and environment closest to the scene of an accident are most vulnerable, however, large scale releases of airborne pollutants may spread for hundreds of kilometers. Lack of safety features or lack of evacuation plan. Unawareness by vulnerable persons of the potential danger
Typical adverse effects	Physical damage — Damage or destruction may occur to structures and infrastructure. Transportation accidents damage vehicles and other objects on impact. Industrial fires may reach high temperatures and affect large areas. *Casualties* — Many people may be killed or injured and require medical treatment. *Environmental* — Contamination of air, water supply, land, and animal life may occur. Areas may become uninhabitable for humans and animals. Ecological systems may be disrupted even on a global scale.
Possible risk reduction measures	Development of a plan, such as the APELL (Awareness and Preparedness for Emergencies at the Local Level) process, to assist decision makers and technical personnel to improve community awareness of hazardous installations and aid them in preparing disaster response plans.
Specific preparedness measures	Hazard mapping Hazardous materials identification Inspection of chemical plants and storage facilities Monitoring toxic waste disposal procedures Improve fire fighting capacity Monitoring pollution levels Prepare and practice evacuation plans Test warning sirens
Typical post-disaster needs	Evacuation from area; search and rescue; alternative sources of water; cleanup; monitor environmental effects.
Impact assessment tools	APELL process forms for emergency response plan evaluation, CHEMTREC (Chemical Transportation Emergency Center) information systems.

CHAPTER 5

Compound and complex disasters[1]

Socio/political forces

Increasingly throughout many parts of the world one type of hazard can trigger a disaster which in turn triggers another hazard and subsequent disaster. For example, a drought may lead to a famine which in turn leads to a civil conflict that results in the mass displacement of people. A flood may force people to seek refuge across an international border where conflicts ensue between refugees and local communities.

Such *compound hazards and disasters* need not happen sequentially; they can also occur simultaneously. Thus, people caught between contending forces in a civil war find that in the midst of a major drought they have no means either to grow food or to receive outside assistance.

In a growing number of countries, *complex disasters* are also becoming more evident. Essentially a complex disaster is a form of human-made emergency in which the cause of the emergency as well as the assistance to the afflicted are bound by intense levels of political considerations. The single most prevalent political condition of a complex emergency is civil conflict, resulting in a collapse of political authority in all or part of a country. In such cases, at least one of three situations arise.

1. The government's ability to assist the disaster-afflicted becomes severely constrained.
2. The government becomes extremely suspicious of or uninterested in afflicted people who have fled from non-government to government held areas.
3. The government or opposition groups actually create or compound a disaster through actions that generate refugees and the mass displacement of people.

In fact, many affected people live in areas outside of government control. They are often the persons who are most in need and they are often the most difficult to reach with aid.

The disaster becomes "complex" because either the collapse or diffusion of political control makes assistance highly problematic. Solutions ultimately depend upon agreements with all parties involved in the conflict to permit assistance to be provided to recognize civilian noncombatants. These solutions may be agreements that are seen essentially as compromising fundamental aspects of sovereignty for what have been labelled as "new mechanisms of humanitarian assistance" (for example, corridors of tranquility).

[1]The material from this chapter is drawn from the DMTP special topic module *Displaced Persons in Civil Conflict* by Frederick Cuny; General Assembly Resolution 46/182, The Executive Summary of the 1992 Consolidated Appeal for the Horn of Africa, and the Themes of Emergencies stated in the First SEPHA Situation Report

An acute example of a situation illustrating the characteristics of both compound and complex emergencies is the Horn of Africa. For the past several years the situation in the Horn of Africa has been characterized by internal conflicts in Ethiopia, Sudan, and Somalia. These conflicts have been exacerbated by recurrent droughts and have resulted in famines on a massive scale and the flight of large numbers of people across national borders. After years of drought in some parts of the region, by 1991 food shortages were widespread. It became apparent that the crisis in the region was less the result of inadequate rainfall than that of a human-made emergency.

During the last half of 1991, the situation in many parts of the Horn remained highly volatile and fragile, largely due to conflict and a break down of law and order. This resulted in further population displacement and in intense misery for millions of people.

Displaced persons

One of the most serious consequences of compound and complex emergencies is the creation of populations of displaced persons. The example of the Horn of Africa refers to many of the displaced populations but there are millions more in other parts of the world.

The term "displaced person" applies in several contexts. These include people who are:

- forced to leave their homes as a result of drought, famine, or other disaster, usually in search of food
- non-combatant individuals and families forced to leave their homes because of the direct or indirect consequences of conflict but who remain inside their country
- forcibly resettled by their government if the resettlement is ethnically, tribally or racially motivated
- expelled from a country, especially as an ethnic or national group, forced out for economic or political reasons.

Reasons for concern

The international humanitarian relief system is just now beginning to meet the challenge of working with the displaced. There are three principle reasons for concern by relief agencies. One is that displaced persons are often ineligible to receive relief and assistance available to refugees (individuals who have crossed an international border seeking protection). A second reason is that the displaced are often insecure about relying on their own government for protection. A third reason is the obstacle of national sovereignty that limits outside agencies to assist this population.

Consequences and effects

The variety of possible situations generating displaced persons makes generalizations difficult, but the following may be experienced in varying degrees.

- loss of means of livelihood
- communities becoming separated from any services previously provided
- loss of normal sources of food
- lack of shelter and household necessities
- lack of fuel for cooking
- lack of potable water
- communicable diseases and over-crowding
- additional burdens particularly for women heads of households
- possibly large numbers of unaccompanied children
- loss of land tenure
- possible communication and logistics problems
- insecurity due to tensions and military activities

Not to be forgotten is the population that may remain at home and, even though they are not "trapped in combat areas," they nonetheless are in places that are hard to reach because of political, logistical and/or security obstacles. They may suffer many of the above problems and be isolated from international humanitarian relief.

The role of the UN in complex emergencies

In light of the issues created by complex emergencies and the special needs of displaced populations, the United Nations has determined to strengthen and make more effective the collective efforts of the international community, in particular the UN system, in providing humanitarian assistance. This determination is reflected in the implementation of General Assembly resolution 46/182, passed in December of 1991.

This resolution affirms that humanitarian assistance must be provided in accordance with the principles of humanity, neutrality and impartiality. Accordingly the UN has a central and unique role to play in providing leadership and coordinating the efforts of the international community to support the affected countries.

The implementation of resolution 46/182 includes the creation of a contingency funding arrangement, that is, a central emergency revolving fund of US $50 million as a cash-flow mechanism to ensure the rapid and coordinated response of the organizations of the system. The UN will also establish a central register of specialized personnel and teams of technical specialists, supplies and other resources that can be called upon at short notice by the UN.

The leadership of this UN initiative will be provided by a high level official, the emergency relief coordinator, designated by the Secretary-General, to work with the entities of the UN system dealing with humanitarian assistance. This position combines the functions previously carried out in the coordination of UN response by representatives of the Secretary-General for major and complex emergencies, as well as by the United Nations Disaster Relief Coordinator.

This emergency relief coordinator, among other duties, is charged with facilitating the access by the operational organizations to emergency areas for the rapid provision of emergency assistance. In cases of complex emergencies this may require negotiation with all parties concerned to obtain their consent and, where needed, the establishment of temporary relief corridors, days and zones of tranquility and other forms.

Safety of relief teams in conflict zones

There are many operational considerations in complex emergencies. One of the most crucial is that of the safety of relief teams in conflict zones. As coordinators of assistance for the displaced, the UN staff bears a special responsibility for ensuring that all personnel operating in or adjacent to conflict zones work in conditions of minimum risk and maximum security. Guidelines and procedures for personnel should be established in conjunction with the host government and, where possible, with insurgent groups. The UN is often charged with the responsibility of notifying relief workers and other organizations about the risks they may face from military operations in or near their relief activities. In this regard, the UN is often able to obtain clearances for special flights into contested areas on airplanes bearing United Nations markings, to arrange for safe transport through the front lines in specially-marked UN vehicles, and to establish special relief corridors whereby food and relief supplies can be delivered under flags of truce or through designated corridors, without undue restraint. It is important for the UN to carefully assess the risks before encouraging relief organizations to commit personnel and resources to operations in non-secure areas. A UN assurance that an area or means of transport is safe carries much weight — and responsibility.

Two of the most important aspects of working in remote and insecure areas are communications and stand-by evacuation support. To the greatest extent possible, UN coordinators should ensure that relief personnel have immediate and 24-hour access to telecommunications facilities and that suitable means are immediately available to evacuate personnel in case of an emergency. This may entail the assignment of light aircraft to be available on short notice to evacuate staff.