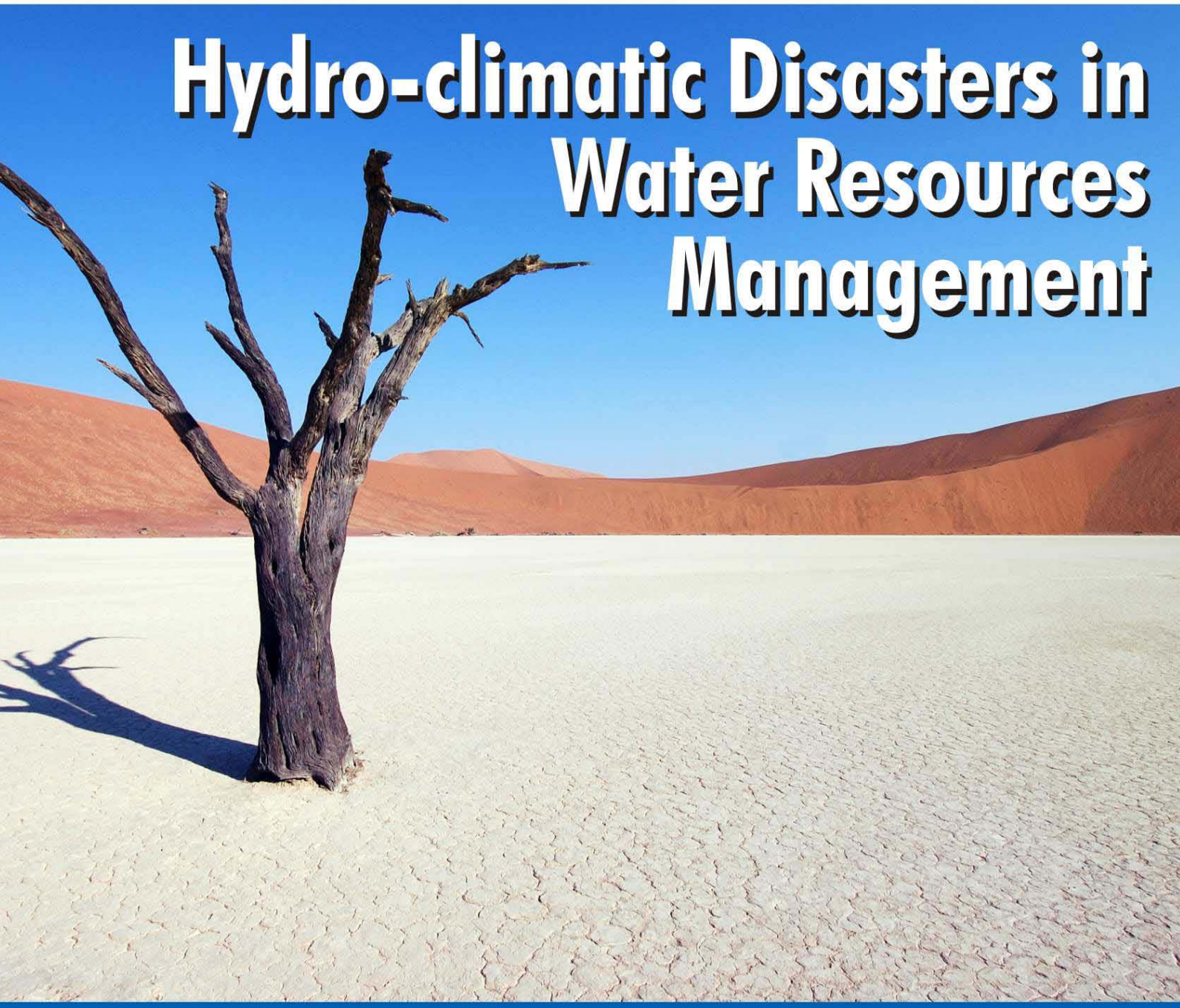
TRAINING MANUAL

Hydro-climatic Disasters in Water Resources Management



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Foreword

Hydro-climatic disasters are responsible for the serious disruption of the functioning of a society or community and widespread human, material or environmental losses. These disasters and the communities exposed to them may be expected to climb with increased climate variability as a result of climate change. Tragically, the span of attention given to hydro-climatic disasters is often short, probably because the disaster events continue only for a short while, and as the memory of disaster events fades, so does the urgency for disaster risk reduction strategies.

An increase in the frequency of disasters and the associated financial costs, is putting pressure for improved measures, tools and approaches to assess and mitigate disaster related risks. Disaster risk reduction aims to minimise disaster losses in the short-term and provide measures for prevention in the longer-term.

The main objective of this training material is to build the capacity of water managers and others to develop strategies for coping with hydro-climatic disasters such as floods and drought within the context of water resources management. An added expectation is improving the resilience of vulnerable communities' and reducing the impact of extreme events.

Implementation of an appropriate strategy at national level and operational levels is also a focus of the manual. The content of the training manual appreciates that the lead role for disaster risk management will most likely be the responsibility of a different agency than the one responsible for water resources management. This highlights the need for collaboration and coordination between disaster management and water management alongside other affected sectors.

The manual builds on international experience in disaster mitigation by the United Nations Office for Coordination of Humanitarian Affairs (UNOCHA), the United Nations International Strategy for Disaster Reduction (UNISDR) and the Cap-Net Global Network. It's development is an initiative of the Kenyan branch of the Nile Capacity Building Network for Integrated Water Resources Management, Nile IWRM Net.

The training manual, PowerPoint presentations and suggested web readings are freely available for use, adaptation and translation as desired and can be downloaded from the Cap-Net website or requested on CD (which will include all resource materials). Please give appropriate acknowledgement to the source(s) when using the materials.

Paul Taylor, Director, Cap-Net

Acknowledgements

The Hydro-climatic Disasters in Water Resource Management training manual has been developed by Wangai Ndirangu, Julius Kabubi and Simeon Dulo of the Nile Capacity Building Network for Integrated Water Resources Management, Nile IWRM Net.

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Part A

Module 1
Water Related Disasters and Integrated Water Resources Management (IWRM) Concepts

Goal

This module explains the linkages between Integrated Water Resources Management (IWRM) and water related disasters and demonstrates how good IWRM practices can be used to build community resilience in coping with disasters.

Learning Objectives

Participants will be able to:

1. Learn the basic elements and principles of IWRM and water related disasters;
2. Understand and realise the linkages between IWRM and disaster management practices and processes; and
3. Appreciate the application of IWRM principles in Disaster Risk Reduction (DRR) in the management of hydro-climatic disasters.

1. Introduction

The foundation principles of IWRM are: Efficiency; Equity and Environmental sustainability in the utilisation of water resources. These principles have been globally accepted as a sure means of managing the endangered and dwindling freshwater resources affecting many parts of the world. IWRM planning and implementation processes have been on-going in a number of countries with progress at various levels.

One of the most striking features of IWRM practice lies in its holistic management approach which has played a major role in accelerating the process of attaining the Millennium Development Goals (MDG(s) by 2015. Water related disasters are amplified by poor water resources and land management.

IWRM and sustainable disaster management approaches bear many similarities and IWRM practices compliments disaster risk reduction.

2. Integrated Water Resources Management (IWRM)

2.1 IWRM defined

Integrated Water Resources Management (IWRM), in the simplest application, is a common sense logical and appealing concept for water resources management. The fundamental understanding of IWRM is that the many different uses of water resources are inter-dependent.

High irrigation demands and polluted drainage flows from agriculture signify less freshwater for drinking or industrial use; contaminated municipal and industrial

wastewater pollutes rivers and threatens ecosystems. If water has to be left in a river to protect fisheries and ecosystems, less can be diverted to grow crops. There are many examples of the basic theme that unregulated use of scarce water resources is wasteful and inherently unsustainable.

Integrated management means that all the different uses of water resources are considered together. Water allocation and management decisions consider the effects of each use on the others. They are able to take account of overall social and economic goals, including the achievement of sustainable development. As we shall see, the basic IWRM concept has been extended to incorporate participatory decision-making.

Different user groups (farmers, communities, environmentalists) can influence strategies for water resource development and management. This approach brings additional benefits since informed users apply local self-regulation. It can be done in the context of water conservation and catchment protection that is far more effective than central regulation and surveillance can achieve.

Management is used in its broadest sense. It emphasises that we must not only focus on development of water resources but that we must consciously manage water development in a way that ensures long term sustainable use for future generations.

Box 1.1: Water Disasters – Facts & Impacts

- 90% of natural disasters in the 1990s were water related.
- Half the population of the developing world are exposed to polluted sources of water that increase disease incidence.
- In 1969 Severe famine in China was responsible for the deaths of an estimated 20 million of the population.
- The Sahel drought from the late 1960's to early 1980's created a famine that killed a million people and afflicted more than 50 million.
- 1977 A devastating cyclone in India results in 20,000 deaths.
- 1995 El Nino causes severe flooding in California.
- In early 2000 a cyclone swept across southern Africa leading to three weeks of severe floods which devastated Mozambique.
- In 2005 Hurricane Katrina swept through New Orleans causing most severe loss of life and damage to property in recent times.
- 2006 Flash floods killed hundreds of people and left tens of thousands homeless in Ethiopia.

Source: http://www.intute.ac.uk/sciences/hazards/timeline.html.

Integrated water resources management is a systematic process for the sustainable development, allocation and monitoring of water resource use in the context of social, economic and environmental objectives.

It contrasts with the sectoral approach as applied in many countries. In some cases the responsibility for drinking water rests with one agency, irrigation water with another and waters for the environment with yet another institution. A general lack of cross-sectoral linkages leads to un-coordinated water resource development and management, resulting in conflict, waste and unsustainable systems.

2.2 Why IWRM?

Water is vital for human survival, health, dignity and a fundamental resource for development.

The world's freshwater resources are under increasing pressure. Many still lack access to adequate water to meet their basic needs.

Population growth, increased economic activity and improved standards of living result in an increased competition for and conflicts over limited freshwater resources. The following points demonstrate why people argue about the world facing impending water crisis:

- Water withdrawals have increased more than twice as fast as population growth and currently one third of the world's population live in countries that experience medium to high water stress;
- Pollution is further enhancing water scarcity by reducing water usability downstream;
- Shortcomings in the management of water, a focus on developing new sources rather than managing existing ones better and top-down sector approaches to water management result in un-coordinated development and management of the resource;
- More and more development means greater impacts on the environment; and
- Current concerns about climate variability and climate change demands improved management of water resources to cope with more intense floods and droughts (Cap-Net, 2002).

Box 1.2: IWRM defined

"IWRM is defined as a process that promotes coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems"

Source: Global Water Partnership, 2000.

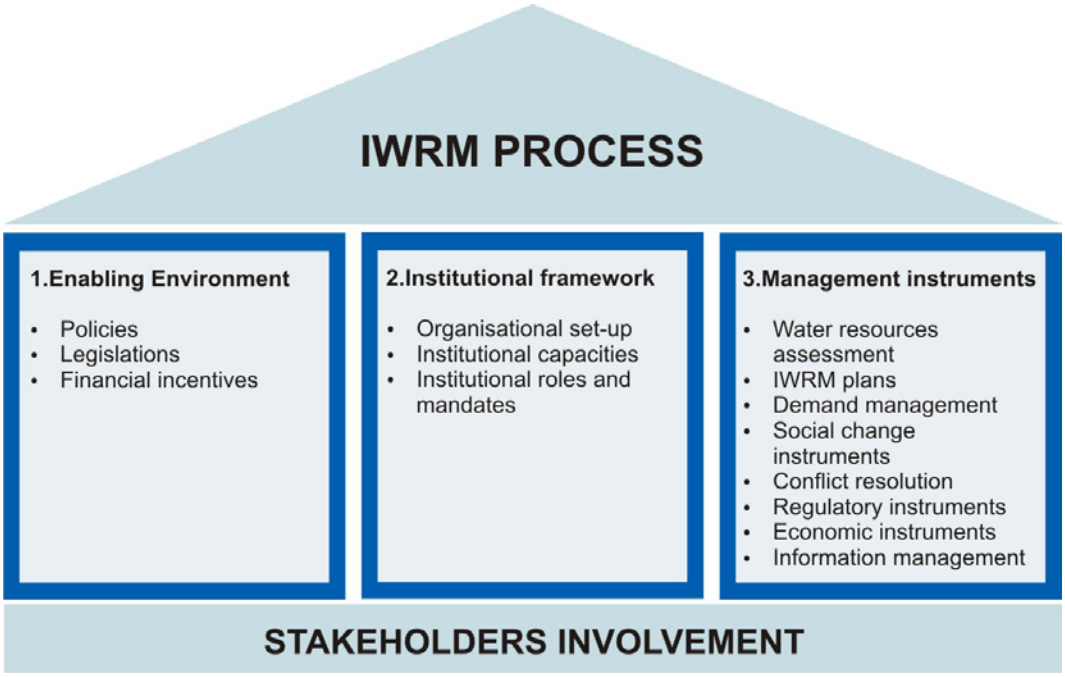

Figure 1.1: IWRM Management Principles

The key issues to consider in undertaking sound water resources management practices are:

- An impending water governance crisis;
- Securing water for people;
- Securing water for food production;
- Protecting vital ecosystems;

- Water flow management; and
- Taking gender disparities into consideration.

The Dublin Conference (1992) developed a set of fundamental principles to guide the water management reforms. Box 1.3 presents these principles.
The primary objectives of IWRM according to the World Water Council (2000) are to empower women, men and communities to decide on their level of access to safe water and hygienic living conditions. People should be able to decide on the sources of water for their economic activities and to organise how to achieve it to:

- Produce more food and create sustainable livelihoods per unit of water applied and ensure access for all to the food required to sustain healthy and productive lives;
- Manage human water use so as to conserve quality and quantity of fresh water and terrestrial ecosystems that provides services to humans and living thing; and
- Manage extreme water events to mitigate damages and losses of life and property.

IWRM is supported by three pillars of:

- Enabling environment;
- Institutional framework; and
- Management instruments.

Box 1.3: Basic Principles of IWRM
Principle 1: Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment – Since water sustains life; effective management of water resources demands a holistic approach, linking social and economic development with protection of natural ecosystems. Effective management links land and water uses across the whole of a catchment area or groundwater aquifer.

Principle 2: Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels – The participatory approach involves raising awareness of the importance of water among policy-makers and the general public. It means that decisions are taken at the lowest appropriate level, with full public consultation and involvement of users in the planning and implementation of water projects.

Principle 3: Women play a central part in the provision, management and safeguarding of water – This pivotal role of women as providers and users of water and guardians of the living environment has seldom been reflected in institutional arrangements for the development and management of water resources. Acceptance and implementation of this principle requires positive policies to address women's specific needs and to equip and empower women to participate at all levels in water resources programs, including decision-making and implementation, in ways defined by them.

Principle 4: Water has an economic value in all its competing uses and should be recognized as an economic good – Within this principle, it is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price. Past failure to recognize the economic value of water has led to wasteful and environmentally damaging uses of the resource. Managing water as an economic good is an important way of achieving efficient and equitable use, and of encouraging conservation and protection of water resources.

Source: Global Water Partnership, 2000.

IWRM has been accepted worldwide as good practice and many governments have embraced IWRM in their water resource management policies but more need to be done to build IWRM capacity in the developing world.

3. Natural Disasters

3.1 Occurrence and Impacts of Disasters

National governments have their own way of declaring when an emergency/hazard can be considered to be a disaster. For example the Emergency database (EM-DAT) operated by Centre for Research on the Epidemiology of Disasters (CRED) in Belgium classifies an event as a disaster if:

- At least 10 people are killed and/or;
- 100 or more are affected and/or;
- An international assistance appeal is sought or;
- A state of emergency is declared. (Text from http://www.emdat.be /ExplanatoryNotes/explanotes.html).

It is difficult to have a generalised definition of a disaster, but the classical definition of a disaster by United Nations International Strategy for Disaster Reduction (UNISDR):

> "*A disaster is a serious disruption of the functioning of a society or community that causes widespread human, material or environmental loss which exceeds the capacity of the affected society to cope without external intervention*".

According to the World Disaster Report (WDR, 2003) the most common natural disasters are classified into two categories:

(i) Hydro meteorological disasters – landslides/avalanches; droughts/famines; extreme temperatures and heat waves; floods; hurricanes; forest fires; wind storms; insect infestation and storm surges.

(ii) Geophysical disasters – earthquakes; volcanoes and tsunamis.

In this training we will concentrate on the first classification particularly in the context of floods and droughts. Recent observations have shown that globally there is an increase in the number of disasters and their total economic impacts (World Data Report, 2003) with about 90% of these natural disasters caused by severe weather and extreme climate events.

A number of severe weather and extreme climate-related events in recent years have led to disasters of devastating consequences to many countries, thus arousing keener interest of the general public and policy makers.

What defines a disaster in your country?

3.2 Role of Weather, Climate and Environment in disasters

The environment is made up of the earth, water, atmosphere and the biosphere. We live within this natural environment and are an integral part of it. Our social and economic activities impact on the environment and can change the manner in which its component interacts with each other.

These changes can result in environmental degradation and contribute to an increase in the frequency and intensity of disasters and the vulnerability of the people.

Global atmospheric and ocean processes affect the different ecosystems in many countries. African countries have the highest exposure to drought in the world and are extremely vulnerable to climate change and variability with increased risk of drought, famine and/or floods.

Floods have the greatest impacts on low-lying areas, river valleys, and coastal zones. It is associated with high rainfall amounts and tropical cyclones that cause havoc. This is especially true for places such as the Eastern African coast.

In the advent of climate change resulting into increased occurrence and frequency of extreme hydro-climatic events, it is clear that we need to integrate IWRM with disaster management so as to reduce the risk and vulnerability of the people.

When does a drought start and when does it end?

Extreme events such as floods and droughts are the most notorious for triggering cross border water conflicts mainly through migration of pastoralists and people in search of food and pastures. Globally, over 90% of all natural hazards are water related.

4. Water Related Disasters

4.1 Drought

Drought occurs when there is a situation of abnormally dry weather in a region where rain is usually expected. This absence of rain causes a serious imbalance in the hydrological system which, for example, leads to water-supply reservoirs and wells drying up leading to water shortages. The severity of a drought is measured by duration, the degree of moisture deficiency and the size of the affected area.

Droughts can last from a few weeks (partial drought) to as long as a number of years. In the context of IWRM drought results in soil moisture deficits, lack of flow in a river, low groundwater or reservoir levels.

A “hydrological” drought occurs when river or groundwater levels are low, and a “water resources” drought occurs when a low river, groundwater, or reservoir levels impacts on water use. Stringent water resources and demand management measures like rationing are undertaken during drought periods due to the limited supply of water.

Droughts can be aggravated by non-climatic pressures like over cropping, increasing population growth due to higher birth-rates or migration, the lack of timely relief measures, and poor internal and international relations.

Famine or food insecurity is closely associated with droughts. This situation is characterised by a widespread lack of food in a region, and can be described as a lack availability of agriculture foodstuffs, limited livestock, or the general unavailability of all foodstuffs required for basic nutrition.

Drought related famine is a major cause of suffering in many African countries due to the production shortage of sufficient food and poor climatic conditions.

Famine could also be caused by other pre-existing conditions, such as conflicts, mass movement of people, and other social factors.

Drought cannot be reliably predicted; however precautionary measures can be taken such as building dams and reservoirs, studying drought cycles and education to prevent the overgrazing, over cropping, increasing populating and improving land-use practices in drought-risk areas.

4.2 Drought Impacts

Drought is known to have a slow onset making it more predictable than floods. It is difficult to tell when a drought starts and when it ends. It is therefore considered to be a slow-creeping hazard with devastating impacts.

Some of these impacts are:

- The risks of infectious diseases (such as cholera, typhoid fever, diarrhoea, acute respiratory infections and measles) are all increased by a lack of water supply and sanitation services.
- Malnutrition and displacement of the population can be brought on by a drought emergency;
- The ability of people to access health-care services is undermined by the disruptions that attend drought emergencies. The disruptions include forced migration, loss of buying power, and the erosion of coping capacities, all of which contribute to an overall increase in morbidity and mortality. Health services might not have adequate water-supply and sanitation facilities, which only adds to the health risks; and
- The worst case scenario of these impacts is death through hunger and malnutrition particularly among the poor and the vulnerable groups.

Box 1.4: Some terminologies used in disaster studies

i) **Hazard -** A potentially damaging physical event , human activity or phenomenon that has potential to cause loss of life or injury, property damage, socio-economic disruption of life and environmental degradation, among others.

ii) **Vulnerability -** A set of conditions resulting from physical, social, economic and environmental factors that increase the susceptibility of a community to the impact of disasters or the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard.

Disaster = Hazard + Vulnerability

iii) **Risk -** The probability of harmful consequences or loss resulting from the interaction between natural hazards and vulnerable conditions of people and property.

Risk = (Hazard X Vulnerability)/Capacity

iv) **Mitigation -** Short and long term actions, programmes or policies in advance of a natural hazard or in its early stages, to reduce the degree of risk to people, property and productive capacity.

v) **Impacts -** Specific effects, consequences or outcomes of hazards or disasters.

vi) **Preparedness -** Pre-disaster activities designed to increase the level of readiness or improve operational capabilities for responding to an emergency.

vii) **Response -** Actions taken immediately before, during or directly after a disaster to reduce the impacts and improve recovery.

viii) **Resilience/Capacity –** The capability of the community to cope with disasters.

Source: Report on the Status of Disaster Risk Reduction in Sub-Saharan Africa Region, 2008.

4.3 Floods

A flood is an unusual high-water period in which water overflows its natural or artificial banks onto normally dry land. It is a regular and natural occurrence to which communities must adapt as part of the usual living conditions that can affect them at any time.

Floods can cause great damage to land and water-related infrastructure and it can have disastrous short and long-term consequences for people and economies. It is important to take floods into consideration when planning the construction of bridges and dams requiring good land use practices. This is why floods are measured in terms of height, volume of flow and the area submerged in order to implement good flood control measures, such as storage reservoirs and protective levees.

Sometimes, though, the discharge volume of a stream varies greatly from month to month and year to year. A flash flood, for example, comes suddenly and unexpectedly. It does not last very long and can be extremely dangerous.

This is another factor to be considered in the design and engineering of structures such as dams and reservoirs that may be affected.

The key issue to consider would be if the expected floods will occur only once in a hundred or perhaps a thousand years.

Floods are not always disastrous and disruptive; they have some positive impacts such as:

- **Nutrients —** in the case of the Nile River before the Aswan High Dam of Egypt was built, the Nile flooded every spring bringing much needed enrichment and moisture to the fertile soil of its floodplains;
- **Recharge —** floods replenishes ground water systems by recharging the underground aquifers;
- **Replenishes —** reservoirs are filled which enhances the national water security; and
- **Washes away —** accumulated waste from water channels and improve the channel water flow.

4.4 Flood Impacts

Despite the potential positive impacts, floods can also bring significant negative impacts:

- Drowning is the leading cause of death in the case of flash floods and coastal floods;
- Fatal injuries can occur during the evacuation or cleanup activities. Injuries consist of small cuts or puncture wounds from glass debris or nails. Electric shocks can also occur;
- In the short-term, the impact of floods on the transmission of communicable diseases is limited, although there is definitely an increased risk for water-borne and vector-borne diseases;
- Flooding can damage lifeline systems, such as the water and sanitation infrastructure, and can interrupt water supply and sanitation services;
- Water sources might become contaminated during flooding. Latrines and shallow wells could be flooded, representing a major health hazard; and
- Toxic chemicals could contaminate water sources during flooding, but this has not been adequately documented to date.

Flood waters are better managed through the construction of reservoirs, diversion canals, channel deepening and dykes.

Better management practices include implementing early warning systems and well coordinated watershed management practices.

4.5 Tropical Cyclones and Hurricanes

Tropical cyclones are amongst the most powerful and destructive meteorological systems on earth. Globally, 80 to 100 cyclones develop over tropical oceans each year. Many of these make landfall and can cause considerable damage to property and loss of life.

A tropical cyclone is a storm system characterised by a low pressure centre and numerous thunderstorms that produce strong winds and flooding rain. They feed on heat released when moist air rises, resulting in condensation of water vapour contained in the moist air.

How would IWRM help to achieve these DRR priorities?

The term "tropical" refers to both the geographic origin of these systems, which form almost exclusively in tropical regions of the globe, and their formation in Maritime Tropical air masses. The term "cyclone" refers to a storm's cyclonic nature, with counter clockwise rotation in the Northern Hemisphere and clockwise rotation in the Southern Hemisphere.

Depending on their location and strength, tropical cyclones are referred to by other names, such as hurricane, typhoon, tropical storm, cyclonic storm, tropical depression or simply cyclone. Tropical cyclones however produce exceptionally powerful winds and torrential rain and can produce high waves and damaging storm surge.

These storms develop over large bodies of warm water and lose their strength when it moves over land. Coastal regions can receive significant damage from a tropical cyclone with inland regions relatively safe from the receiving strong winds.

Heavy rains, conversely, can produce significant flooding inland, and storm surges can produce widespread coastal flooding up to 40 kilometres from the coastline. Even though their effects on human populations can be devastating, tropical cyclones can have an impact on drought situations by bringing much needed relief.

It can also carry heat and energy away from the tropics and transport it toward temperate latitudes which make it an important part of the global atmospheric circulation mechanism. In other words tropical cyclones help to maintain equilibrium in the Earth's troposphere, and support the maintenance of a relatively stable and warm temperature worldwide.

4.6 Landslides

Landslides are another water related disaster. It includes a wide range of ground movement activities such as rock falls, deep failure of slopes and shallow debris flows, which can occur in offshore, coastal and onshore environments. The action of gravity can be seen as the primary driving force for landslides to occur, other contributing factors can influence the original slope stability. Characteristically, pre-conditional factors build up specific sub-surface conditions that make the area or slope prone to failure, while the actual landslide frequently require a trigger before being released.

Commonly identified causes of landslides are:

- Groundwater pressure acting to destabilise the slope;
- Loss or absence of vertical vegetative structure, soil nutrients, and soil structure;
- Erosion of the toe of a slope by rivers or ocean waves;
- Weakening of a slope through saturation by heavy rains;
- Earthquakes adding loads to barely-stable slopes;
- Earth vibrations from machinery, traffic or blasting;
- Earth work which alters the shape of a slope, or which imposes new loads on an existing slope;
- In shallow soils, the removal of deep-rooted vegetation that binds colluviums to bedrock; and
- Activities such as construction, agricultural, or forestry which change the amount of water which infiltrates into the soil. Text adapted from http://en.wikipedia.org/wiki/List_of_geological_phenomena.

Sedimentation, storm surges, coastal denudation and salt water intrusion are all other water related disasters that are not discussed in this manual.

5. Hyogo Framework of Action (HFA) for Disaster Management

In January 2005, 168 Governments adopted a 10-year plan to make the world safer from natural hazards at the world Conference on Disaster Reduction, held in Kobe, Hyogo, Japan. Since then, the Hyogo Framework for Action (HFA) became the world blueprint for Disaster Risk Reduction (DRR) into the next decade. Its goal is to sustainably reduce disaster losses by 2015 in terms of lives as well as the social, economic, and environmental assets of communities and countries.

As in the case of IWRM for sustainable water resources management, the HFA offers guiding principles, priorities for action, and practical means to achieve disaster resilience for vulnerable communities. Box 1. 5 identify the five priority areas for DRR.

6. IWRM linkage to Water Disasters

Floods (too much water) and in droughts (too little water) are the most obvious water related disasters. The less obvious facts about disasters relate to root causes such as human activity that could be addressed through improved public policy or is the result of poor policy. These indirect causes or aggravating factors could be varied and can include water resources management policies, agricultural policy, population development and settlement policies, environmental protection policy (or the lack thereof), industrial and economic development policies to name a few.

The possible implications of policy in the cause of disasters and specific mitigation measures need to be considered during the process of policy formulation. A good IWRM system means better policies for improved catchment management, enhanced sanitation services and good governance.

This is where IWRM plays a vital role in the control and management of water related disasters and also help to increase the resilience of the vulnerable communities.

7. Using IWRM to Build Community Resilience

Until recently, disaster management have been re-active and focused on crisis management and the emergency assistance (relief) needed after the occurrence of a disastrous event. DRR now takes a proactive longer-term view. Its purpose is to assist communities to prepare for and reduce the impacts of disasters that cannot be avoided.

Disaster management focus on these areas:

- Mitigation;
- Preparedness;
- Response and Recovery; and
- Reconstruction.

Box 1.5: Hyogo priorities for disaster risk reduction

Priority 1: Make disaster risk reduction a priority – by ensuring that DRR is national and local priority with strong institutional basis for implementation through:

- Creating effective, multi-sectoral national platforms to provide policy guidance and to coordinate activities;
- Integrating DRR into development policies and planning; and
- Ensuring community participation etc.

Priority 2: Improve risk information and early warning – by identifying, assessing, and monitoring disaster risks and enhancing early warning systems though:

- Investment in research, scientific analysis and prediction methods;
- Modelling of hazards; and
- Disaster thresholds/indices, risk mapping and disaster zoning.

Priority 3: Build understanding and Awareness – by using knowledge, innovations and education to build a culture of safety and resilience at all levels through:

- Providing relevant information on disaster risks and means of protection;
- Strengthening networks and promoting dialogue and cooperation among disaster experts, responders and other stakeholders; and
- Strengthening community based disaster risk management programmes etc.

Priority 4: Reduce disaster risks in key sectors – by reducing the underlying risk factors such as:

- Relocating communities from in hazard prone areas such as flood plains to higher ground areas;
- Adhering strictly to building codes that are disaster sensitive; and
- Carrying out disaster proofing activities like food security, finances and medical supplies.

Priority 5: Strengthen preparedness and response- through:

- Development of regular testing of contingency plans;
- Establishment of disaster budget in the national planning; and
- Coordinated regional approaches for effective disaster response etc.

Source: Turning Words Into Action, ISDR, 2005.

During the mitigation stage, measures are implemented before the occurrence of the disaster. In the context of water related disasters, IWRM plays a very important role in DRR by providing good water management options.

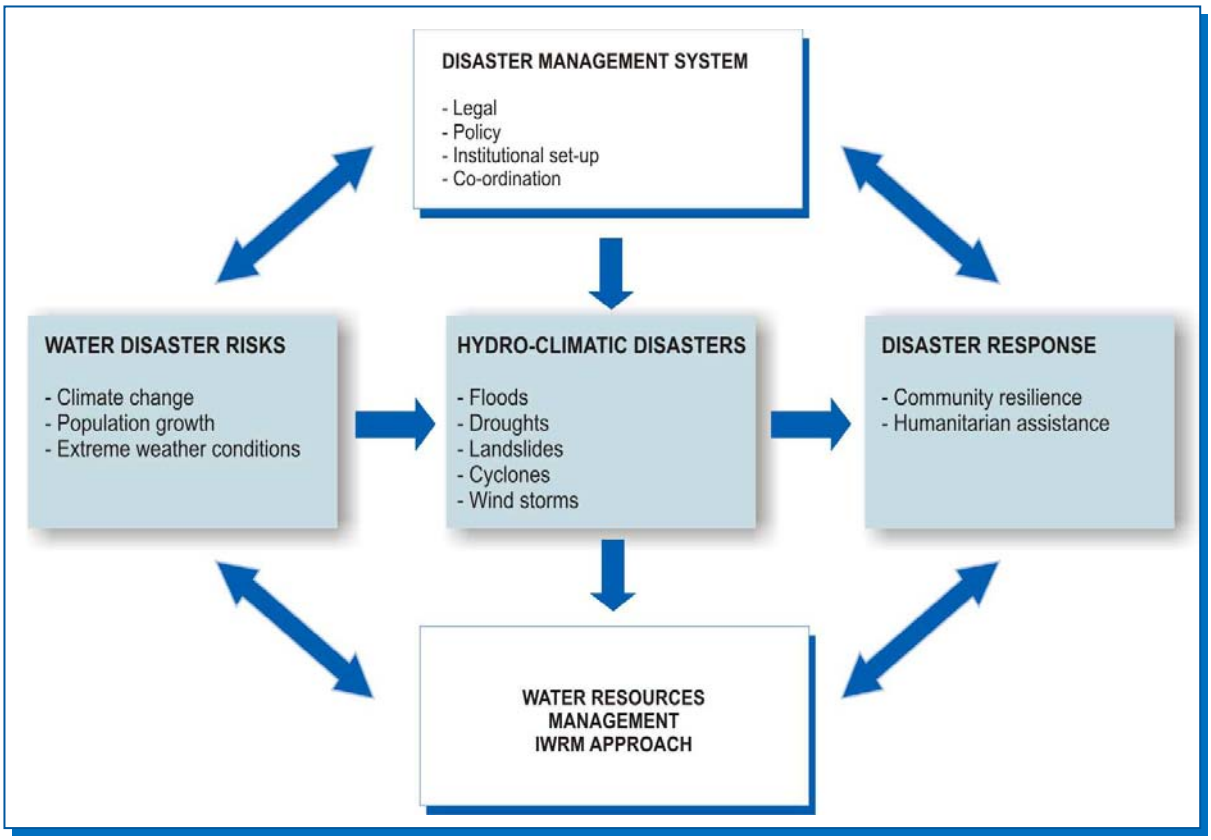

Figure 1.2: Schematic presentation of the linkages of IWRM to water related disasters

Floods can be managed through structural interventions such as dikes, barrages, diversion canals, dams and reservoirs. Non-structural measures such as flood forecasting, public awareness and early warning system would be part of the management process.

The following requirements are necessary for developing community resilience within a national context:

- Assessing information on the role of water in disasters and ensure priority issues get the necessary high-level attention;
- Ensuring government budgets in health and other sectors can fund programmes to improve water and sanitation services during disasters;
- Promoting linkages between water, sanitation, and hygiene as well as health and environment policies;
- Ensuring that health workers, volunteers and others are adequately equipped to address health hazards from disrupted water and sanitation infrastructure; and
- Raising awareness among stakeholders of the dangers during water-related disasters.

At the local level, direct community involvement in water disaster decision-making is critical and it can be done through:

- Building community awareness about water, sanitation and health issues including the importance of preparedness for reducing the vulnerability of water related disasters;
- Promoting recognition of the main hazards related to water disasters;

- Evaluating the impact of the actions taken and lessons learnt after disasters; and
- Involving the private sector in pre-preparedness and vulnerability reduction by forming public/private partnerships.

8. Lessons Learnt

From this module it we learnt that:

- There is a very close link between disaster management as spelt out by the Hyogo Framework and IWRM as expressed in the Dublin Principles;
- An understanding and awareness of hydro-climatic events and trends is important for creating and enhancing community resilience;
- Water related disasters have significant social and economic impacts; and
- An IWRM approach can be used to improve on the management of water related disasters particularly in the context of droughts and floods.

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10. Suggested Web Readings

UN/ISDR, 2007: Words into Action: A Guide for Implementing the Hyogo Framework at website: www.unisdr.org.

Burton J, 2003 (UNESCO): Integrated Water Resources Management on a Basin Level: A Training Manual at www.iepf.org.

Cap-Net, 2006: Tutorial in IWRM at http://archive.capnet.org/IWRM_tutorial/mainmenu.htm)

Exercise

Purpose:
Participants will undertake a comparative analysis of IWRM and Disaster Risk Reduction (DRR).

Activity: 45 minutes
In four groups, the participants will discuss and formulate elements for integration of IWRM and DRR plans at a catchment level.

Reporting: 30 minutes
Each group will then present its findings to the participants for harmonization and discussions.

Facilitator:
Help to identify the commonality and the point of departure for both IWRM and DRR planning by filling in the table below.

No.	Intervention/Element	IWRM	DRR
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Module 2
Disaster Risk Reduction (DRR)

Goal

This module will explain the steps and measures for integrating hydro-climatic Disaster Risk Reduction (DRR) in development at national and community levels.

Learning Objectives

The participants will be able to:

1. Understand the correlation between hazard, vulnerability and assessment of risk;
2. Evaluate disaster risk reduction initiatives; and
3. Understand the use of knowledge, education, training, innovation and information sharing to build safe and resilient communities.

1. Introduction

An increase in the frequency of disasters and the associated financial costs, is putting pressure on the need for better measures, tools and approaches to assess and mitigate disaster related risks. DRR aims to minimise disaster losses in the short-term and put in place possible measures for disaster prevention in the longer-term.

Disaster implies a progressive or sudden, widespread or localised, natural or human caused incident that results in or threatens to cause:

(i) Death, injury or disease;
(ii) Damage to property, infrastructure or the environment; and / or
(iii) Disruption of life and the functioning of the community.

Essentially, a disaster is an event that occurs in a magnitude that exceeds the ability of those affected to cope with the effects within the means of their own resources.

Disaster risk reduction entails continuous and integrated multi-sectoral, multi-disciplinary process of planning, and implementation of interventions of both pre- and post-disaster risk duration.

In broad terms it will include:

- Hazard prevention and minimisation;
- Reducing exposure, severity and susceptibility;
- Emergency preparedness and coping capacity;
- Rapid and effective response; and
- Post disaster recovery and rehabilitation.

What are your suggestions for mitigating disasters in your area?

These efforts represent a break from the cycle of destruction and reconstruction to addressing the root causes of vulnerability, diagnosis of the causes of disaster risks instead of simply treating its symptoms when disasters happen.

Following a DRR process will ensure that good measures are in place before the disasters happen and it will ensure actions after a disaster, building resilience against future hazards.

Disaster managers have to answer some fundamental questions about disasters and their occurrence.

- What causes it?
- Where do they occur?
- How much warning would it be possible to have?
- How could people prepare for it?
- What sort of damage does it do to people and the environment?
- In what manner would the different people be affected?
- Who would be most affected?
- What support might affected people need to rebuild their lives?
- Why might people live in an area affected by this type of disaster?

2. Understanding Disaster Risk Occurrences and Management

Vulnerability to natural hazards is complex and multi-faceted, requiring analysis and solutions from environmental, economic, social, institutional and technical perspectives.

Disasters are a fundamental reflection of the normal life. It is a consequence of the way societies structure themselves, economically and socially. It is also about the way communities and the government interact and how relationships between the decision-makers are sustained.

Disasters stem from the fact that communities especially the poor, often settle in vulnerable areas. It is necessary to make a distinction between hazards and disasters, and to recognise that the effect of the former upon the latter is essentially a measure of the society's vulnerability.

Disaster management aims to reduce the vulnerability to the effect of environmental hazards (both natural and human-induced) to a manageable and acceptable level by enhancing community resilience and integrating sustainable risk management initiatives within the national planning processes.

3. Framework for Disaster Risk Reduction

Disaster management refers to programmes and measures designed to prevent, mitigate, prepare for, respond to, recover from the effects of disasters and reconstruct to build safer societies. It will focus on the basic processes of acquiring and using hazard information. Effective DRR for that reason involves hazard identification and risk assessment processes.

Disaster risk assessment is the first effective step in the management of disasters. The beginning of the process is to start with an understanding of the problem to address in the context of the complex nature and scope of risk factors. This assessment besides prioritising the risk issues, also informs the resources and planning required in dealing with disasters.

The communities should be aware of the risk issues and this knowledge profile is shaped by the existing development approaches in the community. Given the cause and effects of disaster, the challenge is to develop risk sensitive initiatives that integrate disaster reduction in development and planning.

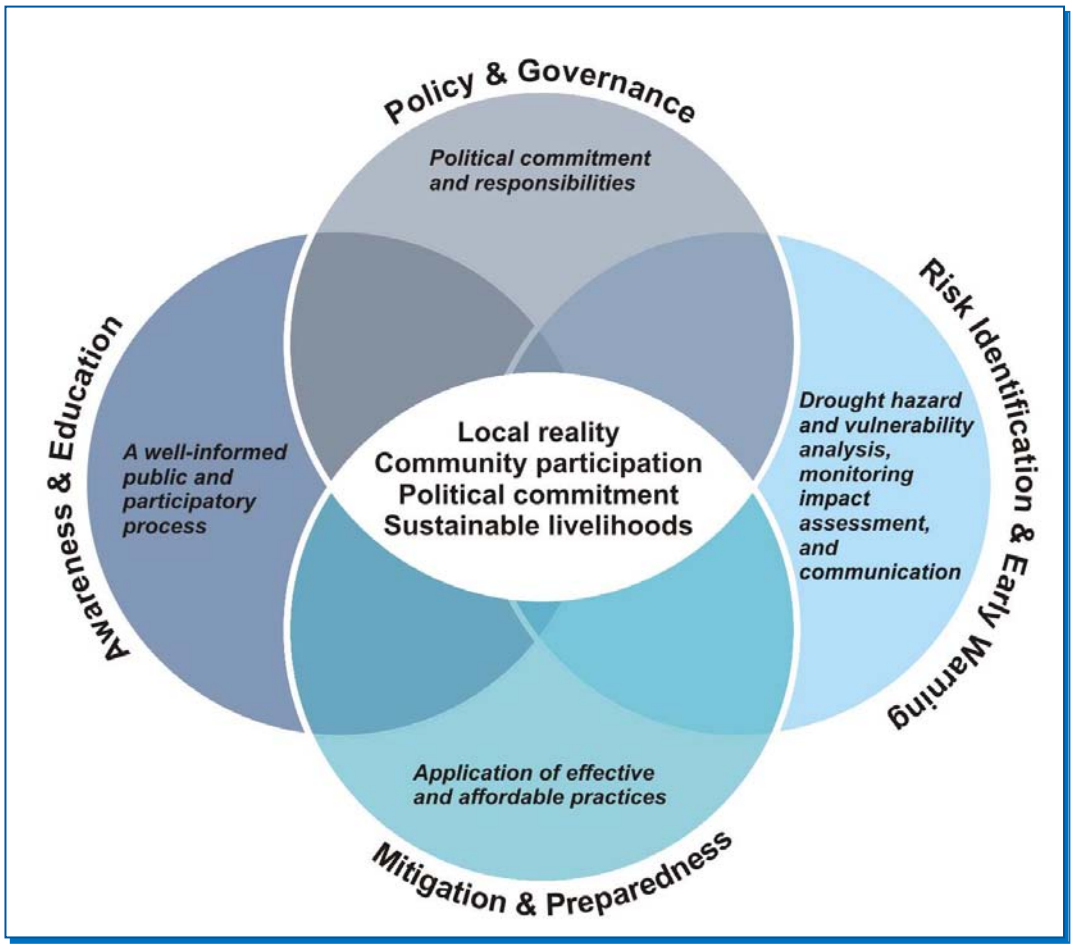


Figure 2.1: Key components for disaster risk management

The effectiveness of disaster management initiatives depend on the decision-making framework at all levels of the society across the government and non-government actors.

This comprises a set of mechanisms, processes, institutions and capacity that collectively makes up the governance and institutional systems for disaster management.

The framework for disaster risk management involves four key elements:
(i) Risk identification;
(ii) Awareness creation and knowledge management;
(iii) Risk management applications and preparedness; and
(iv) Governance and institutional aspects (See Module 6).

4. Risk Factors for Hydro-climatic Disasters

Common primary factors play a large role in determining the severity and magnitude of a disaster. The following underlying factors are general in nature,

and not ranked. They may be more or less applicable to any given society and contributes to determining the vulnerability of a society to disasters.

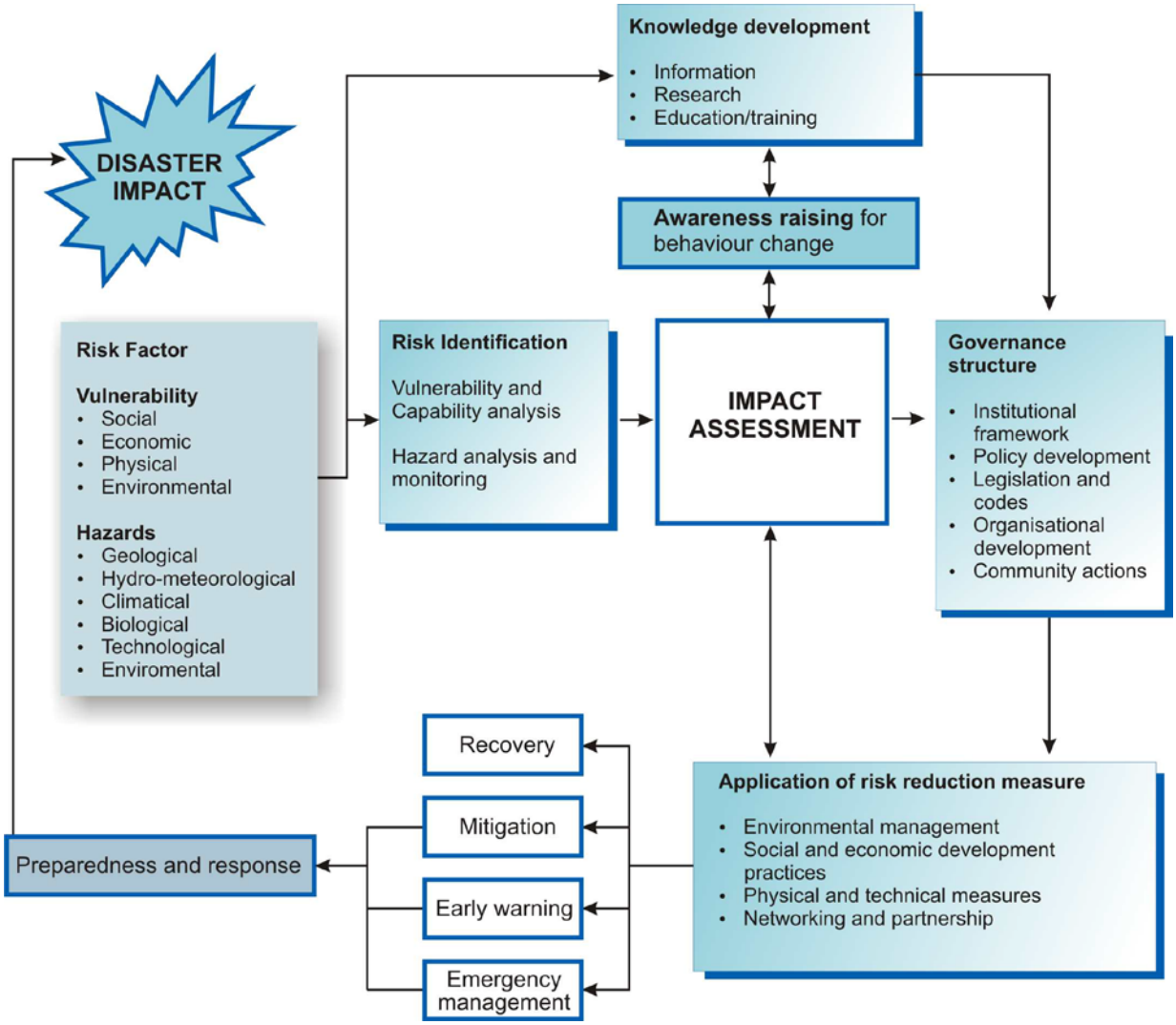


Figure 2.2: Framework for disaster management

Poverty: The single most important factor that increases the vulnerability of a people to disaster is poverty. An impoverished community with low education levels usually lack the economic and political influence to cope with the hazards of their surroundings.

Unregulated development: Ungoverned development growth, together with uncontrolled population growth lead to settlements in hazardous areas, susceptibility to disease, competition for scarce resources, and civil conflict. Disaster losses are significantly reduced when the people of any given society are organised with effective laws and controls to protect the population from potentially hazardous areas, access to public utilities, medical care, education, and economic resources.

Vulnerability to disaster increases when a nation's capacity to govern does not consider the impact and trends in population growth in potentially hazardous areas. Even in the most benign climates rapid urbanisation can create slowly evolving time bombs which could lead to disaster vulnerability.

Rapid urbanisation and migration: Rapid population growth and migration are related to the rapid urbanisation phenomenon. It is characterised by the rural poor or civilians in an area of conflict moving to cities in search of economic opportunities and security. These massive numbers of urban poor increasingly find fewer safe and desirable places available to build their houses.

Competition for scarce resources, an inevitable consequence of rapid urbanisation, can lead to human-made disasters. Many landslides or flooding disasters are closely linked to rapid and unchecked urbanisation forcing low-income families to settle on the slopes of steep hillsides and ravines, or along the banks of flood-prone rivers.

Many victims of hydro-climatic disasters in urban areas are impoverished families forced to live in hazardous physical locations.

Box 2.1: Disaster impacts a factor of preparedness

In 1998 Honduras was hit by Hurricane Mitch at a speed of 270 km/hr affecting 2,112,000 people. In the aftermath of the hurricane 14,600 were dead and a devastating impact of destruction valued at US$3,793,600 was sustained. In comparison in 2001 Cuba was hit by a hurricane of almost equal proportion at 250 km/hour. A total of 5,900,012 people were affected but only 5 people died as a result of the hurricane and property destruction was valued at US$87,000.

Social and cultural transitions: Many of the inevitable changes that occur in all societies lead to an increase in societies' vulnerability to disasters. All societies are in a constant state of transition and change. These transitions are often extremely disruptive and uneven, leaving gaps in social coping mechanisms and technology. An example of this situation is when normally nomadic communities become sedentary, rural people who move to urban areas, and both rural and urban people who move from one economic level to another. More broadly, these cases are typical of a shift from non-industrialised to industrialising societies.

An example of the impact of these transitions is an increase of paved surfaces, using new construction materials and building planning systems that result in incorrect material use or construction techniques that are not fully understood. In disaster prone areas, inadequate construction techniques contribute to houses that are unable to withstand earthquakes or wind storms.

Environmental degradation: Many disasters are either caused or worsened by environmental degradation. Deforestation leads to rapid rainfall-runoff, which contributes to flooding. The destruction of mangrove swamps decreases the coastlines' ability to resist tropical winds and storm surges.

The creation of drought conditions - and the relative severity and length of time the drought lasts - is mainly a natural phenomenon. Human-made contributions to drought conditions include: poor cropping patterns, overgrazing, the stripping of topsoil, poor conservation techniques, depletion of both the surface and groundwater water supply, and, to an extent, unchecked urbanisation.

Lack of awareness and information: Disasters can also occur when people who are vulnerable, have not been educated on how to get out of harm's way or take protective measures at the start of a disaster event. This ignorance may not necessarily be a function of poverty, but a lack of awareness of what measures can be taken to build safe structures on safe building sites. People may be unaware of safe evacuation routes and procedures.
Others may be unaware of where to turn for assistance in times of acute distress.

Nevertheless, this point should not be taken as a justification for ignoring the coping mechanisms of the majority of people affected by disasters. In most

disaster-prone communities, there is a wealth of understanding about disaster threats and responses. This understanding should be incorporated into external initiatives and planning.

War and civil strife: War and civil strife are regarded as hazards or extreme events that produce disasters. War and civil conflict often cause population displacement.

The fundamental factors of war and civil conflict include competition for scarce resources, religious or ethnic intolerance, and ideological differences. Many of these are also by-products of the preceding six causal factors of disasters. The single most prevalent condition in a civil clash is the compounding of a disaster by the collapse of political authority leading to less interest in the welfare of sections of the population and issues of basic securities.

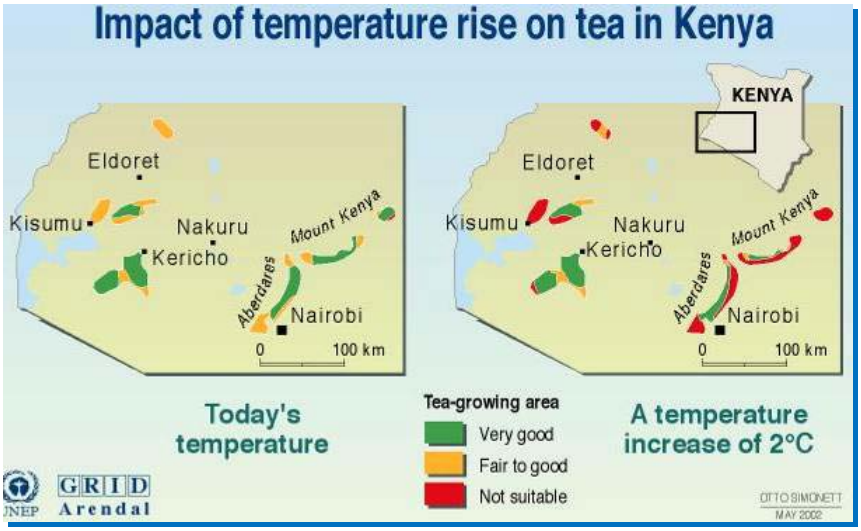


Figure 2.3: Impacts of climate change on hydro-climatic patterns

Change in climatic patterns: Climate change may have significant effect on the patterns and trends of hydro-climatic hazards and disasters (see Module 3).

5. Disaster Risk Assessment

Managers and decision-makers need to decide on how to identify, analyse and address risks. To do this effectively, they have to understand the actual harm of past disasters and potential threats posed by looming hazards.

Disaster risk assessment comprises both vulnerability assessment and hazard analysis. Disaster risk assessment is the process of collecting and analysing information about the nature, likelihood and severity of disaster risks.

The process includes making decisions on the need to prevent and reduce disaster risks, what risks to pay attention to and the optimal approach to tackling risks that are generally unacceptable to the target communities.

Basically, the process of risk assessment may go through several steps:

- Problem/hazard identification;
- Research and analysis of hazard data for vulnerability:
  - Hazard monitoring;
  - Risk evaluation;
  - Risk characterization ; and
  - Vulnerability analysis and impacts assessment; and

- Decision making in disaster risk assessment:
  - Risk communication; and
  - Emergency preparedness.

6. Hazard, Capacity and Vulnerability Identification

The issue of people's vulnerability and capacity in the context of natural hazards is very important in understanding their potential impact and making choices about development interventions. Vulnerability is a product of people's exposure to hazards and their susceptibility to hazard impacts. It reflects social, economic, political, psychological and environmental variables shaped by dynamic pressures (such as urbanisation, lack of land use planning) that are linked to the national and political economy.

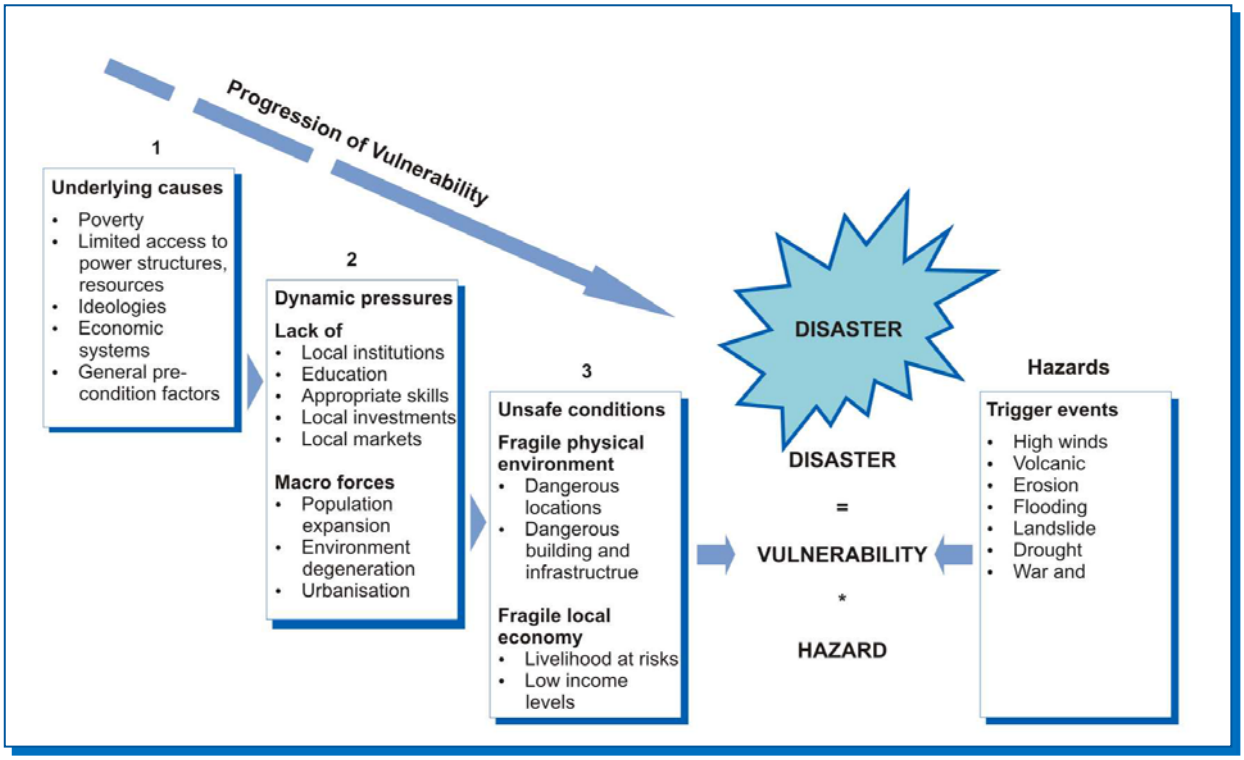


Figure 2.4: Progression of disaster risk vulnerability

The opposite of vulnerability is the capacity to anticipate, cope with, resist and recover from hazard impacts. This ability may be realised through collective action within a favourable institutional framework. Resilience at the community level, may be challenged by new pressures such as climate change and globalisation or limited by defeatist belief systems, but can be boosted by appropriate action on a wider scale.

Poverty and vulnerability go hand-in-hand, but are not synonymous. Not all disasters affect the poorest the most, yet poorer people tend to be more exposed and susceptible to hazards. They suffer greater relative loss of assets, and have a lower capacity to cope and recover. Furthermore, disasters can induce poverty, making better-off people poorer and the poor destitute despite programmes aimed at fighting poverty.

In policy terms this means that poverty reduction can help reduce disaster risk, but this requires a built-in, proactive focus on addressing such risks rather than seeing it as just another constraint to work within. At the same time risk reduction efforts can promote poverty reduction by helping people avoid the impoverishing effects of disasters.

Progression of vulnerability is seen in three stages:

(i) **Underlying causes —** a deep-rooted set of factors within a society that together form and maintains vulnerability;

(ii) **Dynamic pressures —** translating processes that channels the effects of a negative cause into unsafe conditions. This process may be due to a lack of basic services or provisions or may result from a series of macro-forces; and

(iii) **Unsafe conditions —** the vulnerability context where people and property are exposed to the risk of disaster. The fragile physical environment is one element. Other factors include an unstable economy and low income levels.

Disaster reduction strategies must use resources available to limit, and where possible prevent the underlying causes, dynamic pressure and unsafe conditions and mitigate against hazards that lead to occurrence of disasters. Hazards are not a static phenomena and hazard risk exposure will change over time.

7. Hazard Analysis

Once the hazard and vulnerabilities are identified, the disaster process, hazard prevention and minimisation require analysis. It includes collecting and analysing information about the nature, likelihood and severity of the impending disaster risks. This process deals with making decisions on the need to prevent or reduce disaster risks. What risks to tackle and an optimal approach to deal with those risks that is acceptable to the target groups or communities is a part of the process.

The hydro-climatic hazards are quite diverse and similarly the data and related information collection methods vary.

A natural hazard assessment helps to:

- Recognise and understand occurrence of hydro-climatic hazards in the particular country or region;
- Identify knowledge and capacity gaps;
- Identify risks from natural hazards, now and in the future; and
- Make decisions about how to deal with those risks.

What are the major hazards?
What is the extent of the loss?

Information on key features of hazards is needed to identify past, present and potential hazards and their effects.

- **Location and extent —** Is the area affected by one or more natural hazards, what types of hazard, and where?
- **Frequency and probability of occurrence —** How often are hazard events likely to occur? (In the short and the long term.)

- **Intensity/severity —** How severe are the events likely to be? (Flood levels, volume and intensity of rainfall, speed of winds, period of drought, volume/rate of silt transportation?)
- **Duration —** How long will the hazard event last? (From a few minutes in the case of a wind to months or even years in the case of drought.)
- **Predictability —** How reliably can we predict when and where events will happen?
- **Hazard environment —** What are the physical processes and impacts of human activities that create or exacerbate hazards? (Deforestation causing increased runoff hence flooding.)

Information about the time and onset speed of a hazard event is primarily relevant to disaster preparedness and early warning systems, planning evacuation operations and routes. Disaster managers should be aware of the secondary hazards resulting from a hazard event for example landslides triggered by heavy rainfall or dam failure due to floodwaters and impact of hazards outside the occurrence area such as cutting off supplies.

8. Hazard Maps, Risk Information and Education

Communication is critical during an emergency and needs to be addressed thoroughly within the disaster-response plan. Successful disaster response plans requires information and mobilisation response teams, provide guidance, instructions to the affected people, and communicate with the appropriate authorities and external stakeholders.

Challenges include reaching people in different locations quickly and simultaneously; providing the right message (in terms of content, length, and format); monitoring delivery and response; and ensuring that the process is initiated and suspended at the right times.

Mapping is a central tool in communicating hazard identification and assessment. Maps can accurately record the location, probable severity and likelihood of occurrence of hazards and display this information clearly and conveniently. It may be based on a range of data sources e.g. existing maps, remote sensing, surveying. Additional information from photography, field surveys and other sources can be overlaid onto base maps. Geographical Information Systems (GIS) are making this much easier.

Box: 3.2 Disaster Management Pays

China adopted a comprehensive disaster management approach combining economic development with disaster reduction. The disaster reduction system include suite of laws and regulations, institutional development, engineering and non-engineering measures; raising public awareness; improved hazard monitoring and early warning systems; disaster control plans based on risk assessment and science, increased education and training in natural disaster reduction.

The 1998 flood in the Yangtze River though great as those of 1931 and 1954, the area inundated by 1998 flood was insignificant compared to most of middle and lower Yangtze region in 1931 and the 1954 flood which inundated about 3.2 million hectares. The number of deaths in 1931 was 145,000; 33,000 in the 1954; and down to 1562 people for 1998 floods.

Source: www.unescap.org/enrd/water_mineral/disaster/watdis5.htm.

Community hazard mapping exercises can also be undertaken. Communities are often knowledgeable about the location and nature of local hazards and their causal factors. Such information is particularly valuable in identifying and appraising localised hazards but community level outputs can also feed into higher level mapping and planning.

Maps are a good medium for communicating hazard information to decision-makers and non-specialists, but then the particular formats and symbols should be kept familiar.

9. Risk Management Applications and Preparedness

Poverty engenders vulnerability to disaster risks while disasters multiply poverty. The first step would be to profile poverty risk for disaster and understand nature, incidence, severity and exposure of people to poverty and how it worsens disaster risks. Proper initiatives will decide on measures to prevent and reduce those risks and exit from the poverty-disaster cycle.

- Knowledge management and risk identification

Inadequate knowledge and competence in risk management is a major constraint to DRR. Clear efforts must be made to understand the prospective threats and means of effectively incorporating risk minimisation in development. Synergy between disaster management and development is enhanced and effective when based on knowledge of disaster ⇔ development links.

- Institutional development

Implementing DRR is integral to improving disaster management governance. Affected communities need to develop confidence that public warnings of impending disaster are reliable and that the disaster management institutions are capable to deliver services effectively and efficiently.

Furthermore, DRR is multi-thematic and multi-sectoral requiring coherence in the disaster management systems calling on sectoral action coordinated with several other actors. An appropriate institution responsible for disaster management should have this clear capacity and mandate.

- Legislation and policy initiations

Good development governance systems are essential for DRR. It depends on correlation and coordination with development management. Political leadership should give commitment to the objectives of disaster management and allocate the necessary resources for its success.

Government is required to put disaster management policy in place that specifies DRR as a priority, and legislate incentives that promote personal and public responsibility for protection from disaster and ultimately, compliance with disaster warnings.

- Engineering and technological solutions

Engineering and technological solutions can be viewed in two ways. The first is the development of defence infrastructure such as dykes and gabions as structural means of DRR. The second is the design of hazard resistant infrastructure to minimise its own destruction in face of prospective hazards.

Promoting disaster resistant structures will require identification and ranking of asset loss based on the impacts under various degrees of hazard exposure. This may often require a systematic approach that might include development of codes and regulations to enhance compliance.

- Land use planning

In disaster management land use planning implies the use of land as a disaster limiting factor through risk-sensitive land use planning whilst maintaining the objectives of land use management.

Strategies can include development of land use regulation and updating land use plans. Land risk planning will involve trade-offs between competing land use to maintain sustainability and reconcile the location of land use elements e.g. settlements, infrastructure, open spaces in hazard prone areas.

- Effective early warning and hazard information management

Hazard information should be communicated to the affected people accurately and timely? Practically there should be some approximate “stages” or significant levels in development of disaster, and some implications for risk communication. It is critical that disaster management understands the risk and their level of exposure.

People are worried about the magnitude and onset time of a disaster. Once exposed and after the event, their concerns are replaced by concerns for temporary shelter, access to food and water once temporary shelter has been offered.

Soon after the initial concerns, their worries will shift to an anxiety to return to normalcy and livelihood considerations such as the availability of employment, commodity markets, access to credit and technical assistance, schooling for children and other recovery programs.

Adequate preparation and communication of this kind of information gives great assistance to victims of disasters.

- Insurance (financial and social) and asset protection

Social and asset protection systems should respond to the needs of the affected population. The risks that a population faces are often related to a gap that emerges when major relief support and systems come to end when the population cannot cope with the losses incurred during a disaster.

Disaster-related indebtedness, loss of livelihoods and housing may contribute to large numbers of people entering the ranks of the chronically poor. Normal life patterns may take years to re-establish. These risks should be addressed through national poverty programmes, social welfare, credit and insurance structures, as well as diversification of livelihood opportunities in disaster prone areas.

Is information on impending disaster and available assistance communicated to the affected effectively?

- Climate change adaptation

It is important to understand what the present climate change related damages or potential could be and explore the possible adaptive strategies. Yet it should be noted that there is still uncertainty in climate change predictions. It is reasonable (for now) to focus on assessing and strategising for the key sectors at risk.

- Financing disasters management

Disaster management plans will be severely constrained without sufficient funds for implementation. One of the most challenging aspects of disaster management

is a lack of sustained funding for DRR. In many instances the financial resources are diverted from other sectors if and when disaster strikes.

Devoted budget allocations should be considered for disaster management as well as encouraging private sector participation in disaster mitigation.

10. Water Management and Hydro-Climatic Disaster Risk Management

Key principles for mainstreaming DRR in development are closely related to IWRM and include:

- Sound background knowledge on hazards, risk and vulnerability;
- Identification of threats from hazard and vulnerability;
- Awareness of risk and risk reduction measures;
- Determination and development of political and institutional framework in support of disaster risk management;
- Indentify and incorporate structural and non-structural initiatives for mitigating disaster risks in development and synergising with other sectors; and
- Application of multi-thematic and multi-sectoral approaches in the DRR process.

Disaster reduction activities are based on an integrated approach. It encourages taking prevailing risks into consideration. Part of the process is promoting the application of existing local knowledge, networks and partnerships and using multi-thematic and multi-sectoral stakeholder forums such as water resources user associations developed for water resources management to raise awareness. Collaboration between agencies for disaster prevention and response should also be fostered.

It is critical to also strengthen capacities for prevention and mitigation of natural disasters, while promoting sustainable gender and poverty sensitive development approaches to disaster reduction.

The overall goal for DRR is to ensure safe and sustainable livelihoods by minimising the effects of natural disasters through the appropriate planning and use of natural resources.

Water managers will therefore assist disaster management activities by:

- Conducting analysis to identify the kinds of risks faced by people and development investments as well as their magnitude;
- Development, regulation and mitigation to address the structural sources of vulnerability; and
- Post-disaster rehabilitation and reconstruction to support effective recovery and to safeguard against future disasters.

11. Disaster Risk Reduction Indicators

The key DRR indicators are:

- Disaster risk reduction institutions exists and is enshrined in the national laws; and

- Risk assessment is used to enhance DRR and communicate early warnings.

12. Lessons Learnt

- Hazards are a normal part of environmental occurrences, but disasters are enhanced by poor planning.
- Poverty engenders vulnerability to disaster risks, but disasters multiply poverty.
- Focused national institution(s) are necessary to implement disaster risk management.
- DRR starts with risk identification and assessment of vulnerability to enhance decision-making and communication of disaster information in a timely and effective manner where it is required.

13. References

Water Hazards, Resources and Management for Disaster Prevention - Review of the Asian Conditions www.unescap.org/enrd/water_mineral/disaster/watdis5.htm

14. Suggested Web Readings

Cannon T, 2000: *Vulnerability Analysis and Disasters;* Chapter in: D J Parker (ed.) Floods. Routledge available at www.radixonline.org/resources/cannon-floods-chapter.doc

DFID, 2004: Policy Briefing; Disaster Risk Reduction: A development concern http://www.dfid.gov.uk/Pubs/files/disaster-risk-reduction.pdf

Natural disaster management
http://www.globaleducation.edna.edu.au/globaled/go/pid/308

2

Exercise

Objective:
Participants will be able to strengthen their understanding of disaster risks as dynamic occurrences requiring an integrated approach.

Duration: 1 hour
Activity:
Divide the participants in five groups representing:

1. Urban developers
2. Agriculturalists/farmers
3. Water managers
4. Industry
5. Environmentalist

Use cards. Let each group indicate four (4) priority activities related to their sector (one idea per card). Paste the cards up on the wall. Allow discussion to identify three (3) key disasters that frequent in the country or areas the participants live and the affected activities.

Facilitator:
Taking one disaster type at a time, re-assemble the cards of affected activity to identify the stakeholder groups. What role would each group play in mitigating the disaster?

Module 3
Impacts of Climate Change and Variability

Goal

This module explains the impacts of climate change on water resources and its implications to disasters. It explores the ways and means of adaptation to the climate change challenges on disaster management.

Learning Objectives

The participants will be able to:

1. Understand climate change impacts, the underlying risks and resultant challenges to water related disasters; and
2. Apply the knowledge gained in building the resilience of the communities against hydro-climatic disasters.

1. Introduction

According to the World Meteorological Organisation (WMO) climate is a natural resource vital to human well-being, health and prosperity. It can be defined as the average weather situation at a specific place measured during a long time period (30 years or more).

Decision-makers use climate information to plan and adapt activities and projects to likely conditions.

People's lives and livelihoods everywhere are affected by climate. The raising of atmospheric temperature, (also commonly known as global warming, as discussed in 2.3) poses a threat to society in a number of ways. A higher number of and longer droughts threatens millions of people directly.

Millions are affected by smaller crop and fish harvests. Thousands of people are affected by heat waves. Those living in urban areas are more vulnerable with many dying and the most exposed are the elderly and infirm.

The tourism sector in many countries is particularly defenceless against climate shocks, especially the small island states. Some of the impacts are sea-level rise, coastal erosion, saltwater intrusion, lack of freshwater, and the destruction of the natural environment which can severely hamper sustainable development opportunities and threaten livelihood choices.

Despite all the potential negative effects, climate can also support new or alternative livelihood options like renewable and non-polluting energy sources like solar and wind energy development. In understanding climate systems farmers, fisherman and foresters can increase their yields and stocks. Text accessed at http://www.wmo.int/pages/themes/climate/.

2. Defining the Climate Phenomenon

2.1 What is Climate Change?

Climate change is a long-term shift in the climate of a specific location, region or planet. The swing is measured by changes in features associated with average weather, such as temperature, wind patterns and precipitation. What most people don't know is that a change in the variability of climate is also considered climate change, even if average weather conditions remain the same.

A change is noted when the climate of a specific area or planet is altered between two different time periods. It usually happens when something changes the total amount of the sun's energy absorbed by the earth's atmosphere and surface. Climate change also occurs when the amount of heat energy from the earth's surface and atmosphere escapes to space over an extended period of time. Such differences can involve both changes in the average weather conditions and changes in how much the weather varies around these averages.

The changes can be caused by natural processes like volcanic eruptions, variations in the intensity of the sun or very slow changes in ocean circulation and land surfaces which occur on timeframes spanning decades, centuries or longer.

But, humans also cause climates to change by releasing greenhouse gases and aerosols into the atmosphere. They can modify land surfaces and deplete the stratospheric ozone layer. Both natural and human factors that can cause climate change are called 'climate forcing', since they push, or 'force' the climate to shift to new values.

2.2 Climate variability

Climate Variability refers to variations or fluctuations in climate as a deviation from the long-term meteorological average over a certain period of time like a specific month, season or year. The variations are a natural component of the climate caused by changes in the system(s) that influence the climate such as the General Circulation system.

It has been observed periodically weak or strong system(s) can give rise to extreme climate events. A number of climate fluctuations take place without affecting the overall average. For example, a place may have a wetter than normal year followed by a drier than normal year but the average stays nearly the same.

2.3 Why "Global Warming" is the Inappropriate Term

Climate change refers to the general shifts in climate, including temperature, precipitation, winds, and other factors. Global warming (as well as global cooling) refers specifically to any change in the global average surface temperature.

Global warming is often misunderstood to imply that the world will warm uniformly. In fact, an increase in the average global temperature will also cause the circulation of the atmosphere to change, resulting in some areas of the world

warming more and other places less. Some areas can even be cooler. Unfortunately, although it significantly misrepresents what really happens, the term ‘global warming' is still often used by media and others to describe climate change.

2.4 What is the Greenhouse Effect?

A natural system known as the "greenhouse effect" regulates earth temperature. Just like the glass roof and walls of a greenhouse retains the heat, the earth’s atmosphere traps the sun’s heat close to the surface, mainly through heat-trapping properties of certain “greenhouse gases”.

Sunlight heats the earth. Most of the sun's energy passes through the atmosphere, to warm the surface, oceans and atmosphere. In order to keep the atmosphere's energy budget in balance, the warmed earth also emits heat energy back to space as infrared radiation.

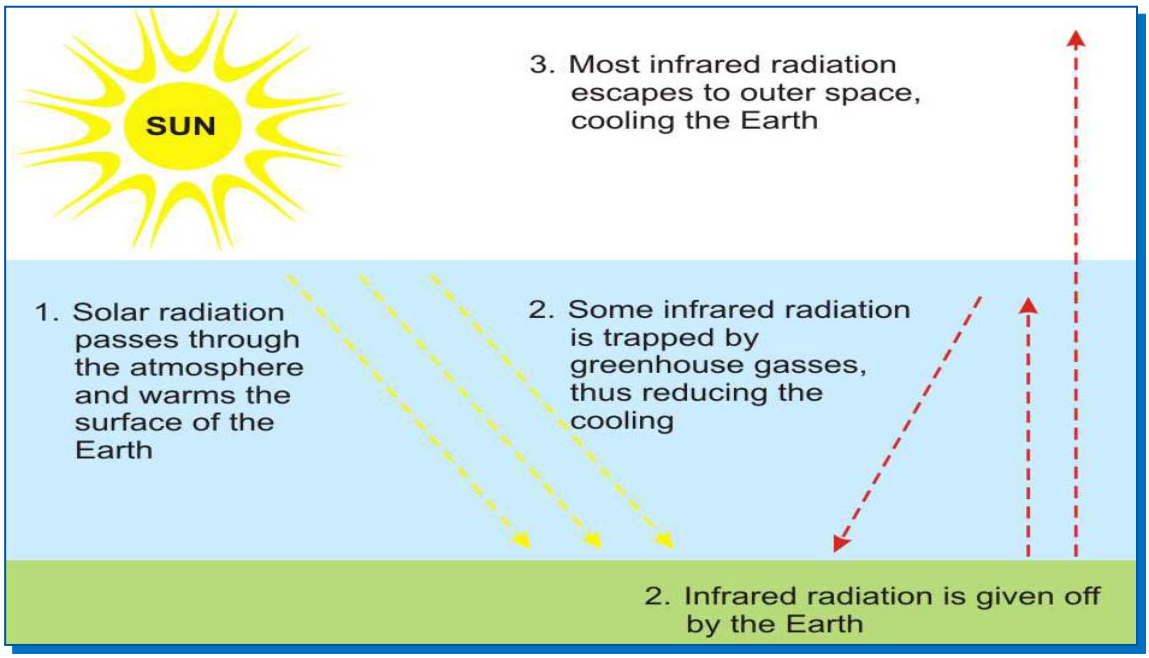


Figure 3.1: The greenhouse effect

As this energy radiates upward, most if it is absorbed by clouds and molecules of greenhouse gases in the lower atmosphere.

These re-radiate the energy in all directions, some back towards the surface and some upward, where other molecules higher up can absorb the energy again. This process of absorption and re-emission is repeated until the energy escapes from the atmosphere to space.

However, because much of the energy has been recycled downward, surface temperatures become much warmer than if the greenhouse gases were absent from the atmosphere. This natural process is known as the greenhouse effect. Without greenhouse gases, the earth's average temperature would be -19°C instead of +14°C or 33°C colder.

Over the past 10,000 years, the amount of greenhouse gases in our atmosphere has been comparatively stable. About two centuries ago the concentrations of these gasses started to rise in the face of higher demand for energy influenced by industrial development and a population growth. Another factor is the changing land use and human settlement patterns. Text accessed at http://www.thegreatwarming.com/pdf/ClimateChangeFactSheet.pdf.

2.5 What Causes Climate Change?

The earth's climate changes naturally. Changes in the intensity of the sunlight reaching the earth causes cycles of warming and cooling that have been a regular feature of the earth's climatic history. Some of these solar cycles - like the four glacial-interglacial swings during the past 400,000 years - extend over a long time period and can have large amplitudes of 5 to 6°C. For the past 10,000 years, the earth has been in the warm interglacial phase of such a cycle. Other solar cycles are much shorter, with the shortest being the 11-year sunspot cycle.

Other natural causes of climate change include variations in ocean currents (which can alter the distribution of heat and precipitation) and large eruptions of volcanoes (which can sporadically increase the concentration of atmospheric particles, blocking out more sunlight).

Still, for thousands of years, the atmosphere of the earth has changed very little. Temperature and the balance of heat-trapping greenhouse gases have remained just right for humans, animals and plants to survive. Currently we are having problems keeping this balance.

The increased use of fossil fuels to heat homes, operate transport, produce electricity, and manufacture products, is adding more greenhouse gases to the atmosphere. By increasing the amount of these gases, humans enhanced the warming capability of the natural greenhouse effect. It's the people-induced enhanced greenhouse effect that causes environmental concern, because it has the potential to warm the planet at a rate that has never been experienced in human history.

2.6 Is climate change real?

There is an emerging international scientific consensus that the world is getting warmer. Significant data demonstrates that the global climate patterns warmed during the last 150 years.

The observations indicate that the temperature increases have not been constant and consists of warming and cooling cycles at intervals of several decades. The long-term trend however, is net global warming.
Information accessed at http://www.csiro.au/resources/ psrs.html.

Together with the rise in temperature the following has been observed:

- The alpine glacier has been retreating;
- Sea levels have risen; and
- Climatic zones are shifting.

The warmest decades on record occurred between the 1980s and 1990s. Global meteorological history reveals that the 10 hottest years occurred in the past 15 years and in the past 600 years the 20th century was the warmest globally.

2.7 What could happen if climate changed?

Climate change is more than a warming trend. Higher temperatures will lead to changes in a number of weather aspects. Wind patterns, the amount and type of precipitation, and the types and frequency of severe weather events are all the aspects that can be expected.

Box 3.1: Some Facts about Climate Change

- 250 million people will be forced to leave their homes between now and 2050.
- Acute water shortages for 1-3 billion people.
- 30 million more people going hungry as agricultural yields go into recession across the globe.
- Sea levels edging towards increases of up to 95cm by the end of the century, submerging 18% of Bangladesh.
- 1°C rise, expected by 2020, would see an extra 240 million people experiencing water 'stress' – where supply can no longer be stretched to meet demand.
- The predicted 1.3°C rise by 2025 would see tens of millions more going hungry due to falling agricultural yields in the developing world and rising global food prices.

Death and Disease

- An estimated 150,000 people die annually from diseases that the changing climate has encouraged to grow.
- Warmer, wetter weather will see malaria, which currently kills up to 3 million people a year, spread to new territories – there is evidence that it has already encroached into previously cool highland areas of Rwanda and Tanzania.
- Christian Aid research, based on scientific predictions, reveals that 182 million people in sub-Saharan Africa alone could die of disease directly attributable to climate change by the end of the century.

Rising Sea-levels

- Melting glaciers and polar ice combined with the thermal expansion of the oceans means we can expect sea-level rise of 15-95cm this century.
- A rise of 1m would displace 10 million people in Vietnam and 8-10 million in Egypt.
- The UK's Department for International Development predicts that the number of Africans at risk of coastal flooding will rise from 1 million in 1990 to 70 million by 2080.
- In Bangladesh, flood damage has become more extreme in the last 20 years. By 2100, predicted ocean rises threaten to submerge 18% of the country, creating 35 million environmental refugees.

Water Shortages

- The Sahel region of Africa has experienced drought-like conditions stretching back to the 1960s. There are no prospects of a revival in its rainfall levels.
- In east Africa, 11 million people were put at risk of hunger by years of unprecedented drought.
- Millions in Asia and South America depend on melting snow and glaciers for water. Thanks to rising temperatures, they are vanishing – since 1995 more than 90% of glaciers have been in retreat. Once they are gone, they cannot be replaced.
- It is expected that Africa's last remaining tropical glacier, on Kenya's Mt Kilimanjaro, will have vanished by 2015.

Extreme Weather

- 90% of the victims of weather-related natural disasters during the 1990s lived in poor countries.
- Over the past 35 years, storms of the force of Hurricane Katrina have almost doubled. Meteorologists say rises in the temperature of the sea surface are the most likely cause.
- Bangladesh could experience 15% more rainfall by 2030, putting 20-40% more of its land at risk of flooding.

Source: http://www.christianaid.org.uk/issues/climatechange/facts/index.aspx.

These changes could have extensive and/or unpredictable environmental, social and economic consequences:

- The global sea level could rise due to several factors including melting ice and glaciers;
- Rising sea levels could damage coastal regions through flooding and erosion;
- The climate of various regions could change too quickly for many plant and animal species to adjust;
- Harsh weather conditions, such as heat waves and droughts, could also happen more often and more severely;
- Climate change could also affect health and well-being; and
- Many mega cities could experience a considerable rise in the number of very hot days. This will increase air pollution problems putting children, the elderly and people suffering from respiratory diseases at risk. Another problem could be an increase in mold and pollens due to warmer temperatures leading to respiratory problems such as asthma.

3. Drivers of Climate

3.1 Precipitation distribution

Atmospheric moisture, although forming one of the smallest storages of the earth's, water is the most vital source of freshwater for people. Water vapour is one of the most important greenhouse gases in the atmosphere and assists in conditioning the earth-atmosphere system for sustenance of life.

Rainfall varies significantly in space and time depending on place and season. It is the main source in the hydrologic system and a great deal is lost through various physical processes until it appears as streamflow at the catchment outlet.

Precipitation is the main driver of variability in the water balance over space and time, and changes in precipitation have very important implications for hydrology and water resources.

Hydrological variability over time in a catchment is influenced by differences in precipitation over daily, seasonal, annual, and decadal time scales. Flood frequency is affected by changes in the year-to-year variability in precipitation and by changes in short-term rainfall properties (such as storm rainfall intensity). The frequency of low or drought flows is affected primarily by changes in the seasonal distribution of precipitation, year-to-year variability, and the occurrence of prolonged droughts.

The unpredictability of rainfall is a normal climatic trend but climate change is usually associated with human activities as they carry on their routine socio-economic activities. Due to climatic change, rainfall belts in many areas have been shifting resulting in more frequent and more severe extreme climate and weather events.

These changes are associated with population pressures on land and environmental degradation through deforestation in general. Some observed time series trend of rainfall in Kenya is shown in Figure 3.1 for two stations located in the semi arid areas of the country and for the short rain season of October, November and December (OND).

The contrasting trends in seasonal rainfall are a clear testimony of the shift in the rain belts associated with climate change.

Other drivers of weather and climate include:

- Solar energy from the sun;
- Earth's pressure systems;
- Moisture sources;
- The sea/ocean land interface;
- The surface albedo; and
- The topography and relief.

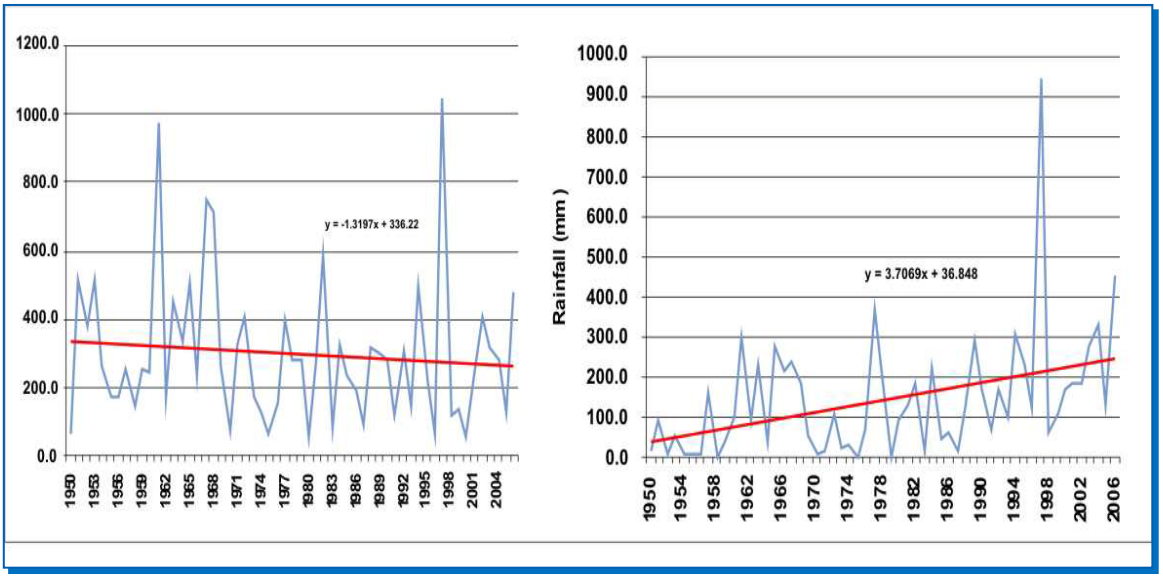


Figure 3.2: Rainfall Trend for Marsabit in the semi arid lands and Lamu in the Coastal region in Kenya during a short rain season

3.2 Temperature

It has been observed that the mean global temperature of the earth has increased by on the average 0.5ºC during the last about 100 years triggering a prolonged debate on climate change over the last 20 years.

Climate change is no longer a debate, but a widely accepted phenomenon. The temperature rise in the lower atmosphere is because of increased green house gas concentrations that block the outgoing long wave radiation.

The costs are manifested in a change in climatic patterns and the appearance of extreme events in greater frequency and severity.

Other climate drivers include:

- **La Niña –** the periodic building up of unusually cold waters in large parts of the same ocean basin resulting to low evaporation and hence depressed rainfall; and
- **El-Niño –** the periodic building up of a large pool of unusually warm waters in large parts of the eastern and central equatorial Pacific Ocean leading to enhanced rainfall.

3.3 Evaporation

The rate of evaporation from the land surface is driven essentially by meteorological controls, mediated by the characteristics of vegetation and soils, and constrained by the amount of water available. The most common types of evaporation from the land surface include:

- Evaporation from open water;
- Soil;
- Shallow groundwater;
- Water stored on vegetation; and
- Transpiration through plants.

Climate change has the potential to affect all of these factors — in a combined way although this is not yet clearly understood — with different components of evaporation affected differently.

The primary meteorological controls on evaporation from a well-watered surface (often known as potential evaporation) are the amount of energy available (characterised by net radiation), the moisture content of the air (humidity—a function of water vapour content and air temperature), and the rate of movement of air across the surface (a function of wind speed). Increasing temperature generally results in an increase in potential evaporation, largely because the water-holding capacity of air is increased. Changes in other meteorological controls may overstress or offset the rise in temperature, and it is possible that increased water vapour content and lower net radiation could lead to lower evaporative demands.

The relative importance of different meteorological controls, however, varies geographically. In dry regions, for example, potential evaporation is driven by energy and is not constrained by atmospheric moisture contents, so changes in humidity are relatively unimportant. In humid regions, however, atmospheric moisture content is a major limitation to evaporation, so changes in humidity have a very big effect on the rate of evaporation.

3.4 Soil moisture

The amount of water stored in the soil is fundamentally important to agriculture and is an influence on the rate of actual evaporation, groundwater recharge, and the generation of runoff. The local effects of climate change on soil moisture, however, will vary not only with the degree of climate change but also with soil characteristics. The water-holding capacity of soil will affect possible changes in soil moisture deficits; the lower the capacity, the greater the sensitivity to climate changes.

Climate change also may affect soil characteristics, perhaps through changes in water logging or cracking, which in turn may affect soil moisture storage properties. Infiltration capacity and water-holding capacity of many soils are influenced by the frequency and intensity of freezing. Boix-Fayos et al. (1998), for example, show that infiltration and water-holding capacity of soils on limestone are greater with increased frost activity and infer that increased temperatures could lead to increased surface or shallow runoff. Komescu et al. (1998) assess the implications of climate change for soil moisture availability in southeast Turkey, finding substantial reductions in availability during summer.

4. Climate Change Impacts

4.1 Water resources

Since the early stages of concern over the possible consequences of global warming, it has been widely recognised that changes in the cycling of water between land, sea, and air could have very significant impacts across many sectors of the economy, society, and the environment. The characteristics of many terrestrial ecosystems, for example, are heavily influenced by water availability and, in the case of in-stream ecosystems and wetlands, by the quantity and quality of water in rivers and aquifers.

Water is fundamental to human life and many activities — most obviously agriculture but also industry, power generation, transportation, and waste management — and the availability of clean water often is a constraint on economic development. Consequently, there have been a great many studies into the potential effects of climate change on hydrology (focusing on cycling of water) and water resources (focusing on human and environmental use of water).

The sensitivity of a water resource system to climate change is a function of several physical features and, importantly, societal characteristics. Physical features that are associated with maximum sensitivity include:

- A current hydrological and climatic regime that is marginal for agriculture and livestock;
- Highly seasonal hydrology as a result of either seasonal precipitation or dependence on snowmelt;
- High rates of sedimentation of reservoir storage;
- Topography and land-use patterns that promote soil erosion and flash flooding conditions; and
- Lack of variety in climatic conditions across the territory of the national state, leading to inability to relocate activities in response to climate change.

4.2 Impacts of climate change to other development sectors

Fluctuations in climate lead to a disruption of many socio-economic activities and have many related impacts. Some of these impacts are exaggerated in climate change scenarios.

Climate change is a big threat to the basic elements of life for people around the world. These basic elements of life include access to water, food, health, and use of land and the environment including conflicts over limited resources such as pasture and water. Sectors impacted on include energy sources, environment, biodiversity, crop production, social economic and health.

4.3 Climate change and extreme events

Natural hazards are severe and extreme weather and climate events occur naturally in all parts of the world, although some regions are more vulnerable to certain hazards than others.

Natural hazards become natural disasters when people's lives and livelihoods are destroyed. Human and material losses caused by natural disasters are a major obstacle to sustainable development. Issuing accurate forecasts and warnings in a form that is readily understood and educating people on how to prepare against such hazards, before they become disasters, lives and property can be protected.

Observations have shown that:

- One of the critical issues regarding climate change is with respect to the extreme events such as floods, droughts, heat waves, cold spells, strong winds and hurricanes; and
- A number of studies suggested that there are significant changes in the frequency and intensity of extreme events with only small changes in climate (i.e. relatively higher frequencies and more intense extreme climate events) Text from http://www.meteo.slt.lk/Researches.htm and http://whc.unesco.org/documents/publi_climatechange.pdf)

Box 3.3: A case study on climate change

At 5,895 m, Mount Kilimanjaro is the highest mountain in Africa. This volcanic massif stands in splendid isolation above the surrounding plains with its snowy peak looming over the savannah. The mountain is encircled by mountain forest. Numerous mammals, many of which are endangered species, live in the Park. The Kilimanjaro National Park was inscribed on the World Heritage List in 1987 because of its outstanding natural beauty.

The glaciers on Mount Kilimanjaro have been persisting for over at least 10,000 years. But as a result of the combined effect of global climate change and modification of local practices (including changes of land use), they lost 80% of their area during the twentieth century. At the Kibo cone of Kilimanjaro, the total ice cover diminished from 12,058 m2, 6,675 m2, and 4,171 m2 to 3,305 m2 between the years 1912, 1953, 1976, and 1989 respectively.

If the current trends are not inflected, losing more than half a meter in thickness each year will likely lead to the complete disappearance of the Kilimanjaro ice fields in less than 15 years.

Similar effects have been observed Mount Kenya and Rwenzori Mountains in the same region. These mountains are important water towers for the East Africa being water recharge areas and sources of numerous rivers and streams.

Source: http://whc.unesco.org/documents/publi_climatechange.pdf.

5. Strategies for Mitigation of Climate Change Risks

Climate change adaptation involves taking action to minimize the negative impacts of climate change and taking advantage of new opportunities that may arise. The types of adaptation measures adopted will depend on the impact of climate change on particular regions and economic sectors.

Increasing our capacity to adapt reduces our vulnerability to the effects of climate so, we may help to lessen some of the environmental, economic and social costs of climate change.

Water management is based on minimising the risk and adaptation to changing circumstances (usually taking the form of altered demands). A wide range of adaptation techniques have been developed and applied in the water sector over decades.

A widely used classification distinguishes between increasing capacity (e.g., building reservoirs or structural flood defences), changing operating rules for existing structures and systems, managing demand, and changing institutional practices.

The first two often are termed “supply-side” strategies, whereas the latter two are “demand-side.” Over the past few years, there has been a considerable increase in interest in demand-side techniques.

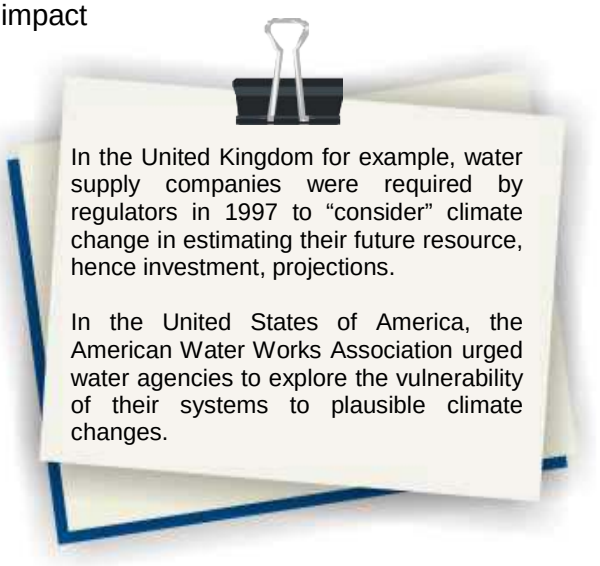
International agencies such as the World Bank (World Bank, 1993) and the Global Water Partnership (GWP) are promoting new ways of managing and pricing water resources to manage resources more effectively.

Water managers are accustomed to adapting to changing circumstances, many of which can be regarded as analogues of future climate change, and a wide range of adaptive options has been developed.

Supply-side options are more familiar to most water managers, but demand-side options are increasingly being implemented. Water management is evolving continually, and this evolution will affect the impact of climate change in practice.

Climate change is likely to challenge existing water management practices, especially in countries with less experience in incorporating uncertainty into water planning.

The generic issue is incorporation of climate change into the types of uncertainty traditionally treated in water resources planning. IWRM is more and more regarded as the most effective way to manage water resources in a changing environment with competing demands.



In the United Kingdom for example, water supply companies were required by regulators in 1997 to “consider” climate change in estimating their future resource, hence investment, projections.

In the United States of America, the American Water Works Association urged water agencies to explore the vulnerability of their systems to plausible climate changes.

It essentially involves three major components:

- The explicit consideration of all potential supply-side and demand-side actions;
- Inclusion of all stakeholders in the decision process; and
- Continued monitoring and review of the water resources situations.

In the absence of climate change, IWRM is an effective approach for attaining sustainable water resources management and there are many good reasons for its implementation. Adopting IWRM strategies will go a long way toward increasing the ability of water managers to adapt to climate change.

It should be noted however, that the ability of water management agencies to alter management practices in general or to incorporate climate change issues varies considerably between countries.

6. Implications of Climate Change for Water Management Policy

Climate change exaggerates current pressures in water management adding to the debate on sound management strategies — adding a new component.

This new element relates to uncertainty in climate change: How can water management efficiently adapt to climate change, given that the magnitude (or possibly even the direction) of change is not known?

Conventionally, water resource managers assume that the future resource base will be the same as that of the past and therefore that estimates of indices such as average reservoir yield or probable maximum flood that are based on past data will apply in the future.

Two issues to consider would be:
(i) Assessing alternatives in the face of uncertainty; and
(ii) Making decisions on the basis of this assessment.

Techniques for assessing alternatives include scenario analysis and risk analysis. Scenario analysis is central to climate change impact assessment, but it is not widely used in water resource assessment (although there are some very important exceptions, such as at the federal level in the United States of America).

Risk analysis, like in climate change impact assessments, tends to involve simulation of the effects of the different scenarios, although in the case of water resources assessment, it tends to demand different operational scenarios rather than different climate scenarios.

A wide variety of national policies and instruments are available to governments to create the incentives for mitigation action. Its applicability depends on national circumstances and an understanding of its interactions.

Is it possible to stop climate change?

Experience from implementation in various countries and sectors shows there are advantages and disadvantages for any given instrument (See Module 6.)

7. Lessons Learnt

From this module, it is clearly understood and observed that climate change:

- Is no longer a myth but a reality as evidenced by environmental changes in many parts of the earth;
- Is now an important decision variable that should be factored in future planning and development of water resources systems;

- Will impact on water related disasters at various scales both in time and space exacerbating impacts on almost all socio-economic sectors.

8. References

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http://www.meteo.slt.lk/Researches.htm
http://www.unesco.org/documents/publi_climatechange.pdf
http://www.grida.no/CLIMATE/IPCC_TAR/wg2/195.htm
http://www.wmo.int/pages/themes/climate/.

9. Suggested Web Readings

Cap-Net, 2002: *Capacity Building for Integrated Water Resources Management; The importance of Local Ownership, Partnerships and Demand Responsiveness*.

http://www.intute.ac.uk/sciencies/hazards/timeline.html

http://across.co.nz/worldWorstDisaster.html

Exercise

Purpose:
To evaluate the current and future climate change impacts at the country level.

Activity: 1 hour
In groups of 5, the participants will discuss the climate change sectoral impacts as guided in the table below. Each group will appoint a Rapporteur who will present their finding to others.

The facilitator will guide the discussions and questions arising from each group presentation.

Sector	Current climate change impacts	Future climate change impacts if unabated
Agriculture		
Energy		
Transport		
Health		
Tourism		
Water		
Land		
Education		

Module 4
Drought Risk Management

Goal

This module explains the occurrence, impact and management of the drought phenomenon. It also outlines the assessment of drought risk, reduction measures and practices that can be used to build resilience.

Learning Objectives

At the end of this chapter, participants are expected to:

1. Understand types, factors and indicators of droughts;
2. Understand intensity, frequency, severity, and risks associated with droughts; and
3. Establish a basis for drought management.

1. Introduction

Past attempts to manage drought and its impacts through a reactive, crisis management approach have been ineffective, poorly coordinated, and untimely, as illustrated by the hydro-illogical cycle in Figure 4.1.

The crisis management approach has been followed in both developed and developing countries. Because of the ineffectiveness of this approach, greater interest has evolved in recent years in the adoption of a more proactive risk-based management approach in some countries. Text accessed at http://www.unisdr.org/terminology.

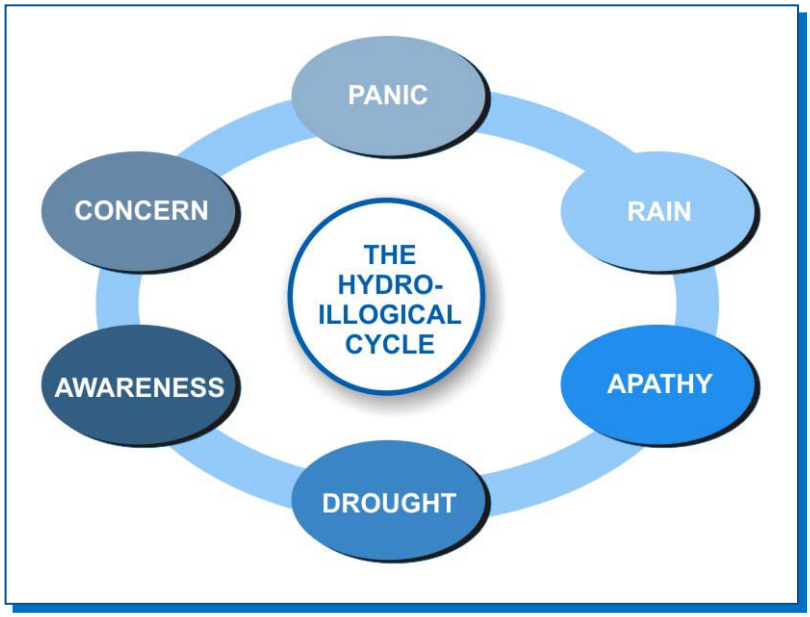

Figure 4.1: The Hydro-illogical Cycle

1.1 Definition

Drought is a normal, recurrent feature of climate. It occurs almost everywhere, although its features vary from region to region.

Defining drought is therefore difficult; it depends on differences in regions, needs, and disciplinary perspectives (UNDP-DDC, 2005).

2. The Concept of Drought

Drought is a normal, recurrent feature of climate, although many erroneously consider it a rare and random event. It occurs in virtually all climatic zones, but its characteristics vary significantly from one region to another. Drought is a temporary abnormality; it differs from aridity, which is restricted to low rainfall regions and is a permanent feature of climate. (See box 4.1)

Drought is a dangerous hazard of nature. Although there are a number of definitions, it originates from a deficiency of precipitation over an extended period of time, usually one season or more. This deficiency results in a water shortage for some activity, group, or environmental sector.

Box 4.1: Definitions

- **Conceptual drought**

Conceptual drought is a protracted period of deficient precipitation resulting in extensive damage to crops, resulting in loss of yield.

- **Operational drought**

Operational drought may compare daily precipitation values to evapo-transpiration rates of soil moisture depletion, and then express these relationships in terms of drought effects on plant behaviour (i.e., growth and yield) at various stages of crop development.

Drought should be considered relative to some long-term average condition of balance between precipitation and evapo-transpiration (evaporation + transpiration) in a particular are, a condition often perceived as “normal”.

It is also related to the timing (principal season of occurrence, delays in the start of the rainy season, occurrence of rains in relation to principal crop growth stages) and the effectiveness (rainfall intensity, number of rainfall events) of the rains. Drought is defined conceptually and operationally.

The **conceptual** definitions of drought are formulated in general terms and help people to understand the concept of drought. The **operational** definitions help people to identify the beginning, end, and degree of severity of a drought.

To determine the beginning of a drought, the operational definitions specify the degree of departure from the average of precipitation or some other climatic variable over some time period. This is usually done by comparing the current situation to the historical average, often based on a 30-year record period. The threshold identified as the beginning of a drought (for example, a 75% of average precipitation over a specified time period) is usually established somewhat arbitrarily, rather than on the basis of its precise relationship to specific impacts.

An operational definition could be used in an operational assessment of drought severity and impacts by tracking:

- Meteorological variables;
- Soil moisture; and
- Crop conditions during the growing season.

At the same time the assessment process will continually re-evaluate the potential impact of these conditions on final yield.

We may define drought in Libya as occurring when annual rainfall is less than 180 mm, but in Bali, drought might be considered to occur after a period of only 6 days without rain!

In the most general sense, drought originates from a deficiency of precipitation over an extended period of time, viewed solely as a physical phenomenon.

(Wilhite et al, 2000)

Operational definitions can also be used to analyse:

- Drought frequency,
- Severity; and
- Duration in a given historical period.

Such definitions, however, require weather data on hourly, daily, monthly, or other time scales and, possibly, impact data (like crop yield), depending on the nature of the definitions being applied.

Developing the climatology of drought for a region provides a greater understanding of its characteristics and the probability of recurrence at various levels of severity. Information of this type is extremely beneficial in the development of response and mitigation strategies and preparedness plans.

3. Disciplinary Perspectives on Drought

Drought can be defined in terms of meteorological, hydrological, agricultural and socioeconomic conditions. The relationships between these types of drought are illustrated in Figure 4.2. Agricultural, hydrological, and socio-economic drought occur less frequently than meteorological drought because impacts in these sectors are related to the availability of surface and subsurface water supplies. It usually takes several weeks before precipitation deficiencies begin to produce soil moisture.

- Hydrological Drought

Hydrological drought is associated with the effects of periods of precipitation (including snowfall) shortfalls on surface or subsurface water supply (streamflow, reservoir and lake levels, and groundwater).

- Meteorological drought

Meteorological drought is defined usually on the basis of the degree of dryness (in comparison to some "normal" or average amount as expressed in Box 4.2) and the duration of the dry period. Definitions of meteorological drought must be considered as region specific since the atmospheric conditions that result in deficiencies of precipitation are highly variable from region to region.

- Socio-economic drought

Socioeconomic definitions of drought associate the supply and demand of some economic good with elements of meteorological, hydrological, and agricultural drought. Its occurrence depends on the time and space processes of supply and demand to identify or classify droughts.

- Agricultural drought

Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural

Box 4.2: Drought Types

- Meteorological drought

Some definitions of meteorological drought identify periods of drought on the basis of the number of days with precipitation less than some specified threshold.

- Socioeconomic drought

In Uruguay in 1988–89, drought resulted in significantly reduced hydroelectric power production because power plants were dependent on streamflow rather than storage for power generation. Reducing hydroelectric power production required the government to convert to more expensive (imported) petroleum and stringent energy conservation measures to meet the nation's power needs.

Source: http://countrystudies.us/uruguay/55.htm.

impacts, focusing on precipitation shortages, differences between actual and potential evapo-transpiration, soil water deficits, reduced ground water or reservoir levels, and so forth.

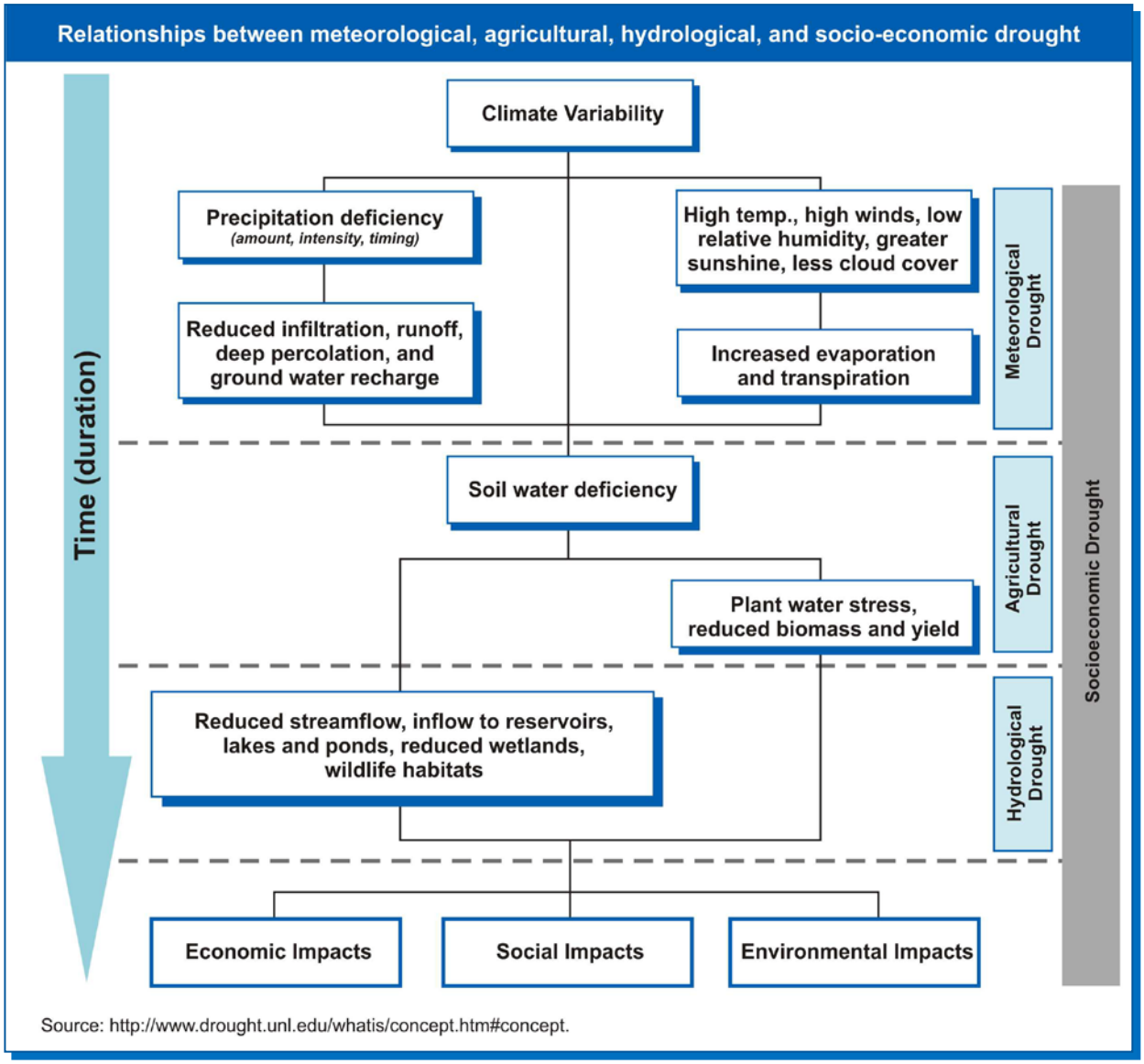

Figure 4.2: Schematic of drought definitions and their impacts

The supply of many economic goods, such as water, forage, food grains, fish, and hydroelectric power, depends on the weather. Because of the natural variability of climate, water supply is ample in some years but unable to meet human and environmental needs in other years. Socio-economic drought occurs when the demand for economic goods exceeds supply as a result of a weather-related shortfall in water supply.

4. Sequence of Drought Impacts

The sequence of impacts associated with meteorological, agricultural, and hydrological drought further emphasizes their differences.

- The agricultural sector is usually the first to be affected at the beginning of a drought, because of its heavy dependence on stored soil water. Soil water can be rapidly depleted during extended dry periods.

- If precipitation deficiencies continue, then people dependent on other sources of water will begin to feel the effects of the shortage. Those who rely on surface water (reservoirs and lakes) and subsurface water (groundwater), for example, are usually the last to be affected.

What defines drought as a disaster?

A short-term drought that persists for 3 to 6 months may have little impact on these sectors, depending on the characteristics of the hydrologic system and water use requirements.

- When precipitation returns to normal and meteorological drought conditions have decreased, the sequence is repeated for the recovery of surface and subsurface water supplies. Soil water reserves are replenished first, followed by streamflow, reservoirs and lakes, and groundwater.

  Drought impacts may diminish rapidly in the agricultural sector because of its reliance on soil water, but linger for months or even years in other sectors dependent on stored surface or subsurface supplies.

  Groundwater users, often the last to be affected by drought during its onset, may be last to experience a return to normal water levels. The length of the recovery period is a function of the intensity of the drought, its duration, and the quantity of precipitation received as the episode terminates.

5. Drought Impacts

- The effects of drought impact the agriculture sector first causing reduction or diminishing water supplies, crop failures and livestock losses.
- Drought can lead to environmental damage through vegetation and wildlife loss.
- The impacts on communities could bring severe water restrictions and cause rising food prices, reduced supply and in extreme cases, devastating famine (e.g. Kenya in 2005-2006 when a sizeable number of people starved to death (Kandji, 2006).
- Periods of drought can have significant environmental, economic and social consequences.

To what level are various sectors affected by drought in your country?

6. Drought Severity

In most instances, the demand for economic goods is increasing as a result of increasing population and per capita consumption. Supply may also increase

because of improved production efficiency, technology, or the construction of reservoirs that increase surface water storage capacity.

If both supply and demand are increasing, the critical factor is the relative rate of change. Is demand increasing more rapidly than supply? If so, vulnerability and the incidence of drought may increase in the future as supply and demand trends converge. Other climatic factors such as high temperature, high wind, and low relative humidity are often associated with it in many regions of the world and can significantly aggravate its severity. The causes of these problems are complex and relate to increased dependence on external resources, poor quality of water resources among other factors.

The common consequences of severe droughts are:

- Wildfires.
- Migration or relocation of those impacted.
- Competition for resources leading to Social unrest, War
- Disease.
- Famine due to lack of water for irrigation.

7. Impact of Drought on the Economy and the Millennium Development Goals (MDGs)

The combination of high levels of food insecurity, income poverty and weakening capacities for delivery of critical services represents a severe threat against meeting the national and the Millennium Development Goals (MDGs) for countries affected by disasters. Recurrent extreme climate events such as floods, cyclones, and droughts are a not only a threat to the required development processes but poses a threat in terms of the economic, social and environment systems.

The accompanying increase in the price of goods and services in certain areas and the outbreak of conflict can significantly reduce the capacity of poor households to cope. Climate change and existing climatic variability is likely to impact negatively on sustainable development plans of many African nations.

It is feared that its impacts will not create a positive environment for the implementation of international, regional and national poverty reduction efforts due to some of the following reasons:

- Climate changes will have a likely negative effect on economic growth – the rate and pattern of which is critical to eradicating poverty;
- It will directly affect poor people's livelihoods and the assets upon which they depend for survival; and
- The increase the risks to people and countries that are already living within fragile conditions and who are already vulnerable.

Box 4.5: Drought Impacts Assessment

Portugal was affected by a severe drought in 2004-2005. The government conducted an assessment of impacts that occurred during the drought to better understand the effects of drought on the country, its people, and their livelihoods. The primary impacts identified were related to agriculture and cattle breeding, energy, urban water supply, and forest fires. For example, the drought caused the drying out of water sources and the loss of their annual replenishing capability.

The people and municipalities primarily affected were those with small caption systems in small river basins, or small underground reservoirs. This type of impact assessment is essential for identifying vulnerable sectors and populations, and targeting limited resources to high-priority needs.

8. Drought Impact Assessment & Vulnerability

Impact assessment examines the consequences of a given event or change, for example, drought is typically associated with a number of outcomes. Vulnerability assessment provides a framework for identifying the social, economic, and environmental causes of drought impacts. It bridges the gap between impact assessment and policy formulation by directing policy attention to underlying causes of vulnerability rather than to its result.

Drought impacts risk is the result of exposure to the drought hazard (probability of occurrence) and societal vulnerability, represented by a combination of economic, environmental, and social factors. Therefore, to reduce vulnerability to drought, it is essential to identify the most significant impacts and assess their underlying causes.

Drought impacts should be examined for their occurrence in past or recent droughts, but consideration should also be given to the question "What drought impacts will be seen in the future?" This last question is crucial as population shift and water demands change. In the United States, the National Drought Mitigation Center has created a national drought impact database to assist in documenting and understanding the effects of drought (Cody et al, 1998).

Users can query the Drought Impact Reporter database to search for impacts that are occurring or have occurred in their region. Impacts are grouped by category, such as agriculture, water, energy, environment, fire and social contexts.

This type of activity will help planners identify the range of impacts that are important in a region. Although the method of impact data collection may vary by country because of technological, financial, political, and other factors, it is essential that impacts are assessed and archived in some manner. Institutional memory is often short and people's recollections biased. Text supported by information accessed at http://droughtreporter.unl.edu.

Accurate records of drought impacts will help provide more objective information on which to base planning decisions. Once a drought impact assessment has been performed, the next step is to rank the highest priority impacts. Drought can result in many direct and indirect impacts. Some of these may be more important than others in terms of values and interests. Addressing the most significant impacts first will help target limited resources and hopefully have a larger effect in reducing drought impacts.

Box 4.6: Drought Risk Plans/Management

- Collect and analyse drought-related information in a timely and systematic manner.
- Identify drought-prone areas and vulnerable economic sectors, individuals, or environments.
- Establish criteria for declaring drought emergencies and triggering various mitigation and response activities.
- Provide an organisational structure and delivery system that ensures information flow between and within levels of government.
- Define the duties and responsibilities of all agencies with respect to drought.
- Maintain a current inventory of government programs used in assessing and responding to drought emergencies.
- Identify mitigation actions that can be taken to address vulnerabilities and reduce drought impacts.
- Provide a mechanism to ensure timely and accurate assessment of drought's impacts on agriculture, industry, municipalities, wildlife, tourism and recreation, health, and other areas.
- Keep the public informed of current conditions and response actions by providing accurate, timely information to media in print and electronic form (e.g. via TV, radio, and the World Wide Web).
- Establish and pursue a strategy to remove obstacles to the equitable allocation of water during shortages.

Source: Wilhite et all, 2000.

Rankings should take into consideration concerns such as cost, area affected, trends over time, public opinion, fairness, and the ability of the affected area to recover. The general public, community advisory committees, and groups of relevant scientists and policy makers should be included in the process to assist in this ranking and ensure equitable policy formulation.

8.1 Vulnerability Analysis

Underlying causes of vulnerability can lead to unsafe conditions that are more susceptible to natural hazards. The Vulnerability Analysis provides a framework for identifying the social, economic, political, physical, and environmental causes of drought impacts. It directs attention to the primary causes of vulnerability rather than to its result, the negative impacts, which follow triggering events such as drought.

In drought conditions, for example, the direct impact of a lack of precipitation may reduce crop yields. The basic cause of this impact, however, can be that farmers did not plant appropriate crops because of cultural preference or government incentives, other seeds were unavailable or too expensive, or there was no drought warning.

Hence, a Vulnerability Analysis, starts by asking why significant impacts have occurred or why they might occur?

It is important to realise that a combination of factors (environmental, economic, and social factors) or underlying causes (livelihoods at risk, incentive preferences, and inappropriate crops) might produce a given event.

9. Drought Risk Reduction Framework

The elements for a drought risk reduction framework can be summarised in four main areas of endeavour as in Table 4.1.

Table 4.1

1.	Policy and governance as an essential element for drought risk management and political commitment.
2.	Drought risk identification, impact assessment, and early warning, which includes hazard monitoring and analysis, vulnerability and capability analysis, assessments of possible impacts, and the development of early warning and communication systems.
3.	Drought awareness and knowledge management to create the basis for a culture of drought risk reduction and resilient communities.
4.	Effective drought mitigation and preparedness measures to move from policies to practices in order to reduce the potential negative effects of drought.

All of these elements need strong political commitment, community participation, and consideration of local realities and indigenous knowledge. The international and regional communities also play an important role in coordinating activities, transferring knowledge, supporting project implementation, and facilitating effective and affordable practices.
Source: UN/ISDR, 2007.

10. Drought Mitigation Measures

Since severe drought is often slow in its development, it is relatively easy to tell when one is coming and in areas that are capable, several mitigation measures can be used to reduce the impacts felt by drought.

The most important steps in lessening the effects of drought are through soil and water conservation. Protected soil, is better able to absorb precipitation and can also help farmers to use less water because it is absorbed and not as much runs off. It also creates less water pollution by the pesticides and fertilizers present in most farm run-off.

In practicing water conservation, public use is often regulated. This mostly includes watering yards, washing cars and outdoor fixtures such as patio tables, and swimming pools. In the United States of America, cities such as Phoenix in Arizona and Las Vegas in Nevada are implementing the use of periscope landscaping to reduce the need to water outdoor plants in dry environments.

What is the normal way for mitigating drought in your case?

Other interventions can include water conservation devices like low-flow toilets, shower heads, and washing machines can be required for use inside the home (Donald et al, 2006).

Desalination of seawater, water recycling, and rainwater harvesting are all activities that are currently under development to build on existing water supplies and further reduce the impacts of drought in dry climates.

Whatever method is used however, extensive monitoring of precipitation and water usage are the best ways to prepare for a drought, inform the public about the problem, and implement conservation strategies.

11. Drought Early Warning System

An Early Warning System (EWS) is a comprehensive monitoring framework for early detection and response to environmental threats.

These systems are more than prediction tools since it encompasses:

- Risk knowledge — prior knowledge of the drought risks faced by communities;
- Warning service — technical monitoring and prediction service for these drought risks;
- Dissemination — dissemination of understandable warnings to those at risk; and
- Response capability — Knowledge and preparedness to act by those threatened.

Are the available structures for early drought warning effective?

12. Lessons Learnt

- Drought is related to the timing (principal season of occurrence, delays in the start of the rainy season, occurrence of rains in relation to principal crop growth stages) and the effectiveness (rainfall intensity, number of rainfall events) of the rains.
- It can be defined and managed depending on the affected sector through proper monitoring.
- Early warning and drought management planning can reduce the socioeconomic impacts and improve resilience.

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Exercise

Objective:
Participants will have an opportunity to share experiences on the implementation of contingency planning for droughts.

Duration: **45 minutes**

Activity:
Organise participants in groups of 4 groups. Each team takes 45 minutes to discuss the following questions.

What is the extent (diversity of affects and affected) of drought problem in the country?
What is the implication of drought disaster to national development
What changes are required for more effective drought management?

Report back: **30 minutes**

Facilitator:
How can water managers help in managing drought effects, and what policy choices undermine this role.

4

Module 5
Flood Risk Management

Goal

The goal of this module is to explain the occurrence, impact and assessment of floods as a natural phenomenon. It also outlines the risk reduction measures and practices that can be used to build community resilience in coping with floods at the catchment level.

Learning Objectives

Participants will be able to:

1. Understand flood types, factors and indicators;
2. Understand the severity and risks associated with floods; and
3. Establish a basis for flood management as a type of natural disaster.

1. Introduction

Floods are a general and temporary condition of partial or complete inundation of normally dry land areas as a result of an:

- Overflow of inland waters; and
- Unusual and rapid accumulation of run-off of surface waters from any source.

It may also be described as the collapse or subsidence of land along the shore of a lake or other body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels.

Floods can also be caused by a sudden unusually high water level in a natural body of water, accompanied by a severe storm or force of nature, such as a flash flood, or by some similarly unusual event which results in flooding.

"Flood management is a broad concept that focuses on reducing flood hazards through a combination of policy, institutional, regulatory and physical measures, while recognising that floods can never be fully controlled.

This takes into account the beneficial uses of floods, which are difficult to quantify in human and economic terms but which sustain natural systems that also have economic, social, and cultural and ecosystem values and functions." (ADB, 2003)

An exceptionally important concept is captured in this definition -- understanding that floods can never be fully controlled.

Box 5.1

Floods are part of the dynamic process of river system functioning and, with rare exceptions, are caused by natural phenomena. Floods are recurrent, their severity varies over a wide range, and they are largely unpredictable in terms of magnitude and occurrence. So-called natural disasters of this kind are only disastrous when people and property are placed in harm's way.

2. Flood Risk Management

A change to proactive management of natural disasters requires:

- Identifying the risk;
- Developing strategies to reduce that risk; and
- Creating policies and programmes to put the strategies into effect.

Risk management is a fundamental activity targeted at evaluating schemes to reduce, but not necessarily eliminate the overall risk. In many cases flood risks cannot be entirely eliminated.

Figure 5.1 provides a schematic overview of the steps associated with risk assessment and management. These steps include assessing the potential for a hazard to occur. A vulnerability analysis can be done to gain an understanding of the consequences should an event of a certain magnitude and frequency occur. Based on this initial work, various mitigation measures can be evaluated to assess their ability for reducing risk exposure. Using a thorough risk assessment, disaster management plans and specific mitigation measures can be identified. Efforts can then be made to implement the selected mitigation measures.

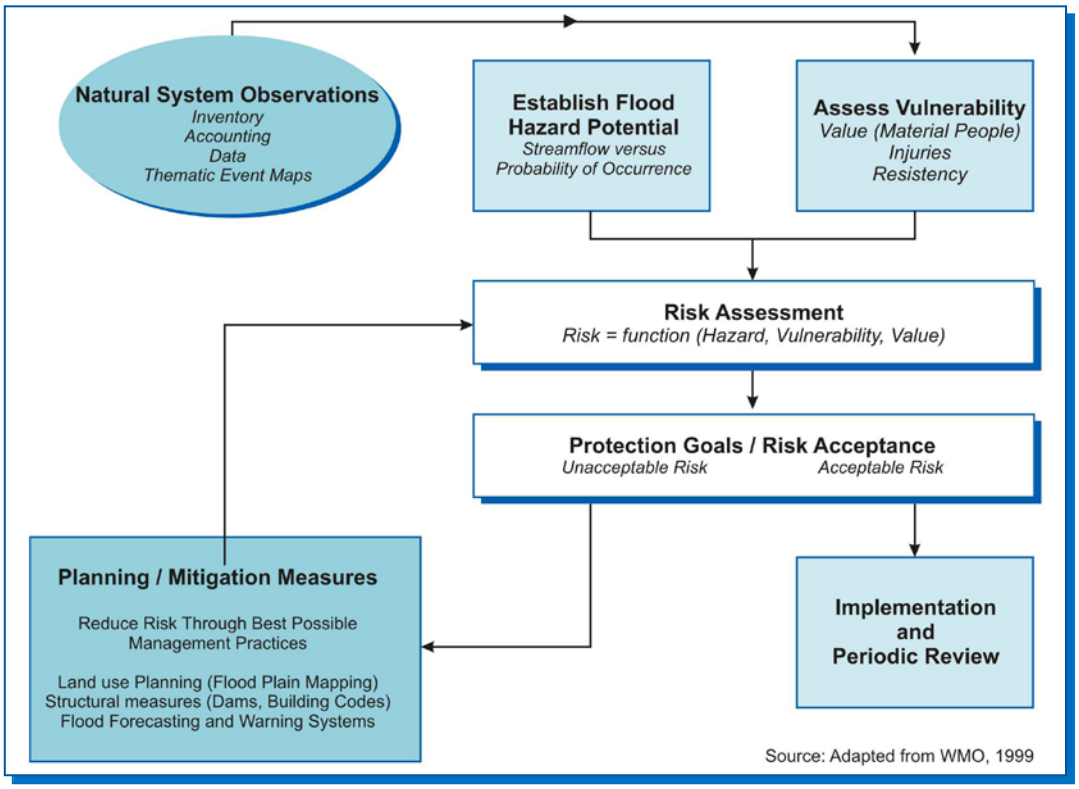


Figure 5.1: Framework for Flood Risk Assessment and Management

In the case of flooding events, there is a need to calculate the likelihood or chance that an extreme event will occur and to establish and estimate the social, economic and environmental implications should the event occur under existing conditions. Maps of the flood-prone areas should be prepared and detailed impacts outlined. A participatory process should be started leading to the development of an acceptable level of risk. Measures can be evaluated and implemented to meet this requirement. This overall process assists the community to have a better understanding of the various actions that can

increase or decrease risk exposure, and can lead to greater community participation in the developed solutions to the flooding problem.

3. Flood Risk and Vulnerability Assessment

A basin flood management plan starts with assessing the present and future flood risks.

As illustrated in Figure 5.2, flood risks are a function of the:

- Magnitude of the hazard;
- Degree of exposure to the hazard; and
- Vulnerability of society against damage due to the hazard.

Higher population pressures on natural resources are forcing people to undertake their socio-economic activities in areas exposed to flooding, compelling them to take greater risks in search of livelihood opportunities.

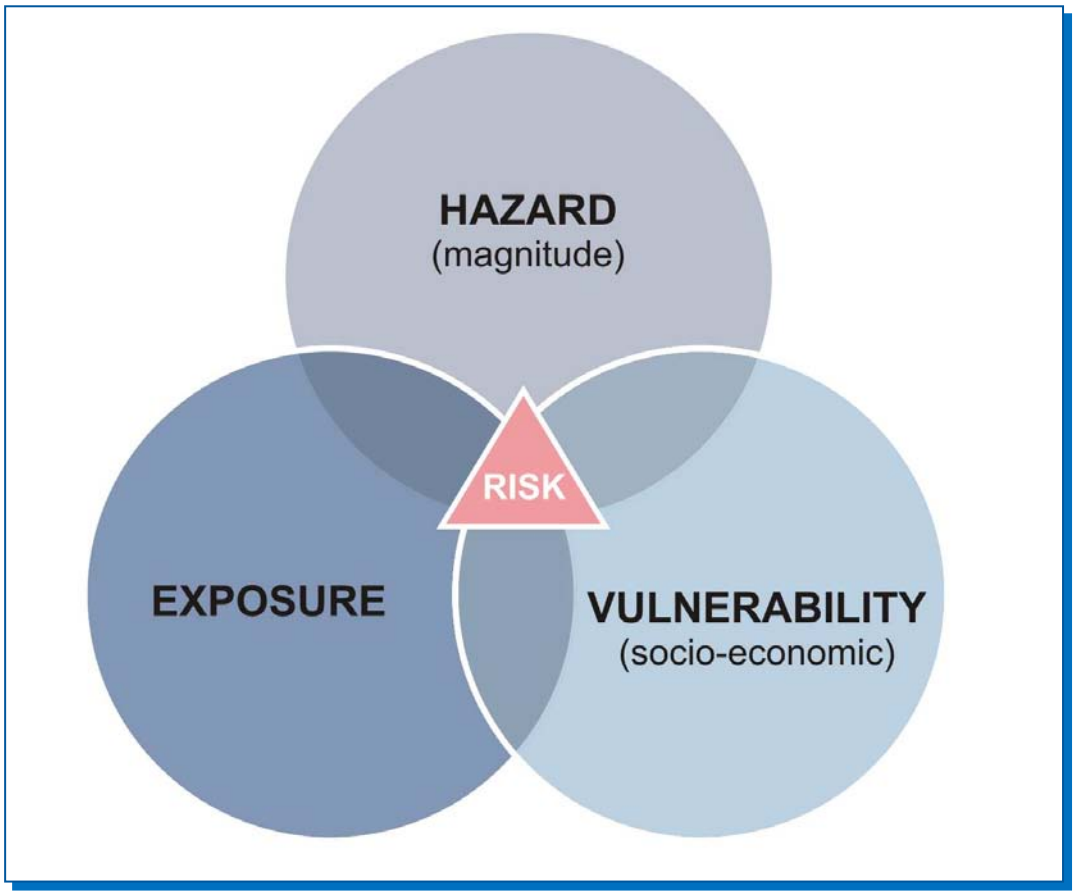


Figure 5.2: Risk as defined by the three functions

4. Flood Problem Analysis

This process starts with developing an understanding of the constituents of flood risks:

- The magnitude of the flood hazard expressed in terms of frequency and severity (depth, extent and duration of inundation and relative velocities);
- The exposure of human activities to flooding; and
- The vulnerability of the elements at risk.

5. Understanding Flood Hazards

The following elements are important to and should be considered in understanding flood hazards and flooding events:

- Hydro meteorological analysis;
- Hydrologic and hydraulic simulation of surface runoffs, floods and inundations;
- Mechanisms of flooding;
- Simulation and analysis projected conditions of land use change, future developments (like urbanization, infrastructure development etc); and
- Future trends of hydro-meteorological phenomenon due to climate variability or change.

Flood inundation maps developed for different scenarios can help build understanding of the issues and communicate with different stakeholders. Such flood maps would be the basis for developing flood risk scenarios based on various development alternatives, social and economic conditions.

Developed with a view of the different uses, flood maps should include other related and supplementary information like defining evacuation routes, raising risk awareness or it can be tool for flood regulation purposes.

Box 5.2

Over the past years the growth of economic infrastructure in flood-prone areas and development activities is creating the potential to increase the magnitude of flood hazards, also raising risk levels.

A risk culture that allows and enables us to assess, evaluate and reduce the prevailing risks and their escalation due to development activities is required.

6. Analysis of Exposure

The analysis of the exposure to flood risk calls for knowledge of the existing land use and the kind of activities that are undertaken in these areas. This investigation is useful when considering the regulatory mechanism required as a possible alternative for risk reduction. It is also essential to assess exposure based on the planned future land uses under consideration.

Identifying the communities who will be vulnerable and exposed to flooding will show why and to what extent they will be or are affected.

Flood plain occupants can be considered vulnerable due to the following circumstances:

- Social factors like poverty, lack of livelihood opportunities or participating in livelihood activities in a fragile environmental context, gender, weaker social groups, as well as minority and ethnic groups; and
- Vulnerability conditions in terms of their physical location, lack of access to constitutional rights or poor social motivation.

This analysis could take the form of a demographic investigation using survey methodology that will engage the communities in these assessments along with the experts giving credibility to such studies.

Estimation of damage in financial and non-monetary terms for a given condition is required in the assessment of the flood risk.

This forms the basis of economic analysis of various options and deciding the priority of various basin flood management options.

Flood Loss Assessment Tools for example, provide basic assessment methodologies. Outcomes of these analyses should also be translated into an easily reasonable manner to be able to get the common understanding among all stakeholders concerned.

Box 5.3

Other functions of flood maps could be (non-inclusive):

- Planning: Impacts of urbanisation, other land uses and climate change;
- Regulatory: Land use regulation and building codes;
- Rescue Operations: Building shelters and earmarking escape routes;
- Flood Insurance; and
- Informational/Educational: record of flood magnitudes in an area.

Source: EXCIMAP, 2007.

7. Impact of Floods on the Economy and Millennium Development Goals (MDGs)

Flood plains provide precious opportunities for farming, industry and urban development because of abundant water supplies, rich productive soils, and proximity to rivers. Flood plains are hence playing an important role in achieving various societal objectives such as food security, securing livelihoods and enhance economic activities that contribute to the growth of Gross Domestic Product (GDP) of countries.

National development visions should therefore reflect the current conditions and issues in its basins and future prospects of improvement that can be realised through flood management measures in the basins.

Flood management strategies should attempt to recognise national development goals by providing the enabling conditions in the flood plains, the fundamentals of national development vision and policies should be examined for its relevance to floods and flooding conditions in the flood plains.

Should the national development visions and policies not take flood management issues into consideration these processes should be implemented.

Basin flood management plans should identify floods and flooding issues. Analysis of flood water benefits as well as the negative socio-economic impacts of floods and take note of flood risks. These should be the starting inputs in formulating future vision, policy, strategies and action plan for flood management.

Consideration have to be given to whether the existing flood management conditions must be maintained, improved or modified. This analysis should be done in close cooperation with all basin stakeholders particularly the flood prone communities, the public sector, local, district and national governments.

They will understand the issues comprehensively and as such form the starting point of identification and involvement of stakeholders. In this process communities will be able to get the opportunity to express their interests and concerns.

8. Identification and Selection of Options to Reduce Risks

Once flood impact priorities have been set and the corresponding underlying causes of vulnerability have been explored and adequately recorded, the actions appropriate for reducing flood risk can be identified. Appropriate flood management options should be explored.

Hazards could be reduced by adopting different approaches such as moderating the flood peaks and delaying flood peaks by retarding the surface run-off.

It can be achieved by:

- Moderating the flood peaks through the retention of the water where it falls;
- Diverting and retaining the surface runoff in natural or artificial depressions;
- Storing it in an on-stream reservoir; or
- A combination of the above strategies.

These options are also possible if reducing flood hazards provides functional efficiency, economic viability and environmental acceptability. Similarly flood risks could be reduced by preventing exposure to flooding. Another approach would be to increase societal resilience to withstand adverse flood impacts.

Reducing people's vulnerability can be a key factor in supporting their ability to develop strategies to deal with residual risks in living with floods. Table 5.1 lists options for reducing flood risk elements. This is not an exhaustive list but serve as indicators to the possible means in terms of flood management.

Good guidance on available options can be obtained by analysing past flood management practices as well as historical flood mitigation tactics. Such an analysis would also provide guidance on the improvements and modifications that may be required in a basin specific situation.

Table 5.1: Comparative Hazards Exposure and Vulnerability

Reduce hazard	Reduce Exposure	Reduce Vulnerability
• Retaining water where it falls (increasing infiltration, rooftop storing). • Retention basins (natural wet lands or depressions, human constructed such as school play grounds, household underground tanks). • Dams and reservoirs. • Diversion channels. • Land use management (e.g., house building codes in urban areas, infrastructure building practices, appropriate landscape planning).	• Structural measures on the river (dykes, river training work such as channelization, flood walls, raised infrastructure such as roads and railways. • Structural and non-structural measures/actions by individual (flood proofing). • Land regulation. • Flood emergency measures (flood warning and evacuation).	• Physical: by improving the infrastructure, well-being, occupational opportunities, and living environment. • Constitutional: by facilitating equal participation opportunities, education and awareness, providing adequate skills and social support systems. • Motivational: by building awareness and facilitating self organisation.

An exhaustive list of potential options for achieving the desired basin flood management targets could be developed in a variety of ways. It would be critical to learn from the experience in the technical departments. However, care should be taken that the experts from other disciplines such as ecology, sociology, economics participate in brainstorming mode of discussion and put forth their point of view and suggestion for achieving the targets.

The options should then undergo a multi-stage screening process from various perspectives:

- Technical feasibility;
- Economic efficiency;
- Social acceptability; and
- Environmental viability.

Technical standards should be adopted or developed to assess the technical feasibility of flood management strategies and plans. This guarantees the design consistency maintains the level of structure safety.

Various tools such as Strategic Environmental Assessment (SEA), Social Impact Assessment (SIA), Cost Benefit Analysis and Multi-criteria Analysis are available to carry out each of these screening tests. In the early stages of doing a Flood Risk Assessment it may not be feasible or necessary to carry out these tests vigorously and a qualitative assessment from a technical, social, environmental and economic perspective may be sufficient.

It is advised that an inter-disciplinary team of experts from the major stakeholder ministries and institutions and specialist non-governmental organisations closely associated with flood issues should undertake the work. In the selection of options in mitigating impacts, knowing the requirement of multi-purpose use of dams and reservoirs is critical. In this regard, it is more cost effective and feasible to develop a flood management plan as a subset of a basin IWRM plan.

In the second stage of screening, which is generally more detailed, an environmentally sensitive framework is useful for decision-making. Economic analysis provides efficiency and sustainability of the options. A Strategic Environmental Assessment (SEA) examines the impact of the intervention on the ecosystem in a basin to evaluate the environmental viability and sustainability, whilst a Social Impact Assessment (SIA) helps evaluate the social impacts such as equity and change in livelihood opportunities possible for the affected communities.

Multi-criteria analysis is one method that can be used to identify the best mix of options by comparing various assessment results and objectives. These analyses should be done maintaining the transparency and accountability of the process and contents through stakeholders' participation. Making the information available will enable wider public awareness of the process is crucial to gain their ownership in the process.

The analysis and evaluation can provide a range of options meeting the targets of a basin flood management plan to be incorporated into basin plan.

The decisions which are the best options among available and practical choices are a

What is the experience with flood mitigation measures applied in your country?

challenge for decision-makers since there may be conflicts between the stakeholders. Appropriate decision-making mechanisms should be sought and used.

9. Integrated Flood Management

The Integrated Flood Management (IFM) approach aims to maximise the net benefits from flood plains and at the same time reduce loss of life due to flooding, flood vulnerability and risks, and preserve ecosystems and their associated biodiversity within the overall framework of IWRM.

The concept recognises the benefits of smaller more frequent floods, the significance of flood plains and the increasing development demands they face. Floods offer significant benefits but at the same time recognising the disruptive nature of floods requiring interventions that can integrate:

- Structural and non-structural measures;
- Land and water management;
- Ecosystem preservation and development needs; and
- Short- and long-term flood management measures.

Integrated Flood Management aims to maximise the efficient use of flood plains while minimising the loss of life from flooding.

It proposes these key elements:

- Adopting a best mix of strategies, both structural and non-structural;
- Managing the water cycle as a whole while considering all floods, including both extremes;
- Integrating land and water management, as both have impacts on flood magnitudes and flood risks;
- Adopting integrated hazard management approaches, taking into consideration the risks due to all related hazards such as landslides, mudflows, avalanches, storm surges and tsunamis and creating synergies; and
- Ensuring a participatory approach to develop a sense of ownership and reduce vulnerability.

It further requires adopting a river basin approach to planning through multi-disciplinary inputs in order to reduce flood vulnerability and risks and preserve ecosystems. It also strengthens the adaptive capacity to climate variability and change. The United Nations in its policy paper entitled Water Hazard Risks, has accordingly adopted Integrated Flood Management as the basic principle for dealing with water hazards related to floods. Text accessed at http://www.apfm.info/pdf/ifm.

10. Flood Management Policy and Planning

Globally the increasing trends of flood losses threatening development sustainability brought greater attention of policy makers to the issue. It is vital to remember that floods are the only natural hazard that also provides freshwater resources.

Flooding brings natural, societal and environmental benefits. As such flood management policies have to be developed separate from disaster management policies. These policies have to be closely aligned to water resources development and management.

The driving force behind establishing or modification of flood management policies would be different in different physical and socio-economic contexts. Issues to consider are:

- Increasing damages;
- Increasing casualties;
- Population migration flood prone areas to cities (if they are not already in the cities); or
- A threat to food security.

Whatever the driving force, flood management policies have to be closely aligned with the national development vision and in certain cases regional development goals.

National vision and policy indicates a nation's social, economic and cultural development direction and goals. It generally provides principles and strategies of the management of natural, land and human resources and the financial mechanism to sustain development within a country. It indicates how national resources are deployed to achieve the national development goals.

These are some of the issues that make up national development vision and policy relevant to flood management and need to be clearly identified:

- Natural resources management (including water resources for domestic, agriculture, fishery, and industry);
- Land use management (agriculture, industry, dwelling, urban development);
- Environmental management (conservation and modification);
- Risk management policies, and
- Social development issues (living conditions, level of poverty, equity and fairness principles).

National development policy should:

- Stipulate the basic policy of risk management;
- Be embodied in the strategy for development in various sectors;
- Generally provide the mechanism to formulate a flood management strategy and action plan; and
- Articulate public participation in decision making process and defining the role and responsibility of stakeholders in the decision making process.

11. Implementation Plan and Monitoring

Implementing basin flood management plans have several requirements. Legal and institutional arrangements may be vital to ensure a participatory process in the implementation of the plan.

Flood management plans may require clear assignment of the roles and responsibilities to apply and manage the implementation process including monitoring its operation. Some of the institutions may not have the capacity to undertake the responsibilities assigned to them.

Capacity building requirements for all the basin institutions and stakeholders at different levels should be clearly defined. Areas of skills to be developed could include building the capacity of the flood practitioners to implement the plan and monitor the entire process and supporting the institutions that are needed to build public awareness.

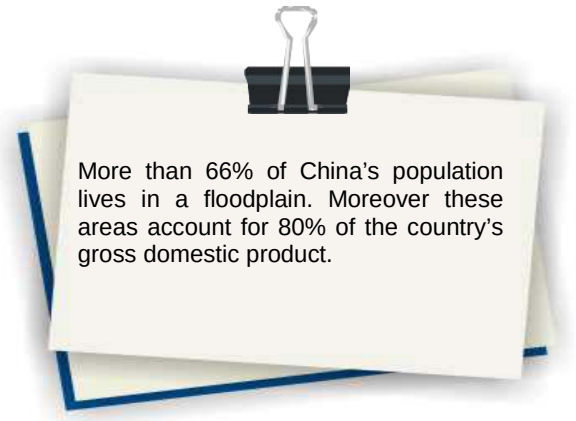
An implementation plan containing basin flood management options providing clear timelines for meeting short-, medium- and long-term targets should be developed. The required financial resources ought to be assessed including the way these resources are to be used. This necessitates a clear assignment of tasks among the organisations responsible and consultation with financial institutions to secure financial resources. Alternative approaches to meet the targets if the required resources for taking up the plan as scheduled are not available should be explored as part of the implementation plan.

Identification of possible external resources for implementation of the plan should also be undertaken in consultation with the national finance ministries and the financial institutions. For this purpose, it is important to involve the relevant stakeholders at the start of the planning process.

Implementation has to give a detailed design of various options to be carried out along with the Environmental Impact Assessment (EIA) and an economic analysis. Final decisions for implementing any component of the plan would be made based on the outcomes of these analyses.

Monitoring of the basin conditions before, during and after the implementation of the plan is essential to check its sustainability and help take corrective measures.

Appropriate performance indicators, suitable for various levels of management have to be established and the threshold values assigned. If adverse affects beyond the specified threshold values are observed, modification and adjustment in the plan should be carried out.



12. Supportive Technologies

A number of tools are available to disseminate and display information to be used by technical experts to explain programmes of flood damage reduction to the decision-makers, and to communicate real time forecasts and warnings to the public.

In general the tools should be interactive allowing for regular and easy updating and flexible enough to develop scenarios as well as providing visual and quantitative information regarding the state of conditions during the forecasted event.

- Geographic Information Systems (GIS)

Geographic Information Systems (GIS) provide computer-based information and manipulation systems that is useful in the support of flow forecasting and

emergency response. Information from a variety of sources and scales can be combined as a series of layers, provided that the information can be identified to a common location.

For example, information on vegetation cover can be combined with soils and land slope information to estimate infiltration rates for forecasting purposes. Similarly layers of utility, land use, flood plain delineation, and structures information can help in the development and updating of emergency response plans.

To what extent has technology enhanced flood management?

A good representation of the basin topography is an important asset in flood forecasting, emergency action and mitigation. A Digital Elevation Model (DEM) or Digital Terrain Model (DTM) for the basin should be developed as part of any GIS. Technologies exist that enable the construction of a "seamless best available" DEM (EXCIMAP, 2007).

In other words the DEM is constructed from whatever topographic information is available. Parts of the basin or certain features may be very accurate while others may be quite basic. It can be improved with time. The development of inexpensive global position indicators has made GIS information easier to obtain. For example, data network sites, buildings or physical features can now be easily located with precision and at low cost. Land use, vegetation cover or soils information is also easier to assemble.

- Mapping

Maps of areas at risk from natural disasters are valuable information and communication tools. It can be used for a wide variety of purposes ranging from flood plain delineation, zoning and land use planning to presentation of information at public meetings.

Zoning maps, however, are static and may require updating with time as changes occur. For static information, such as the delineation of the flood-prone area, frequent updating is not required, and maps are a useful reference tool for a wide variety of users.

- Visualisation techniques

Geographic Information Systems (GIS) and other computer-based information systems allow for a wide range of presentational material to be easily generated and tailored to the target audience. Three dimensional displays together with zoom and scan, and rotational techniques can be combined with other informational material such as pictures, overheads or slides.

As an example, a GIS flood inundation map can be generated based on information from hydraulic models. The map can be shared with residents in the flood plain and is useful for depicting the probable impact of the approaching flood. Providing the technical information in displays that are more readily understood is valuable for explaining programmes to decision-makers, informed experts, and the public at large.

Highly visual information is particularly valuable for public meetings or open houses, but must be carefully tailored for the audience. In particular, the information must be credible and easily understood. The above techniques,

combined with the flood forecast, provide a very effective means to describe areas at risk and for communicating this to the decision-makers, emergency response teams, and the public.

- Approaches to flood control

The fact that floodplains represent a valuable resource providing livelihood opportunities, food, and wealth to communities means that millions of people live in flood-affected areas. It is unthinkable that development should be excluded from such zones, not only because of the scale of such an action but also because the losses would far outweigh the gains.

People everywhere have accepted the risk of living with floods and there are many examples of communities that have adapted their way of living to cope with floods while getting the economic and social gain it brings.

In such communities, for example, houses are built to allow for flooding during the wet season, people use boats to travel when roads are impassable, and the whole cycle of planting and cropping is linked to the rise and fall of rivers.

Box 5.6

For example, terracing of farmland is a structural measure but its impact is of a benign nature in terms of river flow. Similarly, provision of evacuation roads, flood-proofing of houses, raising of the land on which villages are built, and construction of flood retention (or off-stream storage) basins are structural measures having beneficial impacts on the flow regime.

- Structural measures

Successful coping strategy involves the construction of flood defences in various forms as:

- Small scale works — low flood protection embankments along a river can effectively provide protection against frequently occurring small floods, thereby prolonging the period of the year during which crops can be planted.

  Altering the river course in this way have minor negative impacts on the river system, they can be built to withstand overtopping by larger floods and, when they are overtopped, little damage occurs. Unfortunately, the success of minor flood protection embankments has led many communities to attempt to control much larger floods by constructing ever bigger structural flood control works. The potential gains in terms of unrestrained economic development based on newly-created flood-free land in the floodplains are often irresistible to decision makers;

- High flood embankments — have been installed along both sides of the river and the conditions are ripe for catastrophic flooding. The quality of construction of such embankments is never uniformly good.

  The embankments themselves deteriorate with time due to erosion by rainfall, interference by humans (cutting through embankments to allow for passage of irrigation water in the dry season), burrowing of animals, and roads or other traffic along and across the structure. Given that the hydraulic design of flood control embankments is not an exact science; a standard

Box 5.7

The WMO's Associated Programme on Flood Management reports that the number of flood victims has increased nearly seven times between 1993 and 1997— from 19 million to 131 million. Economic losses from flooding during the 1990s were 10 times those of the 1960s in real terms. Surely something is not working well in the realm of flood control.

Source: www.apfm.info/pdf/ifm.

freeboard is normally provided to allow for errors in calculation.

This means that the actual design standard of any part of the embankment system is not known and the point of least resistance (i.e., where the embankment would first overtop in a larger-than-design flood) cannot be calculated beforehand; and

- Large flood control works enables development to spread into severe flood hazard areas, with all of the consequent risks of increased loss of life and damage to property should an embankment fail. Sections of this text were drawn from ttp://www.apfm.info/pdf/ifm.

The struggle to contain floods has at times taken on epic proportions, as can be seen in many examples and especially the attempts to control the Mississippi River in the United States of America (USA) and some of the large rivers in China. Both the USA and China have abandoned the goal of total flood control, but only after having spent enormous amounts of money on elaborate structural flood control measures. To their great disappointment, they have learned that structural measures provide a false sense of security and encourage unimpeded development in areas where devastating floods will nevertheless inevitably occur.

In many river systems where extensive flood control embankments have been installed, the handling of floods becomes a process of crisis management. Not knowing where or when flood embankments may overtop or fail the river basin authority is forced into a state of constant alert, with large reserves of manpower and machinery kept on hand in case an embankment failure becomes imminent.

A major disaster could be unleashed at any time. Such situations, which occur with apparently increasing frequency, provide the alarming stories and eye-catching photos in the world's newspapers and newscasts. We have all seen the heroic efforts of "flood fighters" filling sandbags and jumping into the breach when embankments start to collapse.

- Non-structural measures

The World Meteorological Organisation Associated Programme on Flood Management (WMO-APFM) provides the following examples of non-structural measures:

- Development of integrated land and water planning policies, including:
  - Catchment management policies;
  - Re-zoning of flood plains; and
  - Development of appropriate legislation.
- Flood risk assessment;
- Assessment of social acceptability risk;
- Flood forecasting and early warning, involving both hydrological and meteorological services;
- Public awareness and emergency preparedness; and
- Use of economic tools, such as compensation and insurance.

They argue that ideally the use of combined structural and non-structural approaches to flood protection, including flood risk insurance is recommended. However, engineers and politicians do not easily abandon a reliance on the structural measures. Even a small shift away from structural toward non-

structural approaches will require considerable imagination, public relations effort, and willingness to experiment with new approaches.

These are good examples but do not capture the full range of possible non-structural solutions. In practice, the distinction between structural and non-structural measures may be somewhat artificial. A more useful way to classify measures could be to consider the impact they have on the flow regime within the river channel (and hence their potential for increasing risk of failure – see box 5.6).

Flood mitigation reservoirs are structural measures which help to reduce the volume of water to be conveyed in the river corridor and may (depending on their environmental impacts) be considered benign. Conversely, works designed to keep water within the river corridor have potentially serious negative impacts on the environment and, in relation to the safety of the "protected" public, have impacts of a "hard" nature.

13. Lessons Learnt

- Floods are part of the dynamic process of river system functioning and, with rare exceptions, are caused by natural phenomena.
- Floods are recurrent, their severity varies over a wide range, and they are largely unpredictable in terms of magnitude and occurrence.
- So-called natural disasters of this kind are only disastrous when people and property are placed in harm's way.
- Proper planning and management can reduce the impact of floods on the vulnerable settlements.

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Web References

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15. Suggested Web Readings

The Associated Programme on Flood Management, 2008: *Urban Flood Risk Management A Tool for Integrated Flood Management* at http://www.apfm.info/pdf/ifm_tools/Tools_Urban_Flood_Risk_Management.pdf.

The Associated Programme on Flood Management, 2008: *Flood Loss Assessment: A Tool for Integrated Flood Management* at http://www.apfm.info/ifm_tools.htm

Samuels P G, 1999: *Integrated River Management and Flood Risk* at www.iiasa.ac.at/Research/RMS/june99/papers/samuels.pdf.

Exercise

Objective:
To appreciate the role of water managers in contingency planning for flood mitigation.

Duration: 1 hour 15 minutes

Activity:
- Form four teams representing
- Water managers for:
  - Upper catchment zone;
  - Middle catchment zone; and
  - Lower catchment zone
- National Disaster Management agency

- Each team takes 30 minutes to prepare their inputs for flood Preparedness interventions for their respective areas.
- Each team makes a short oral presentation.
- Hold a plenary to draw a summary on merits and demerits of each groups plan.

Facilitator:
Select a catchment and highlights of catchment characteristics between seasons. Identify issues of common concern to water managers in the context of flood disaster management.

Module 6
Policy, Legislation and Institutions for Disaster Management

Goal

The goal of this module is to navigate the essential character for policy and institutions in the management of hydro-climatic disasters.

Learning Objectives

Participants are expected to be able to:

1. Examine the importance of governance aspects in disaster risk reduction (DRR);
2. Understand institutional mechanisms, capacities and effectiveness for response to hazards at all levels; and
3. Improve effectiveness of the response through stronger disaster preparedness.

1. Introduction

The thrust of disaster management is to establish a process and structure for the coordinated and effective integration of disaster reduction in development planning and sector policies, delivery of assistance and addressing the consequences of major disasters declared in the country under the appropriate national legislation.

A comprehensive disaster management strategy will include coordinated and clear lines of roles and responsibilities, capacity on the part of national and local government implement a timely response to disasters and the integration of local level communities into effective disaster management systems.

The absence of a disaster management policy and institutions would imply:

- Greater and extended hardship (especially to those that can ill afford it);
- An increase in the disaster impact and consequences;
- Larger and avoidable financial strain and delay in economic recovery and urgently needed new developments;
- Re-scheduling of development funds to address the consequences of a disaster;
- Hesitancy on the part of international and local investors to invest in a country and areas that cannot deal effectively or limit avoidable disasters;
- Avoidable loss of life, property and infrastructures; and
- Greater possibility of epidemics.

People and institutions at the highest political level need to be fully aware of the danger that disasters poses. They have to note the hardship it can create for people whose livelihoods are vulnerable to hazards, and be committed to disseminating information and implementing policies to help reduce consequent damage and potential human suffering.

The irony is that people and governments are seemingly addressing more urgent problems and urging for quick development interventions until disaster strikes, at which point it is difficult to implement change or development progress.

Disaster impact mitigation need to be part of other long-term considerations and an integral part of policies related to agriculture, water, food security, environment and development. National policies should create and encourage practices that reduce vulnerability to hazards. All this requires sustainable policies and governance systems which may necessitate capacity development to foster meaningful participation in policy and planning processes.

The primary constraint towards a more favourable environment for organisational and local institutional development in DRR is the very short attention spans that hydro-climatic disaster risks generally command. In the immediate aftermath of a natural disaster strike, with memories of human and material losses vivid, mitigation investment is a very high priority in both the eyes of communities at risk and also local and central governments. As time goes by and memories fade, so too does the priority for mitigation.

Institutional development will establish a 'win-win' partnership between disaster management and water resources management as the frontline operators for mitigation of water related disasters, presenting unique opportunities to "do things differently" in stopping to treat DRR as an exceptional activity brought about by exceptional circumstances.

2. Policy Framework for Disaster Management

The implementation framework of disaster management is not a separate sector or discipline but an approach to solving problems that will enhance disaster management.

Ideally it will harness the skills and resources across all stakeholder institutions taking an integrated, multi-hazard, inclusive approach to address vulnerability, risk assessment and disaster management.
This strategy will include prevention, mitigation, preparedness, response and recovery as essential elements building a safer environment.

Consequently, while for most activities the implementing agencies take a lead role, it is necessary to define the responsible office for overall coordination and direction of activities.

What is the mandate of the lead institution for disaster management?

Various disaster risk management goals and actions are also included within the policy context like predictive capacities and protection from hazards and various programmes to support those affected by disasters. Examples are the provision of humanitarian relief, loans for small businesses and housing.

2.1 Objective of Disaster Management Policy and Legislation

- Policy and legislation create and enabling framework for disaster management. It sets out disaster management goals and institutionalises

and implements the process of addressing disaster risk in a strategic and coordinated fashion. It seeks to explore the complex, cross-cutting and multi-faceted nature of vulnerability and identifies appropriate, proactive risk management solutions.

The following aspects should be taken into consideration:

- Establishing and sustaining political commitment, strong institutions and appropriate governance systems that ensures integration of disaster management and risk reduction in national and local level processes;
- Enacting legislation on disaster risk management;
- Building a database of government institutions and other stakeholders on disaster risk management;
- Mapping priority needs in the country for disaster risk management;
- Committing government to establish an emergency preparedness fund;
- Implementing national disaster management planning and regular updating of the plan;
- Providing support to pursue the implementation of the strategy and programme of action;
- Facilitating the development of regional strategies and district strategies to harmonise with national strategy; and
- Ensuring overall coordination and monitoring in implementation of the strategy.

- Strengthening development of sound background knowledge on hazards, risk and risk reduction and sharing of information is another element of the work. It can be done through:
  - Ensuring overall coordination and monitoring in implementation of the strategy;
  - Improving the quality of information and data on disaster risk;
  - Improving identification assessment and monitoring of hazards, vulnerabilities and capacities;
  - Setting up and strengthen early warning systems, institutions, capacities and resource base, including observational and research sub-systems;
  - Establishing communication and information exchange amongst stakeholders in risk identification and assessment; and
  - Disaster management institutions engage other stakeholder institutions in joint assessment exercises.

- Disaster risk reduction will be enhanced through the development of institutional capacity on a multi-thematic and multi-sectoral approach. These elements will strengthen the process:
  - Building the capacity of the national disaster management agency;
  - Assessing the existing capacities of institutions to harmonise terms, policies and strategies at national and local levels;
  - Developing and strengthening national platforms for disaster risk reduction at required levels;
  - Strengthening decentralisation of DRR interventions;
  - Promoting public participation in planning and implementing disaster risk reduction interventions;

- Promoting increased inter-country cooperation and coordination; and
- Strengthening monitoring and evaluation of programme of action.

- Funding for disaster management should be sufficient, streamlined and efficient. These steps need to be in place:
  - Committed government resources to disaster management;
  - Ensuring financial sustainability of disaster management institution(s) through levies and fees; and
  - Applying penalties and disincentives for risky practices.

- Emphasising mitigation and preparedness rather than relying solely on disaster relief by:
  - Advocating for the inclusion of DRR in development strategies and emergency response management at national and local level;
  - Preparing and disseminating guidelines for integrating disaster risk reduction in development planning and activities consistent with environmental action plan;
  - Facilitating the strengthening of contingency planning and emergency response towards disaster risk reduction;
  - Advocating adoption of multi-hazard approach to disaster risk reduction in sustainable development strategies taking into account prevalent hazards, for example environmental and human induced phenomena; and
  - Consulting with national and international partners for training and capacity building in disaster risk reduction for disaster managers and volunteers.

- Enhancing awareness of risk and risk reduction measures through:
  - Improved information dissemination and communication considering the existing information and feedback after problem identification;
  - Promoting integration of disaster risk management in the formal and informal educational systems;
  - Mainstreaming the media in public education;
  - Strengthening the role and experience of traditional authorities and other opinion leaders in public awareness programmes; and
  - Strengthen the role of women, youths and vulnerable groups in disaster risk management.

Box 6.1: Criteria for a well functioning disaster management institution

- A well-defined mandate and the legal, political, and administrative power to carry it out. In particular it needs to be clear at what level decision-making authority is vested and mechanisms for resolving conflicting interests between levels.
- Adequate staffing and capacity building, especially for environmental issues, which are often new and informed by limited data availability.
- Strong, broad-based political and stakeholder support.
- Sustainable funding disaster management operations need to be financed, whether out of user or through government subsidies.

- Enhancing community-level capacity for disaster risk reduction and ensuring social protection of vulnerable groups in emergencies by:
  - Undertaking a joint assessment approach;
  - Involving local people;

- Implementing a standard response system; and
- Providing for transition and recovery.

3. From Policy to Practice

Progress with integrating DRR into development is related to policy and institutional changes. Finding political commitment for this process requires strong institutions since these structures are crucial for building and maintaining the necessary support to formulate disaster policies as well as integrating disaster risk issues into a sustainable development and DRR processes.

Developing an effective DRR strategy and implementing practical actions requires the contribution and coordination of organisations and institutions at all levels. Each role player has a particular function for which it is responsible and accountable.

Community participation, both in decision making and implementation, is also vital in order to move from policy to practice. Participation is required to develop policies and strategies that are relevant, feasible, and equitable at the local level. It may also help create a larger sense of ownership among stakeholders that will foster commitment and responsibility when implementing disaster policy.

3.1 Essentials of disaster management institutions

- Clarity of role

The political authority needs to show commitment for disaster management by creating separate laws and clear institutional mechanisms for disaster management that will include multi-disciplinary and multi sectoral coordination at different levels of implementation.

- Autonomy

Disaster management require an overarching organisation to pay the necessary attention to DRR rather than the responsibility of humanitarian departments. This will give the institution the required leeway to plan and operate and it would include financial independence.

- Recognition of the institution among stakeholders

The lead institution for disaster management should develop the necessary efficiency, capacity and command in disaster issues. This will lead to stakeholder confidence and allow disaster management activities across the various sectors to come together around them.

- Cross-sectoral coordination

Several activities are envisaged in the management of hydro-climatic disasters and these include but are not limited to weather monitoring, regulation of flow, settlement planning, social welfare and resilience in agriculture. All these activities are more than any single institution can do on its own, it thus calls for rational coordination between the lead institutions and responsible institutions.

- Capacity to collect and use hazard information

Developing the necessary human capacity to do analysis of hazards, vulnerability assessments and planning interventions and who will be able to find sustainable means of financing disaster operations. This is crucial for a successful shift in the emphasis from only responding after disasters strikes to supporting activities that anticipate and mitigate the likely impact of potential disasters.

- Adaptive management

Disaster situations keep changing depending on locality, land use and development activities. Dealing with stakeholders competing for available water resources, and various other types of changes like the social, economic and political situations can influence the types of demands on disaster institutions.

Climate change implications will further complicate and alter variously. Disaster management institutions should have the capacity to continually adapt to variations in the local situation.

3.2 Institutional responsibilities for disaster management and response mechanisms

Institutions charged with disaster mitigation will be required to systematically manage risks related to natural hazards by identifying these risks, reducing vulnerability and by preventing and mitigating related disasters before they occur. Their responsibility for disaster management is best defined by the necessary functions that pave the way for DRR.

- Disaster assessment and monitoring

What is the chance of the occurrence of a hazard event and what elements (people, livelihood, ecosystem and physical assets) are at risk, the likely extent of loss, damage or injury from the hazard event? Disaster management institutions are responsible for conducting a systematic analysis of impacts and losses after each disaster and use the results of impact assessment in risk identification for future events.

- Forecasting, early warning systems and preparedness

The first step in disaster preparedness is to improve on contingency planning which in turn depend on effective early warning systems. Every disaster management institution need examine to what extent their hydro-climatic hazards forecast and early warning systems are developed and used in planning risk reduction.

- Information and communication

Risk characterisation and communication should be an integral part of risk management. Impending hazards need to be effectively communicated at the appropriate level and often within a very short time. This communication pre-supposes that the recipients have advanced information on the necessary action upon sounding of a warning.

- Stakeholder participation and coordination

In order to promote involvement in disaster prevention and preparedness, mobilisation, awareness and educational programmes relating to warning

systems and other aspects of disaster preparedness should be developed and implemented. Committees that include stakeholder representatives should be established. It is recognised that the most vital response to a disaster must be at the local level and communities must be well informed about disaster-preparedness measures and be alert during a disaster.

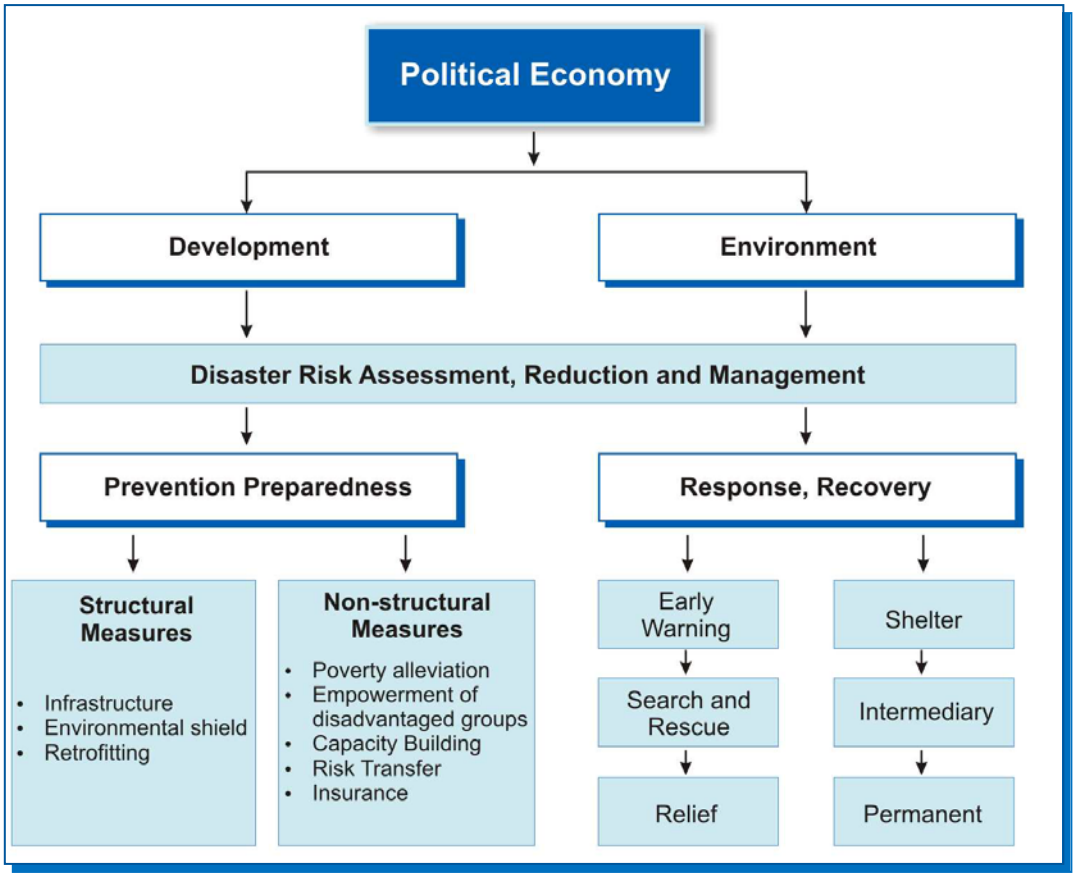

Figure 6.1: Disaster Management Framework

- Disaster mitigation plans

Disaster institutions are required to develop clear plans for protection against disaster and that will include both structural and non-structural measures.

- Relief and emergency management

Emergency assistance is important although not the only element of disaster risk reduction. It is reliant on rehearsed contingency plans that include a well-functioning communication and coordination system as well as logistic support. Emergency and relief management should go a step further to include recovery operations. The recovery time is ideal for applying emergency measures that may reduce vulnerability for example review the development pattern and re-location.

- Financing disaster management

Natural hazards can have potentially serious implications for the social and economic processes. Government have a responsibility to facilitate reasonable and sustainable investment for disaster management. Securing finances dedicated to disaster risk reduction allow the institutions to play a significant role disaster management. However, in the face of tight budgetary constraints and

many competing demands for public resources, there will be pressure for the institutions explore robust secondary avenues for financing disaster management operations.

3.3 Institutional responsibility for disaster risk mitigation at community level

The following elements are critical and should be taken into consideration when developing and undertaking institutional responsibility for disaster risk mitigation at community level.

- Development and application of operational guidelines

Clear operational guidelines should be established with regular rehearsals of disaster management procedures.

- Development and delivery of training materials

Preparing and delivering awareness and training materials on hazard risks and risk reduction for communities and leaders.

- Adequate supporting information

Provide sufficient and accurate information and/or updates efficiently delivered to help timely action.

- Development and application of disaster risk indicators

By developing uncomplicated indicators communities can assist with the quantification of risk. These indicators can be used in monitoring and evaluating programme performance.

- Treatment of low-probability, high-impact risks

Hazards with shorter return periods are easily identified on the basis of the higher probability that they will occur in the short-term. In contrast some climatologically risks, have much longer return periods, and are likely to be discounted in the mind of the potential victims. A proper safety perspective and protection for these kind of events should be communicated.

- Transparent, inclusive and accountable consultation

Consultative processes give voice to community groups, who are often among the most vulnerable to natural hazards, and ensure that their interests are adequately addressed and their rights protected.

3.4 Coordinating water resources and disaster management

A close link exists between disaster mitigation and preventive measures. There is also an intimate link between natural disasters and development. Managing DRR requires the collaboration of a wide cross-section of actors from different sectors (among others, water resources, environment, infrastructure, civil protection, education and health).

It is important to ensure that an integrated approach is adopted. Each sector and actor should be encouraged to cooperate in a multi-sectoral manner when implementing disaster prevention strategies and measures.

Emerging national and local level institutions for water resources management, under the water sector reforms should create an enabling environment for disaster management. The full implications of the relationship between water resources management, disaster management and economic and social development need to be understood completely. Partnerships between disaster management and water resources as sector actors for mitigation of water related disasters should be encouraged institutionalised.

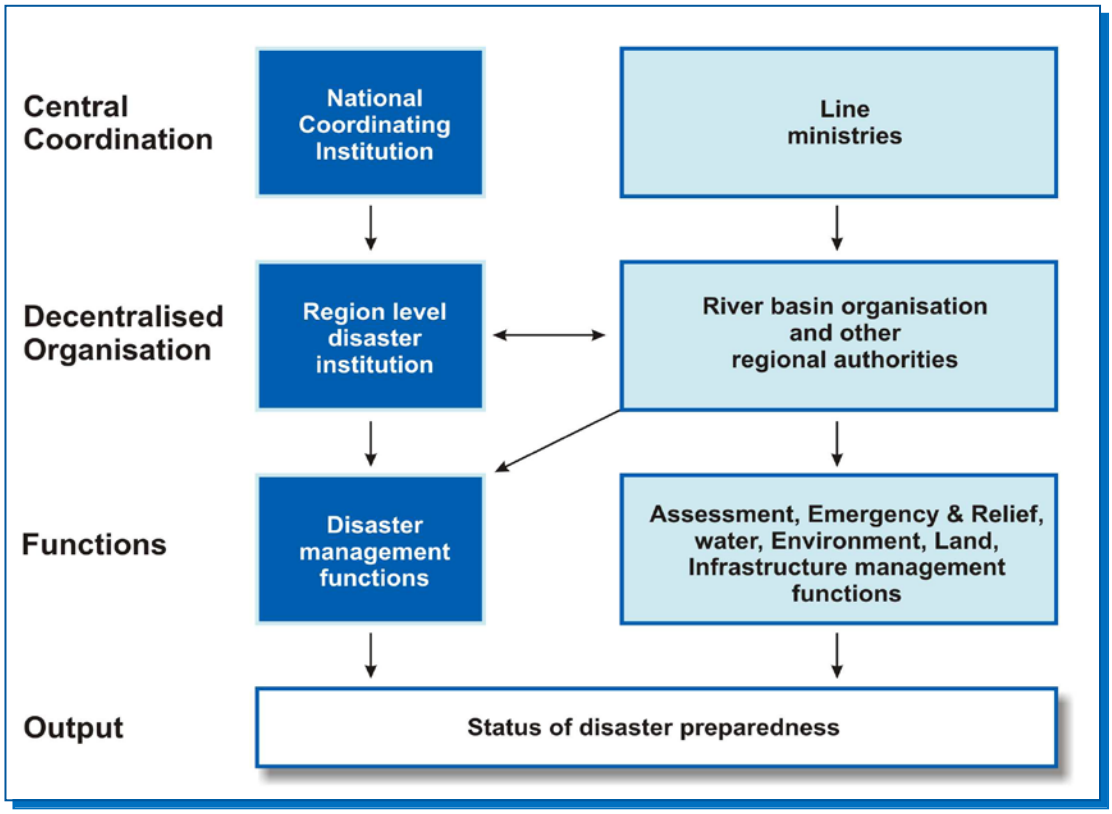

Figure 6.2: Coordination mechanism for disaster management

4. Lessons learnt

- Development cannot be sustained unless a holistic framework on disaster reduction is in place.
- Disaster management responsibilities are spread over several institutions, but best coordinated by lead institution with a clear mandate, adequate autonomy and financing.
- Policy and institutional formation should allow a shift from relief and emergency intervention aspects of DRR to prevention of disasters.

5. References

The Role of Local Institutions in Reducing Vulnerability to Recurrent Natural Disasters and in Sustainable Livelihoods Development in High Risk Areas http://www.fao.org/wairdocs/ad695e/ad695e00.HTM

Exercise

Objective:
Share experience on institutional creation for disaster management and coordination mechanism.

Activity:
Work in three country or river basin groups and discuss for 45 minutes.

Task one: Choose a prominent disaster phenomenon in the basin/ country. How does it manifest and who has the responsibility for its management. Which other governmental organisations need to coordinate with the responsible institution?

Task two: Formulate water management responsibilities necessary to mitigate impacts of disaster type identified

Report back: 30 minutes

Module 7
Economics of Disasters

Goal

The goal of this module is to establish the implications of hydro-climatic disasters on economic development and the necessary disaster risk investment for mitigation.

Learning Objectives

Participants are expected to be able to:

1. Appreciate disaster risk reduction (DRR) as a national and local priority;
2. Elaborate the significance of disasters in economic development; and
3. Discuss possible ways for disaster risk transfer and financing.

1. Introduction

An economic perspective of disasters is potentially useful in identifying and clarifying the issues involved in making particular decisions in reaction to disasters. Reflection on disaster risk concerns as part of the economic process is an essential step in ensuring that development gains in hazard-prone countries are sustainable and in highlighting related issues of responsibility and accountability.

Approximately 90% of all natural hazards are water and weather related. These events can have potentially serious implications on the viability of economic and development processes as well as damage or destroy physical infrastructure and capital equipment. It often results in additional indirect and secondary project and broader socio-economic outcomes.

Indeed, there can be potentially high returns to disaster risk reduction investments in hazard-prone areas, in the form of both specific disaster risk reduction projects and the disaster-proofing of other development projects. Such investments can also have noteworthy additional indirect benefits for the broader economy and sustainable development.

Careful consideration of the following issues would be critical:

- What are the long-run economic and welfare impacts of disasters?
- What incentives — or perhaps disincentives — do governments face to make disaster risk reduction a development priority?
- Are there any win-win situations where water resources development could both reduce disaster risk and also give economic and social benefit?

2. Economic Cost of Disasters

Hydro-climatic disasters can have a considerable impact on the welfare of an entire nation. The impacts of climate change will bring about increased frequency

and magnitude of hydro-climatic disasters. Managing hydro-climatic disasters will be a major cost to many developing and developed economies.

Increasing interest in disasters is justified by the rising frequency with which natural disasters are taking place. Disaster frequency has doubled every ten years since 1960. Over the last 50 years, there has been a 14-fold increase in the global cost of natural disasters. In 2007, the cost of the world's natural disasters was estimated at US$ 62.5 billion, with weather-related natural disasters accounting for two-thirds of all losses (CRED, 2007).

Impacts of disasters can be broken down in terms of direct costs, indirect costs and secondary impacts.

Direct impacts are damages to physical and human capital, including the costs of relief, rehabilitation and reconstruction that occur immediately during or after the phenomenon that caused the disaster. The following are examples:

- Impacts on assets;
- Infrastructure;
- Capital;
- Stocks; and
- Loss of life.

Indirect impacts can be observed after the phenomenon over a period of weeks to months, till recuperation occurs in the form of goods that will not be produced and services that will not be provided. The following are examples:

- Loss of investment;
- Loss of earnings & unemployment;
- Increased expenses both private and public;
- Loss of productivity due to death, illness and injuries;
- Increase in operational cost; and
- Cost of alternative provision good and services.

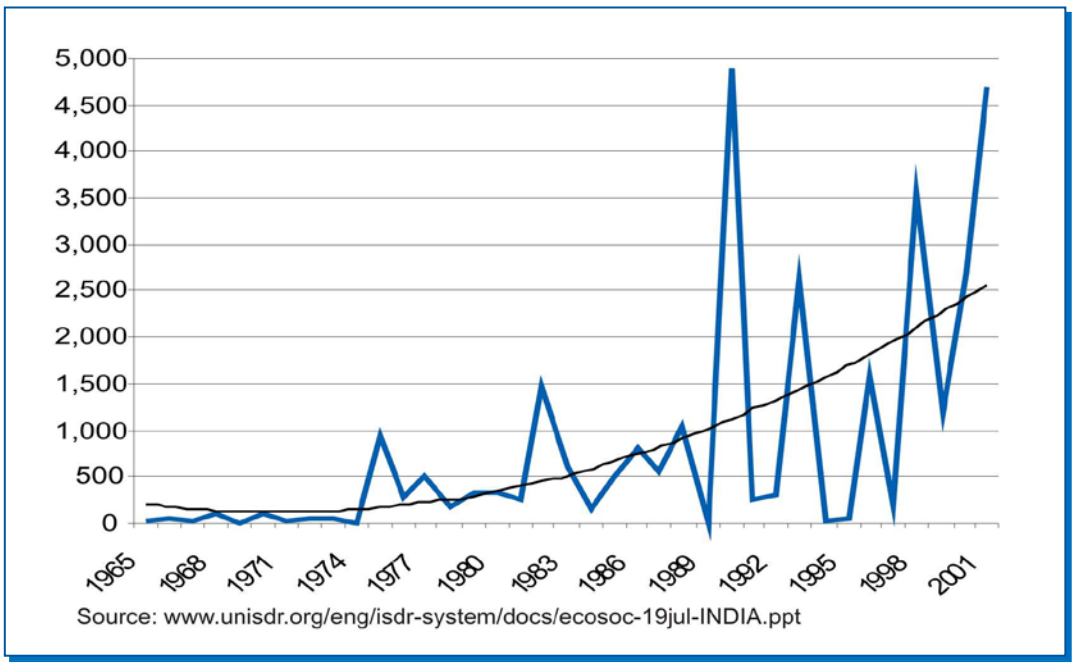

Figure 7.1: Reported disaster losses in India between 1965-2002 (US$)

Secondary impacts include macro-economic and longer-term impacts on the economic performance after a disaster and may persist for a number of years after the event, depending on the characteristics and magnitude.

The main elements to monitor are:

- Gross Domestic Product growth;
- State of public finance e.g. decline in tax revenue;
- Price increases of and inflation; and
- Balance of payments, trade deficits and rise in the level of indebtedness.

3. Why is Disaster a Development Issue?

In hazard-prone areas and countries, development potential may be depressed as a result of increased public expenditure on disaster mitigation.

Disasters can also cause potential declines in revenue due to reduced economic activity as well as any losses incurred by actual disaster events. This serves to exacerbate inequalities in economic development.

Disaster proneness may act as a disincentive to new investors, particularly during reconstruction when perceptions of hazard risks are heightened and the economy is unstable.

Disasters reduce government's ability to invest in developmental projects through lowering the tax base as a result of development opportunities foregone and production failures, and the additional burdens of hazard mitigation and preparedness, relief and reconstruction. Another aspect to consider is that development can itself heighten disaster risk or economic vulnerability.

Serious threats to long-term development result from the reallocation of expenditure that occurs following a disaster. Ad hoc re-assignment of funds become frequent if not routine in disaster-prone countries, and even if funds are well used for disaster reconstruction, a sudden, unplanned reallocation can destabilise or sacrifice longer-term development objectives.

Responding to disasters also undermines budgetary planning, investment confidence and interrupts ongoing projects and reduces the abilities of communities and governments to pursue long term development goals.

Why does development policy and programming overlook disaster risk?

4. Poverty and Disasters

Poverty and vulnerability to natural hazards are closely linked and mutually reinforcing. Disasters are a source of hardship and distress, potentially temporarily forcing certain groups below the poverty threshold and also contributing to more persistent, chronic poverty.

Disasters can result in the loss of lives, homes and assets. Other impacts are disrupted livelihood opportunities, schooling, the provision of social services, the loss of savings and an increase in the number of health problems, sometimes with long-term consequences. It can also interrupt ongoing poverty reduction

activities and force a diversion of related financial resources into relief and rehabilitation efforts.

Poverty can be further reinforced by deliberate risk-averting, influencing livelihood choices that poorer households may make. For example, poorer households may choose to lose the potential benefits of higher yielding or more profitable crops in favour of more hazard-tolerant ones.

Poor and socially disadvantaged groups, in turn, are among the most vulnerable to hazards, reflecting their social, cultural, economic and political environments. People might be settled in sub-standard quality housing located in dangerous areas like flood plains, riverbanks or steep slopes.

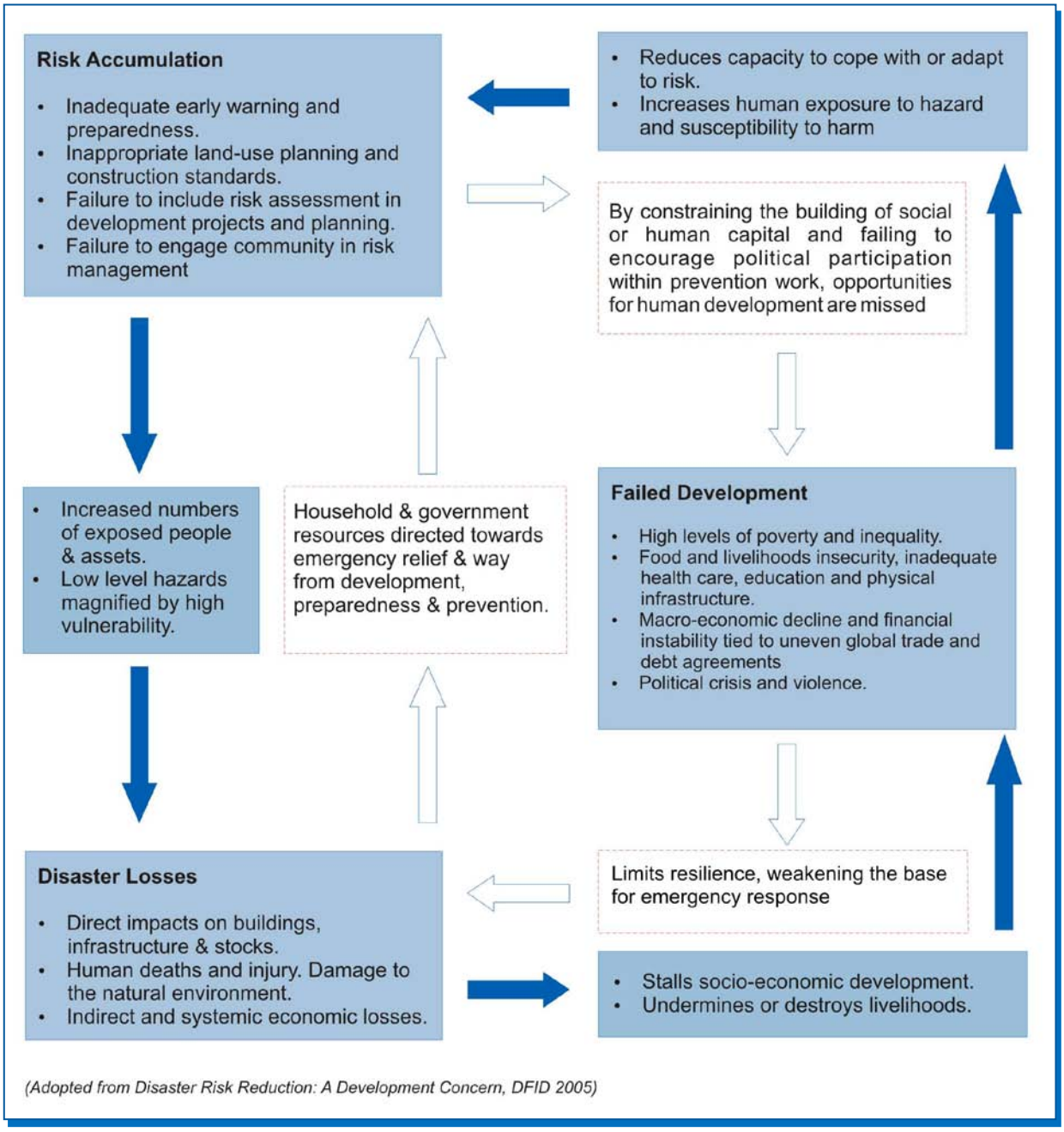

Figure 7.2: Vicious cycle of disaster risk and development failure

Additional factors can be lower levels of access to basic services, particularly for the rural poor and illegal settlements, uncertain ownership rights, reducing incentives to manage resources sustainably or invest in structural mitigation measures. Vulnerable communities have generally less access to financial resources, constraining their ability to diversify livelihood options. They might be unable to recover after a disaster and generally suffer the effects of more fragile livelihoods.

The poor can also aggravate their own risk where limited livelihood opportunities force the over-exploitation of the local environment and yet these communities have a limited scope for formal and informal community-based support systems in the aftermath of a disaster.

5. Disasters are Entrenched in Development Failure

Disasters do not "just happen" and to a large extent stem from development failure that increases the vulnerability to hazard events. It is often the case that the assessment of disaster impacts focuses only on quantifying immediate direct damages often only in financial terms. Aspects such as the non-market economic costs like the value of lives lost are not addressed.

Long-term indirect costs in the flows of goods and services, reduced levels of production and non-market impacts such as environmental damage and psycho-social effects are frequently omitted from such assessments.

6. Macro-economic Impacts of Disasters

The focus on direct damages and loss of life during a disaster is largely due to the fact that there are difficulties in accounting for indirect and non-monetary damages. Another reason can be that economic studies of this nature are a low priority in the post-disaster recovery effort. The interaction between the types of natural hazard risk to which a country is exposed, and the basic structure of its economy (at a particular moment in time) play a significant role in determining the broader macro-economic vulnerability.

These five basic factors determine the broad macro-economic vulnerability to natural hazards:

- The type of natural hazard;
- The overall structure of an economy, including natural resource endowments;
- The geographic size of a country;
- The country's income level and stage of development; and
- Prevailing socio-economic conditions, including the policy environment and the state of the economy.

In the longer-term, impacts of disasters are more difficult to determine empirically but may be significant, in part this is because disasters reduce the pace of capital accumulation, destroying existing productive and social capital and diverting scarce resources away from new investment. As such, disasters represent a threat to both short-term economic stability and long-term sustainable development. Moreover, macroeconomic vulnerability to natural hazards is higher during the earlier stages of economic development.

During earlier stages of economic development, vulnerability can increase at the micro- and macroeconomic levels. Socio-economic change leads to a breakdown of familial support and traditional coping mechanisms, increasing reliance on monetary earnings rather than in-kind production and movements of people to occupy and seek livelihoods in more hazard-prone places.

What is the part of insurance in underwriting natural disaster losses?

Many developing countries are experiencing rapid urbanisation that is typically un-planned with poorly enforced building and land use codes. In many cases communities have little regard to the state of the environment and natural resources.

States with more developed economies might have higher disaster-related physical losses, but the economic impacts of disasters decline again proportionately, in part due to increased investment in mitigation and preparedness measures, improved environmental management.

Aspects such as improved access to financial resources and lower associated opportunity costs as well as a reduction in the scale of absolute poverty and household vulnerability is also at play. A larger share of private sector economic assets is also likely to be adequately insured against disaster and the burden softened by global reinsurance.

7. Impacts of Climate Change and Variability

Climate change is just one of many pressures facing the hydrological system and water resources. The implications of climate change for the regularity and size of disaster events is unavoidable. Since the early stages of concern over the possible consequences of global warming, it has been widely recognised that changes in the cycling of water between land, sea, and air could have significant impacts across many sectors of the economy, society, and the environment.

Table 7.1: Social and Economic Impacts of Climate and Rainfall Variability in Selected African Countries

Country	Event	Year	Impact
Ethiopia	Drought	1983/84	• 300,000 deaths
Zimbabwe	Drought	1991/92	• 45% decline in agricultural production • 11% decline in GDP • 62% decline in stock market • 9% decline in manufacturing • 15% reduction in power generation
Kenya and Tanzania	El Nino Rains	1998	• Infrastructure destroyed • Disease and economy-wide damage
Mozambique and Sudan	Floods	2000	• Deaths • Homes & infrastructure destroyed • Economy-wide shock

In some regions climate change and variability increases the already high degree of temporal and spatial variability and un-predictability of rainfall. An example of this is in Mozambique which, along with Angola and Zambia became significantly drier over a 30-year period only to be hit by a devastating flood in the year 2000. It appears that the drier the country or sub-region, the higher the rainfall

variability in time and quantity. These variations have high social and economic costs. Table 7.1 shows the social and economic impacts of drought and floods in selected countries. Text accessed at http://www.sarpn.org.za/wssd/may 2002/ water/php.

8. Opportunities for Reducing Macro-economic Risk of Disasters

The discussion thus far suggests that natural disasters can and often do have negative impacts on both short-term and long-term growth. It also demonstrates opportunities for changing levels and forms of vulnerability.

Risk reduction investments play a collective, broader role in reducing macro-economic vulnerability to natural hazards and supporting efforts to alleviate poverty. These benefits are typically too far removed from individual DRR to be taken into account in project economic appraisal. However, they may be an important consideration in determining a broader strategic development focus in hazard-prone countries.

If risk management initiatives are to succeed in developing countries, ensuring that it is well designed and managed is essential which requires a coordinated effort amongst national risk management agencies. It is advisable to have insurers and reinsurers, other players and external advisors with established track record in other countries as part of the process.

A well-conceived national risk management strategy will first consider:

- Risk analysis and quantification;
- The establishment of a legal and institutional disaster management framework;
- Implementation of incentives for risk mitigation;
- Capacity building; and
- Development of appropriate risk funding instruments, including reinsurance before the disaster happens.

Risk management involves the private and public sectors. The private sector should be encouraged and supported in enhancing its awareness and understanding of risks posed by natural hazards. They should also consider adopting appropriate structural and non-structural risk management tools.

It is important to ensure that sufficient investment is made in risk-mapping, monitoring, assessment and dissemination and that this information is provided in an easily understood and usable form.

The emphasis is currently on post disaster reconstruction which often seems to be on restoring the status quo, which is politically and administratively the easiest approach and satisfies pressures for rapid recovery. Efforts need to be well planned and carefully coordinated and should seek to maximize the economic-structural, technological, and other improvements that can be made when rebuilding an economy.

Pre-planning of changes that could be implemented after a disaster to reduce future vulnerability could be useful. This might be easier since the political will for change would already have been assembled and pre-investment analysis

completed, so that the changes could be made without jeopardizing the objective of rapid recovery.

Lessons drawn from particular disasters need to be assessed, and action should be taken as appropriate. Disasters can induce policy changes and institutional innovations that are ultimately beneficial, not only in reducing vulnerability but also in supporting economic growth and development.

9. Financing Disaster Management

There is a consensus that in many long term cases, scarce resources would be better spent in improved preparedness and mitigation. Whilst some elements of a disaster management strategy do not require substantial financial resources others may require significant investment. Even if the funds required are modest, budgets are invariably limited with many competing demands.

Unfortunately, many disaster costs are highly variable and difficult to identify. The cost and benefit analysis process to make this judgement more transparent is in its infancy. Countries that are vulnerable to the rapid onset natural disasters and reliant on post -disaster funding sources, particularly donor assistance, may not be able to have a sustainable response and in many respects might not have the optimal systems from a risk management and capacity building viewpoint. In certain cases these disasters will adversely affect their long-term growth prospects.

Futuristic financing mechanisms provide liquidity immediately following natural disasters and this alone may be sufficient reason to consider the mechanism even if a resource gap does not appear to exist.

Catastrophe insurance pools and other risk aggregating instruments (including government budget processes) can provide a convenient institutional setting for developing a risk management approach where insurance markets are incomplete.

A well structured catastrophe insurance pool, for example, will achieve affordable premium levels combined with sound insurance policy design.

Other issues to consider would be:

- Good governance and professional management;
- Effective risk management; and
- Incentives for the private insurance industry to distribute the insurance product efficiently and effectively.

The prevailing situation of limited domestic insurance coverage for disastrous risks provided by local markets, and lack of economic incentives to engage in pre-risk management, governments generally respond to natural disasters after the fact. They often have to rely on donor grants and domestic budgets, including diversion of resources from other planned development projects.

The state typically retains all risks associated with their investments, including those relating to natural hazards. Whereas governments in developed nations have the resources to absorb risks by adjusting internal funds, their counterparts in many developing countries frequently do not.

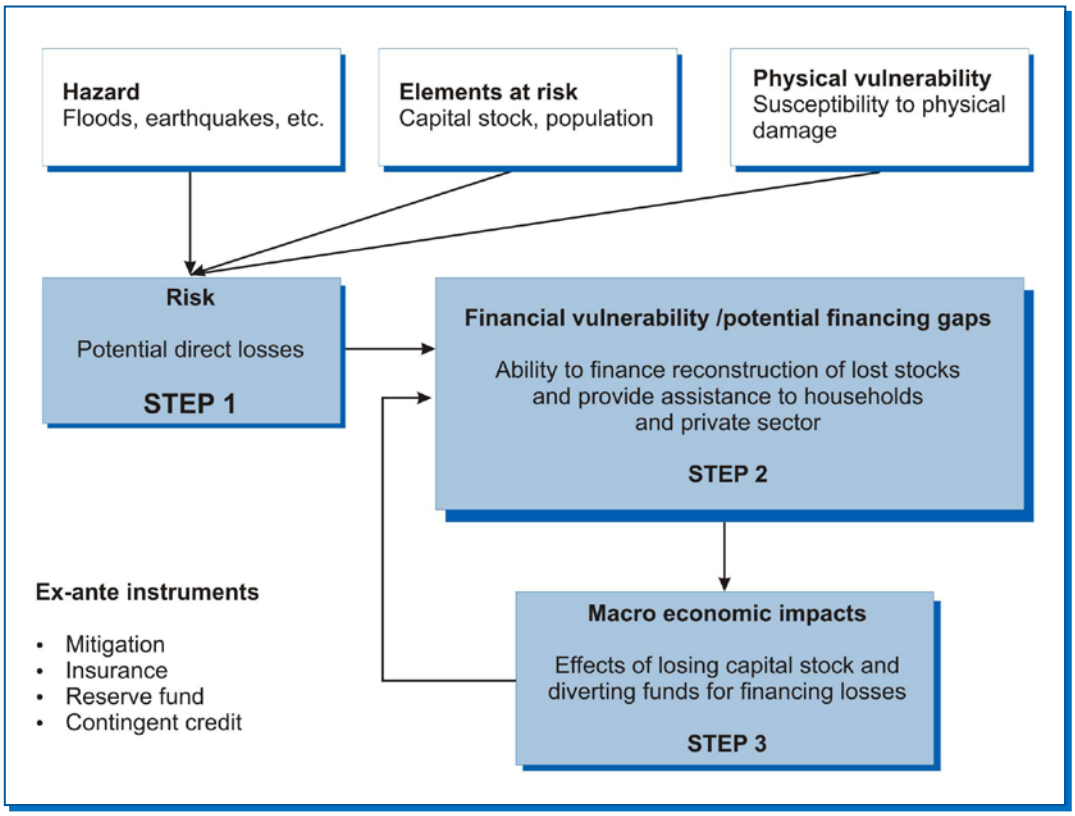

Figure 7.3: Risk reduction investment

Policies on the future funding of post-disaster relief and reconstruction would benefit from better information on the impact and cost of disasters. Explicit policy on financing post-disaster response is often lacking in many countries, beyond making some relatively minor annual budgetary allocations for use in the event of a disaster. Instead, they implicitly rely on post-disaster reallocations to meet a large share of relief and rehabilitation costs, without exploring the long-term developmental implications of the various funding options (reallocation, borrowing, insurance, and so on). Such approaches to the financing of disaster relief and rehabilitation constitute poor planning.

Table 7.2: Post- and Pre- Disaster Financial Instruments

Type	Source
Pre-disaster risk-transfer	
	• Reserve fund • Insurance and Bonds • Contingent credit
Post-disaster financing	
Decreasing government expenditures	• Diversion from budget
Raising government revenues	• Taxation
Deficit financing *Domestic*	• Central Bank credit • Foreign reserves • Domestic bonds and credit
Deficit financing *External*	• Multilateral borrowing • International borrowing • Assistance

In countries that experience localised hydro-climatic disasters, such as drought and flooding, almost every year, there is a strong case for the annual pre-assignment of funds to meet a substantial share of relief and rehabilitation costs.

Annual budget allocations help to strengthen financial planning and fiscal discipline, but without responsible and effective institutions, the allocations alone, may not be the most cost-effective strategy. When disasters do not occur, the contingency provisions may well be dissipated in wasteful, last minute, unplanned supplementary expenditure in other areas.

Longer-term disaster contingency reserves that are rolled over from year to year raise different problems. These reserves can be held in the country, ideally in highly liquid accounts allowing immediate access to funds.

Besides the fact that such accounts, offer lower rate of return, compared to investment in development projects, there is political difficulties in keeping up adequate commitments and protecting accumulated funds if there is a long run of disaster-free years.

Box 7.1: Benefits of Disaster Investment

During the floods 1998 floods in Bangladesh the value of cattle saved through the construction of a 4-acre flood defence shelter exceeded the cost of the flood shelter by seventeen times.

In 1979, when Hurricane David hit the Dominica republic the reconstruction costs of the new deep water port was estimated at 41% of the original investment as compared to 12% additional cost that that would, have been used to build resistance of the port to the hurricane impacts.

Source: Natural Disaster and Disaster Risk Reduction Measures DFID, 2005.

For improved financial management of disasters, all possible instruments and the funding and determination of appropriate forms of mitigation and preparedness and adequate levels of funding for them need to be explored.

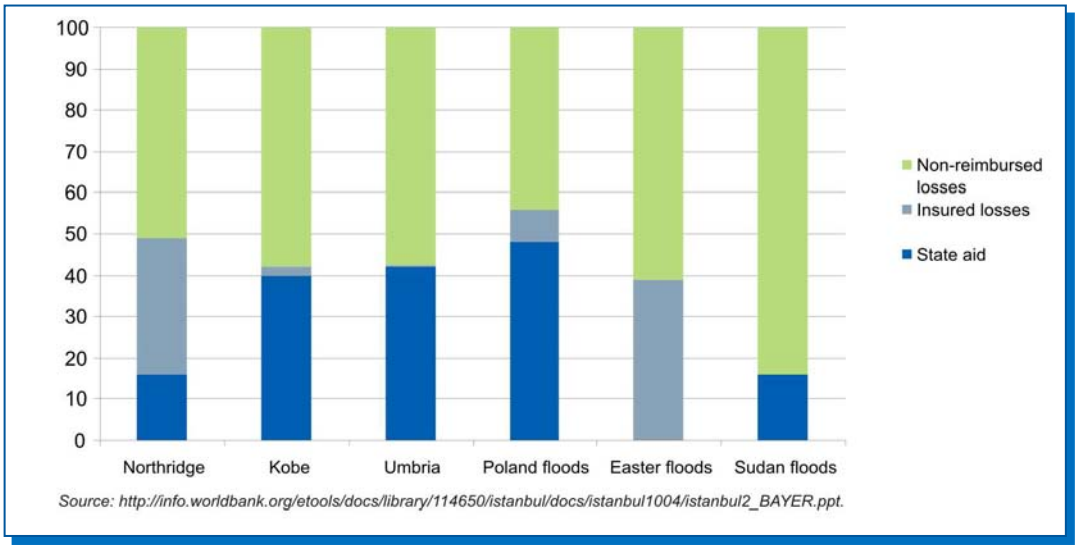

Figure 7.4: Share of direct disaster losses reimbursed by insurance and government assistance

10. Risk Transfer Tools

Risk transfer mechanisms shift financial risk from one party to another. The two basic tools for catastrophic risk are: insurance; and instruments for spreading risk directly to the capital market.

An insurance policy provides cash payouts in the aftermath of a disaster in return for the payment of monthly premiums beforehand. Insurance companies, in turn, redistribute their risk to global reinsurers.

The potential advantages of risk transfer mechanisms include:

- A reduction in post disaster pressure on fiscal and external balances;
- Increased government control over the financing of disasters, possibly including the immediate and timely availability of funds;
- Greater capacity for a government to set its own priorities in the management of relief and rehabilitation;
- Increased transparency in the delivery of relief and reconstruction funding; and
- Promotion of mitigation by making provision of mechanisms conditional on particular structural measures being in place or by offering discounts where they are.

An increase in public insurance, in whatever form, may also stimulate more extensive and fuller private coverage. Despite growing exposure and vulnerability to hazards, developing countries retain most of the attendant risk due to the undeveloped state of their domestic insurance markets and an inability to transfer risk to international reinsurance markets.

Should government create a reserve fund, insure, or purchase other pre-disaster risk-transfer instruments?

In these countries, less than 1% of total direct losses from natural disasters are insured, compared with 40-100% in industrial countries. Even the small amount of insurance coverage that is available in practice tends to be limited to major commercial properties in urban areas, with the level of insurance penetration for homeowners and small businesses in most of these countries being negligible.

Disaster protection is low, since low-income consumers have less discretionary income, fewer assets to insure, and are expensive for commercial insurers to reach and service. In addition, domestic insurance companies in developing markets tend to be undercapitalized and most do not have the capacity to retain exposure to the risk of natural disasters. As a result, whatever limited catastrophe risk coverage they offer has to be largely reinsured through international markets that further raise the cost of insurance.

The main obstacles to coverage of disaster risk in developing countries are affordability, demand, determination of insurance parameters for verification of loss, and the structure of the insurance industry.

11. Water Resources Development Investment in Disasters Mitigation

Various forms of investments in disaster mitigation prevent the occurrence of a disaster or reduce the severity of vulnerability and direct losses from disasters over time. Reduction in disaster vulnerability on the other hand may result in public relegation of disaster issues and associated costs for disaster mitigation.

Someone will however continue to bear the cost of disaster mitigation e.g. disaster monitoring, strengthening of flood defence systems and the maintenance of contingent means of water supply during drought to name a few. Consequently, there is a need to explore sustainable funding for disaster mitigation based on potential flows of net benefits from DRR measures.

In a case of water resources management, disaster mitigation may be considered as part of improved water management. The benefits can accrue to water resources aspects and reduce disaster risk and vulnerability. Such measures include improved basin management, river flow regulation and regular maintenance of water storage facilities and sources. Disaster management cost can be recovered and sustained within the water use charges.

The problem with this approach is that that DRR initiatives for water related disasters are rarely seen as an investment, but it is treated as a normal cost due to the absence of expert cost-benefit analyses to make the point. A Common perception still treats disaster management as traditionally being outside the normal business of water resources development. It is considered to be a special activity brought about by exceptional circumstances. Ironically, in the most disaster-prone countries such exceptional activities are almost an annual activity.

12. Lessons Learnt

- The cost of disasters is a growing burden to the poor.
- Disasters have adverse effects on development and on progress and it are often overlooked in development programming.
- Development of disaster insurance and/or reserve funds will provide liquidity immediately following natural disasters.
- Water resources development investments may reduce disaster risk and offer socio-economic benefits as well.

13. References

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Exercise

Objective:
To understand ways in which water managers can respond to disaster mitigation as normal part of water resource development investment.

Activity:
Break into three groups and discuss for 30 minutes.

For each of the water basin or country represented. Discuss the existing water resource development; what are the primary function(s) of the developments, what is the common form of water related disasters in the area? What would are necessary considerations to accommodate disaster mitigation concerns in water development in these areas?

Report back: **30 minutes**

Facilitator:
Is there a basis for multi-functional water resource development approach that combines disaster mitigation action with compatible water use?

7

Module 8
Emergency and Humanitarian Response

Goal

The goal of this module is to explain the role, impact and management of emergencies and humanitarian responses to disasters. It outlines the preparation, measures undertaken and management issues during disaster emergencies.

Learning Objectives

Participants are expected to understand:

1. The objective of emergency and humanitarian response;
2. Emergency response pre-requisites; and
3. The logistics required for an effective humanitarian response plan.

1. Introduction

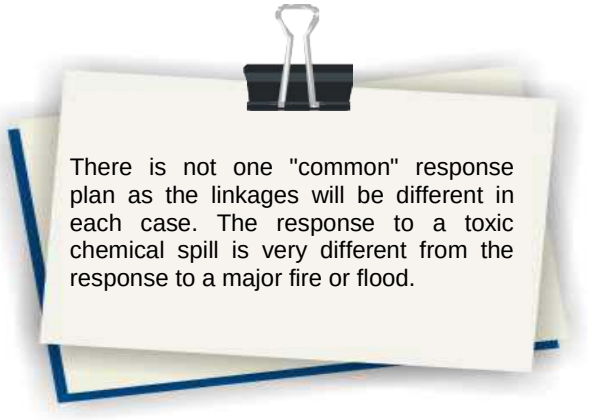
The most critical element in the suite of activities associated with disaster reduction is emergency preparedness and response activity. The response to a natural disaster warning must be immediate, comprehensive, and demonstrate very clear lines of command. Mechanisms must be in place to quickly draw upon external resources available at higher levels of government, or even internationally, when the local level of response will not be sufficient.

Many countries have systems in place where a provincial/state wide or national disaster can be declared to bring in the resources needed.

2. Collaboration and Coordination

Disasters are normally local but the response to them is point of a commonality. Emergency planning and preparedness is first a local responsibility, but one that requires collaboration and coordination with others in a growing circle of like-minded and expert groups that can be drawn upon as events unfold.

There must be strong and reliable communication linkages to storm warning and forecast centres so that the emergency response actions taken are appropriate to the magnitude of the probable event.



The network of linkages from the local level upward must be established in advance and, more importantly, key players must periodically meet to exchange information and become comfortable working together. Information sharing should be bi-directional, both upward and downward, between the levels of government.

Practice drills are important. Emergency response must include input from the community and political levels but cannot become a collective responsibility. There must be clear lines of authority, even if the lead agency changes dependent on the magnitude of the event.

The community and individuals must have a good understanding of what is expected of them. A good example would be how to react in an evacuation situation.

Information that defines evacuation routes, identifies emergency shelters, and specifies actions to be taken before leaving, such as removing mobile equipment and removing personal goods and furniture, must be available in advance.

Who and when triggers emergency planning?

3. Contingency Planning

Contingency Planning is a forward planning process in a state of uncertainty. Scenarios and objectives are agreed, managerial & technical aspects defined, and potential response systems put in place in order to prevent, or better respond to an emergency.

It is a process that involves:

i) Analysing potential emergencies and their humanitarian impact;
ii) Prioritising potential emergencies;
iii) Developing appropriate plans, including establishing clear goals, setting objectives, policies and procedures to deal with prioritised potential emergencies; and
iv) Ensuring necessary preparedness measures and follow-up actions are taken.

- Why Plan?

  It is essential to do contingency planning because it;
  - Enhances effectiveness and timeliness of response to emergencies;
  - Helps to ensure that the response is coordinated;
  - Avoids problems by attempting to anticipate and overcome difficulties;
  - Creates relationships and forums with other agencies and actors; and
  - Planning ensures effective emergency management.

- When to plan?
  - Planning is critical in the face of an imminent emergency.
  - When there is a situation of recurrent disasters / hazards e.g. floods, fires and drought.
  - Contingency planning should be incorporated into all relevant regular planning process. These plans should be regularly updated since rapidly changing situations require would require this.

What are things that hinder effective emergency response?

- What to plan for?

  Planning should be in place for all types of humanitarian emergencies such as:
  - Complex emergencies involving cross border political and humanitarian needs;
  - Natural and environmental disasters; and
  - Significant crises of long term ramifications on the affected.

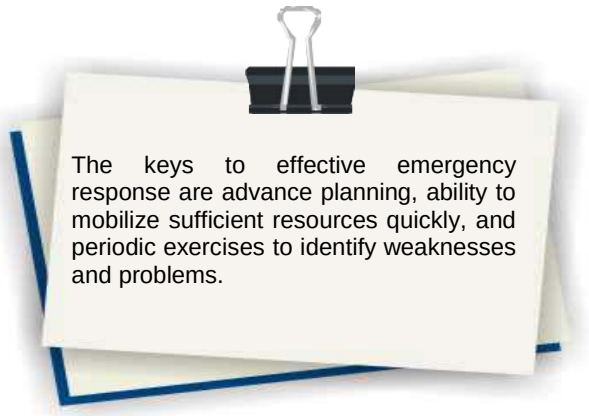
  Planning should be specific taking into account the situation at hand, district/government capacity, donor support, likelihood of occurrence and the population's vulnerability.

- Who to plan with?
  - Contingency planning is a participatory process and includes all actors. The level of involvement of other actors depends primarily on the contextual situation & assessment of the situation.
  - Contingency plans should be made in consideration to other local existing plans by other international organisations / relief agencies, line ministries, community, etc.
  - Transparency and inclusiveness leads to a more effective response and it is critical to note that some, such as droughts or biological and nuclear accidents are sensitive and require preclusion during planning.

- Who leads the planning process?
  - Any organisation / agency / department or line ministry with a comparative advantage of handling the situation at hand should take the lead in planning.
  - In most situations the government takes the lead in contingency planning.
  - Other organisations like the International Red Cross (IRC) and the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) come in to support where necessary.
  - Some situations involving interstate or regional coverage necessitate other of international organisations / agencies to take lead in planning.
  - It should be noted that each organisation has its own plans and the lead agency should coordinate the approach harmonisation.

- Where to Plan?

  Disaster Planning requires a focus on different geographical areas or levels:
  - Community;
  - Divisional;
  - District;
  - Provincial;
  - National; and
  - Regional (between counties).



4. Preparedness and Response Plans

Detailed response plans need to be prepared in advance and reviewed with all the key agencies and players. The written plan must be available to those that will be responding and it must be continually reviewed and updated.

Some of the key pieces of information are:

- Which agency and individuals have the specific responsibility;
- Whom to contact for expert advice; and
- Where to go for information on backup communication systems.

This information is constantly changing and needs to be verified periodically and tested in exercises. Multiple contact points need to be established as the emergency may occur on a weekend, holiday, or after regular business hours.

Mechanisms for coordination must be included in the plan, including the structure of response committees, where they will meet and sources of resource information available to them. Often this takes the form of something equivalent to a "operations room" where maps, plans, other material and support staff are available immediately.

5. Inventory of Resources

A key component of any emergency preparedness plan is an inventory of resources that can be accessed. In the case of flooding this could include items such as emergency vehicles, buses and trucks, earthmoving equipment, pumps, plastic, plywood, emergency generators, supplies of gravel and sand, sandbags, and mobile communications equipment.

The inventory should also include access to expertise such as surveyors, levee or slope stability experts, forecasting specialists, the media and community leaders.

Emergency shelters should be designated in advance, their individual capacity defined and plans made for obtaining sufficient supplies of water, food, medicine and medical/social assistance. If local resources are not sufficient, then the availability circle must be expanded to include adjacent communities, the provincial/state and national government levels.

6. Triggering Emergency Action

Advance warning is the key to effective disaster response. It is possible to set up a series of warnings in advance of an actual extreme storm event that can be used as alerts. This could start with long-term climatologic forecasts or more immediate hurricane forecasts that identify potential danger.

In a basin specific context an alert could be issued based on antecedent precipitation and rainfall intensity data in advance of an actual flood forecast. A more detailed forecast would then be issued when all of the data and information required to make a flood forecast became available. The emergency response to such alerts is very site-specific and should be included in the plan.

The response to an extreme flood forecast should be immediate, and with no uncertainty as to what actions and activities should be taken. The public expects authorities to act quickly and in a professional manner under such circumstances. Community leaders should be visible, informed and active right from the start.

7. International Collaboration

There are a number of United Nations specialised agencies and programmes that can be of assistance to a country establishing a programme aimed at reducing the losses that result from flooding. Some of these are described herein and could be contacted by interested parties.

The *UN Department of Economic and Social Affairs (UNDESA)* has been actively involved in providing advice to governments on water resource management during extreme hydrological events in a wide range of environmental and climatic settings from the drought-prone upland plateaus of central Africa through large river basins and aquifer systems in Asia to vulnerable groundwater lenses on Pacific atolls.

The *United Nations Development Programme (UNDP)* has a programme for strengthening national capacities related to flood mitigation, prevention and preparedness in developing countries.

This agency works in flood reduction and recovery through practical application at the regional and country levels. UNDP has devoted special attention to reducing social and economic vulnerability and loss of lives, and to protecting livelihoods and broad based development gains.

What role can international organisation play in emergency response?

The World Meteorological Organization (WMO), a specialized agency of the UN, was established in 1950 to facilitate worldwide cooperation in meteorology, hydrology and climatology for the benefit of humanity. WMO promotes the following types of activities:

- The establishment of the networks of stations for acquiring meteorological, hydrological and related geophysical observations and the standardization of observational methodologies;
- Establishment and maintenance of systems for processing and exchanging data and information; activities in operational hydrology, such as flood forecast and warning systems; and
- Multi-agency and interdisciplinary programmes on water resources, climate change, natural disasters, and other environmental issues; and research and training.

The International Strategy for Disaster Reduction (ISDR) was launched by the General Assembly of the United Nations in January 2000, to provide a global framework for action with the objective of reducing human, social, economic and environmental losses due to natural hazards and related technological and environmental phenomena. The ISDR aims at building disaster-resilient communities by promoting awareness of the importance of disaster reduction as an integral component of sustainable development. The General Assembly

established two mechanisms for the implementation of the ISDR: the Inter-Agency Secretariat and the Inter-Agency Task Force on Disaster Reduction (IATF/DR). Text accessed at www.unisdr.org/drought-risk-reduction.

The ISDR Secretariat serves as a focal point within the United Nations system for coordination of strategies and programmes for disaster reduction and to ensure synergy between disaster reduction activities and those in the socio-economic and humanitarian fields. They also serve as an international clearinghouse for the management and the dissemination of information, in particular on current knowledge and status of disaster reduction through the publication of its Global Review of Disaster Reduction Initiatives (as in module 2).

It develops activities such as advocacy campaigns to promote wider understanding of natural hazards, as well as risk assessment and management to motivate a world-wide commitment to disaster reduction, through a framework.

Box 8.1

The only meaningful way to test response plans is to carry out periodic emergency exercises. These exercises are meant to simulate real emergency situations and test all aspects of the plan.

The ISDR Secretariat has a facilitating role, bringing agencies, organisations and different disciplines together, and providing a common platform and understanding of the scope of disaster risk reduction. In this regard, one main function of the Secretariat is to support the Inter-Agency Task Force for the development of policies on natural disaster. In particular, the ISDR Secretariat supports activities, such as the development of guidelines, related to reducing the risk from water-related hazards.

This requires, on the one hand, support for the development of capacities to monitor the magnitude, duration, timing and location of hazards, such as floods and droughts, as well as landslides, storms, earthquakes, and volcanic eruptions. All of these latter hazards also have impacts on freshwater resources and infrastructure.

On the other hand, it also requires promoting the assessment and reduction of the vulnerability to such extremes. This calls for decision-making on issues such as development and planning control, legislation and land-use, environmental management and financial tools (e.g., insurance).

ISDR's focus is on DRR, they draw relevance from previous practices in the disaster management fields, where traditionally the focus has been on preparedness for response.

Political authorities, professionals from many different fields, commercial interests, public organizations, educational institutions and local community leaders are increasingly recognising the essential public value of sustained efforts to reduce the social, economic and environmental costs of disasters.

Box 8.2

If, for example, emergency actions such as temporary levees are necessary, then, the work could begin based on an alert rather than the specific forecast. The same may hold for emergency evacuation.

There is now increased emphasis placed on risk, and a growing acceptance that disaster, development and environmental problems are inextricably linked.

8. Training and Response Exercises

Emergency response teams need to be well trained in advance and their skills constantly upgraded. Once the disaster strikes, it is too late to train or try to find missing expertise.

Trained staff should know their responsibilities and have immediate access to response plans and other critical information. They should have built a working relationship with colleagues in other organisations and have mechanisms in place to test experiences. Costs are significant, but the returns will be evident during an actual emergency. This process provides the opportunity to learn about critical gaps and it gives the chance to develop appropriate backup strategies as part of the exercise.

9. Advance Preparation

Assuming that there is advance warning of a major storm event, a number of steps can be taken to increase readiness.

Such steps include:

- Construction of temporary flood protection works;
- Placing emergency response teams on high alert; distribution of critical materials such as stockpiled sandbags to targeted locations; and
- Preparation of emergency shelters and hospitals prepared for occupation.

The population at risk can be informed of what is expected of them in the actuality of an extreme event. As the event becomes more certain, actions such as evacuation of people, goods and machinery can begin. Even if the incident is not as extreme as predicted, these preparations help test emergency response plans and inform the public as to the nature of natural hazards.

Media and public information sessions help set the stage as well. The media are key players in the link between public officials and the communities. It helps if they are familiar with the terminology used in warnings and forecasts and know whom to contact for more detailed information during an actual flood event.

10. After an Emergency

The emergency response does not end with the event, but continues through cleanup and resettlement stages. People will want to know what assistance will be made available, who is responsible, and how to go about seeking that assistance. Senior levels of government should develop clearly defined response policies and programmes in advance. In the absence of such policies, the response is often ad hoc, politically and emotionally motivated, and sets precedents that are not wise in the longer run.

When does emergency response stop?

Often the response is incomplete in that the obvious and immediate requirements are addressed, but fundamental changes in thinking and sustainable strategies are ignored. After a major flood it is beneficial to conduct an assessment of the causes and effects of the flood and to make

recommendations that would improve preparedness for the next event and reduce future flood losses. Such an assessment can also lead to improvements in flood plain management policies.

The long-term economic and social implications of flooding become evident in the post-disaster period. Governments need to demonstrate leadership and sometimes take bold steps to restore employment, address social issues and move the economy in a new direction. In that sense, natural disasters can be a positive motivator for change.

11. Lessons Learnt

- Emergency and humanitarian response planning must be done at all levels.
- Risk assessment and reduction is critical in emergency and humanitarian response.
- Contingencies must cover all phases of disaster process.
- Coordinated intervention and response reduces the community loss

12. References

United Nations secretariat of the International Strategy for Disaster Reduction (UN/ISDR), 2007: *Drought Risk Reduction Framework and Practices*, Geneva, Switzerland. http://www.unisdr.org/eng/about_isdr/isdr-publications/10-drought-risk-reduction/drought-risk-reduction.pdf.

www.prepare.org/USAID Disaster Assistance: Prepare.org | Preparedness Information.

www.usaid.gov/our_work/humanitarian_assistance/disaster_assistance

Humanitarian Charter and minimum standards in disaster response. http://www.sphereproject.org.

13. Suggested Web Readings

United Nations secretariat of the International Strategy for Disaster Reduction (UN/ISDR), 2007: Drought Risk Reduction Framework and Practices, Geneva, Switzerland. http://www.unisdr.org/eng/about_isdr/isdr-publications/10-drought-risk-reduction/drought-risk-reduction.pdf.

Exercise

Objective:
Participants should be able to elaborate the complimentary roles in Preparedness and response for disaster.

Scenario
A severe drought event is predicted in the country in the coming 3 months.

Activity: -- Role play:
Arrange the participants in 5 groups representing

- Community
- Civil society
- Disaster management
- Water management
- Public health

Each group will spend 30 minutes to discuss their own responsibilities and that of other parties for the following components: Monitoring, Forecasting, Alerting, Activation, Response, and Coordination. The groups will spend the next 30 minutes to negotiate support and take up responsibilities.

Report back: 30 minutes

In the plenary the groups present the original plan of responsibility and the revised one after negotiation.

Facilitator:
Focus on good practices for disaster risk management.

- Community based interventions.
- Preparedness and establishment of emergency inventory.
- Flood early warning systems.
- Relocation of vulnerable communities both pre and post-impact.
- Prevent re-occupation of affected areas.

8

FACILIATORS GUIDE

Part A: Facilitation Support

1. Introduction

This general guideline serves to build on and strengthen the existing capacity building skills of those offering the course.

1.1 Facilitator Defined

A facilitator is literally defined as “one who helps others to learn or who helps make things easy.” A facilitator helps participants to collaborate as they explore a topic or issue. The goal is to encourage participants to think productively and ultimately to articulate key ideas, to ask vital questions, to uncover variables, to find solutions, and/or to identify productive actions.

The word Trainer is often used interchangeably with facilitator, but the trainer usually connotes a facilitator who has content expertise. Both facilitators and trainers must understand how adults learn and how to draw out the best thinking of a group.

1.2 Facilitators Code

In building a learning event or a meeting, make sure that it meets “facilitators’ code.” In other words, "How well does your intended approach match with adult learning theory?"

Assess your approach against the following questions.

- Are you allowing your participants to be active learners? (This means that you provide the raw material for them to build learning constructs, to solve problems, and to discover and explore new learning)
- Do you articulate a clear purpose for learning—both the overall goals as well as individual activity objectives?
- Do your lessons and activities connect with the group’s experience and shared responsibilities? Can you articulate this?
- Have you included opportunity for participants to express their concerns?
- Have you allowed for different learning styles?
- Do you draw upon the expertise of the group?
- Have you clarified how the learning will help the participants in their jobs?
- Does your material challenge their thinking and encourage new ways of seeing things?
- Have you built in time for reflection and self-assessment?
- Have you allowed adequate time for participants to share their learning with each other?
- Are you sure that you and the participants share a common language that defines and delineates the topic at hand?
- Do you use strategies to include all participants in the learning?

1.3 People Concerns

Facilitators will sometimes be required to calm or redirect individuals who are derailing the learning or disrupting participation. When you handle these challenging people be certain that you don't allow your own frustration to become personally negative.

It is advisable to always address the surplus interruption and not the person. If it feels like a retaliatory strike, you run the risk of losing the whole group. The following strategies can assist in the process.

- Remind the group how important it is to stay on the agenda.
- Tell the person that you would like to continue his/her line of reasoning during the break and not at that particular time.
- Ask if you can move his/her questions to lunch as a discussion topic.
- Speak with the person during a break and ask him/her to give others an opportunity to participate.
- Compliment him/her on his insights and move on.
- Express an awareness of his/her issue and get back on track.
- Say "I hear your concerns and I will make adjustments at our next session."
- Say "Perhaps I wasn't clear when I made that point, let me try saying it a different way."
- Ask the group if there is anyone who can summarise the issues then end the discussion -- Say "Thanks for sharing" and move on.
- Encourage balanced participation and get someone to take the discussion in another direction.

1.4 Characteristics of an Adult Learner

Job training experiences are more likely to be successful if they are built upon the needs of adult learners. These vital adult learning principles is a guideline.

- Adults need to be actively involved in the learning and are generally more internally rather than externally motivated.
- Adult learners are self-directed. Portions of the learning should thus ideally be self-directed.
- Adult learning is generally more "problem" rather than "subject" focused.
- Learning must be practicably connected life experiences and ideally be relevant to everyday work needs.
- It must be structured so that participants can see where they are going and why.
- Learning outcomes should be clearly directed and well organised.
- Adult participants must have time to voice opinions and personal experiences. Leave space for adult learners to tell their story and accommodate time for discussion.
- It is important to let adult learners feel that they are helping to shape their learning direction.
- Build some room in the training to reflect and speculate.
- Adults learn best when challenged.

- Time is needed to practice new skills and facilitate opportunity for experiential learning. .
- Adult groups like to find common ground and shared meaning.
- Learning should be ongoing where concepts can be reinforced and expanded.

2. Preparing and Starting the Course

2.1 Introduction

a) Workshop Purpose

The purpose of the training and planning workshop is to build the capacity of an interagency, multi-sectoral team to prevent and respond to water related disasters. Special focus is given to the role of water managers in mitigation of hydro-climatic disasters, while appreciating that water management will contribute to efforts led by other agencies. The courses/workshops build on individual knowledge, understanding, and skills while building a sense of teamwork and collaboration.

The objectives and the expected audience for the course/workshop should be clearly stated in the course advertisement/call for participants.

b) Training Objectives

The training package considers these subjects as part of the IWRM approach to sustainable management of water resources and as related to the mitigation of water related disaster and contribution to climate change adaptation.

By the end of the workshop, participants will be able to:

- Appreciate the occurrence of hydro-climatic disasters;
- Identify frequent hydro-climatic disaster hazards in their areas and potential impacts on development;
- Identify the setting, causes and perpetuating factors for hydro climatic disaster;
- Identify strengths and gaps for a multi disciplinary, multi-sectoral prevention and response; and
- Appreciate win-win intervention for water resources and disaster management.

c) Target Participants

The training material mainly targets water managers and practitioners across various sectors in the basin that have a responsibility to manage water resources. However, the subjects may find useful application for professional in disaster management across different sectors.

3. Planning a Course/Workshop

a) Trainer Qualifications

It is recommended that two trainers work as co-facilitators. It is strongly suggested that both trainers be knowledgeable about water resources management and management of extreme water events. If necessary, specific

knowledge gaps may be filled by inviting qualified expertise to handle the specific session.

b) Pre-workshop Activities

Experience has shown that advance involvement of participants builds individuals' commitment to the workshop and enhances outcomes. Approximately 4-6 weeks in before the workshop, send a questionnaire to each participant.

They should complete the questionnaire and return it before the start of the course/workshop. The questions should (at least) find out more information about the participants' prior experiences and training on the topic.

Another useful pre-workshop activity is to send everyone a case study and require them to answer a series of questions. Select a "typical" water related disaster that highlights problems in interagency coordination, preparedness and response procedures, community attitude and capacity in face of disaster. You may task some participants to prepare case studies related to management of hydro-climatic disaster for sharing during the training.

Send participant and resource person invitation letters at least 6 weeks before the start of the course/workshop to allow time for necessary authorisation from employer and (where required) visa applications.

Pass on information about the weather, transport arrangements, safety, health warnings, currency requirements and any other logistical information about the district or country to facilitate settling in at least two weeks before the start of a national, regional or international course/workshop.

Local participants who will be daily commuters to the course should be given clear daily start and expected end times in order to avoid losing participants to the end of the training day.

c) Venue and Training Room Layout

Take particular care in selecting a venue for the workshop. The venue should allow the participants a break from excess distractions and pressure from normal work demands.

A residential program at a hotel or conference centre is more effective for teambuilding and observance of time schedules but may not be possible due to funding considerations. Participants should sit in a semi-circle or open rectangle, preferable at tables, facing one another.

Tips for the venue

- ☑ You are on the right track if you have a room with natural light (as far as possible). It should be large enough for all to move easily and feel comfortable.
- ☑ Temperature in the room and fresh air are important to allow for maximum concentration -- a long week in training requires environment.
- ☑ Facilitate the space to allow for a different room for group work. It will create movement and change of the scenery and contribute to participant's refreshment.
- ☑ Space for breakaway groups and games should take the weather into consideration.
- ☑ In addition to coffee and tea breaks, water should be available at all times.

For multi-day residential workshops, it is strongly recommended that there be someone other than the trainers serving as a logistics and support person.

Participants will have many logistical needs and questions throughout the workshop, and trainers should be focusing on workshop content, not logistical details.

d) Handouts

Handouts for each module are included and should be copied for participants at the start of the training or in advance of the respective sessions. Conduct a quick orientation at the beginning of the workshop so that participants are aware of the materials in their folders.

e) Training Programme and Module Layout

A well prepared course programme must be available before the course, and sessions should be clearly assigned to specific facilitators.

- It is always good to begin the course with a "welcome" session, and then finalise with an open discussion where participants will evaluate the course and give feedback to the organisers.
- Maintain a careful balance when designing the programme. Lecture content sessions must not take over the course; they should be complemented with sessions for exercises and discussions and case study presentations.
- It is advisable to create some sessions for participants. Select participants on the first day of the course to conduct the morning recap for previous day starting from day two. Make time in the programme for sharing and discussion of case studies and experiences from participants.
- A field trip should only be part of a course programme when it will give an added value to the course in terms of content, experience and possibility of interaction with from the ground experiences and stakeholders. It must be carefully planned.
- Each module begins with an overview and general information about objectives, preparation, and timing. Times throughout the programme are estimated and can be shortened or lengthened depending on the trainer's facilitation.

f) Use of PowerPoint presentation

PowerPoint presentations are provided for all modules. Effort has been made to limit the number of slides to maximum of 20. This will allow ample time for presentations, questions and discussions. It is a facilitating tool, but must be used properly to reach its best results.

Presentation Tips

- ☑ You will spend on average 2-3 minutes explaining each slide. Therefore do not have more than 12-15 slides for a 45 minute presentation;
- ☑ Avoid overcrowding text on a slide and do not just read from the slide;
- ☑ Put short statements on the slide as headings and reminders to yourself about what to say and in what order;
- ☑ Avoid colours that are difficult to read such as red or yellow;
- ☑ Most importantly, check the slides yourself from where the participants will be sitting to see if they are readable.

g) Training Methods

A variety of training methods are used in each module. It includes small group and individual work, games, exercises, lecture-style presentations, feedback sessions and large group discussions.

Trainers/Facilitators should take care to avoid lengthy lectures or too many large group discussions. Always remember that individual participants learn through different methods.

When you facilitate group discussions and exercises, make absolutely certain at the outset that everyone in the room understands the subject that is being discussed. Take care to:

- Accept every idea suggested without any critical comments;

- Capture every idea suggested;
- If you have to shorten it, ask the creator if your shortened version captures the original idea;
- Don't worry if the ideas seem to be tagging onto one another; if this is a problem, someone in the group will notice it and come up with a different idea;
- Work quickly; don't let the group pause for long periods; and
- When no one has suggested any idea for thirty to forty-five seconds, bring the proliferation phase to a close and move into the refinement phase.

4. Starting the Course

The opening of a course is always an important time and an opportunity to ensure that expectations are in line with the course purpose.

a) Before the Course/Workshop Begins

Before any kind of workplace learning event, from team meetings to professional development workshops, the facilitator must take care of some basics.

Some tasks to consider:

- Survey the location before the session to ensure there is adequate lighting, disability access, parking (if the session is off site), bathrooms;
- Be certain that all supplies are ready to go;
- Check equipment to make sure everything is working and correctly placed;
- Arrange the room to maximise learning;
- Check that training material and handouts are placed (this includes the programme); and
- Know your participants before the training begin e.g. educational backgrounds, age spread, work experience, titles and roles, and their developmental needs.

b) Welcome and warm up

Many people attending the workshop will not be familiar any of the other participants. Other persons may feel intimidated by the subject or other participants. The facilitator will make effort to create and enabling environment and help participants to interact during the course.

Use the opportunity of the first 1-2 hours to:

- Introduce the course and its objective and explain why it is being held in the country/region/district.
- Enable participants to get to know each other;
- Build understanding and team spirit among the participants;
- Introduce the host organisation and any other partners;
- Present the course expectations and link it with the course content and overall program schedule; and
- Discuss the workshop logistical management issues like starting times, meals and accommodation.

c) Expectations and hopes

To encourage participants to think about what they expect, and to inform you, ask them what their expectations, hopes or fears are. Consider the following options.

- Ask participants to take cards and write down their expectations and stick them up on a wall or board.
- Ask pairs or small groups to write expectations, or hopes and fears, on cards, one item to one card, which is then sorted on the ground, stuck up and displayed.
- Contributions can be great. They can also be too many, or embarrassingly inappropriate. Be cautious.

The expectations, hopes and fears can be addressed and commented on before starting. There are usually some humorous fears. Course organisers may wish to come back to these cards during the course, as a way to visualise the advance of the course with these expectations.

On the last day of the course, when participants are asked to give feedback on the course, the expectations from day one may be reviewed and commented again, where they meet?

d) Introductions

Mutual Introductions — participants pair off, introduce themselves to each other, and then each introduces the other to the whole group. The pairs can be formed in different ways:

- Random or self-selected;
- Preset by the facilitator (two cards for each pair, one name on either side, can be picked up, and pairs find one another);
- Deliberate diversity mix: e.g. one person who has been at an earlier workshop, and one who has not, or one woman and one man, one old and one young, from different countries; and
- Hat selection: each person writes personal details (e.g. date of birth, height, favourite colour, favourite drink, hobby and favourite film star) on a piece of paper, the pieces of paper are folded and mixed in a hat, each person draws one and searches for the originator.

Variant: This can be done with threes instead of pairs -A introduces B, B introduces C and C introduces A-.

Name and Throw — this game can help in the process of learning each other's names in an enjoyable and non-threatening manner. It is suitable for groups 20-25.

You need: big, legible name labels, a rubber ball (or ball of string for the variant). Ensure everyone's name tags are visible from a distance. Stand in a circle. Whoever holds the ball calls out the name of another and throws the ball to her or him. She or he then does the same for someone who has not yet had the ball. Continue until everyone has taken part.

Variant: Use a ball of string, holding the string. At the end there will be a web connecting everyone. This is particularly interesting for networks!

5. Moderation & Innovative Learning Tips

5.1 Buzz group: everybody gets involved

- Buzz groups can be used as a tool to activate a group/audience of any size to discuss a topic or do a little assignment Buzz groups are made up of 2-4 people who work together for a short time.
- Give them a simple task or question, which takes from 5 to 10 minutes maximum where they are sitting and take feedback in the big group.

Some reasons to use buzz groups:

- Buzz groups help to maintain interest and to get people involved;
- It stimulates their learning by discussing and expressing their thoughts;
- They offer information and experiences to further build on during the lecture or training session; and
- It helps participants to get acquainted.

Tips

- ☑ It is a simple way to 'neutralise' people who dominate the discussion in plenary sessions.
- ☑ Using buzz groups in the beginning of a session helps to create an informal atmosphere.
- ☑ There are many questions raised in each of the chapters of this manual, use buzz groups in your course for participants to think about them.

Buzz groups get their name from two characteristics of their activity:

- There is generally quite a noisy buzz in the room; and
- Working in this way sets ideas buzzing in the group and in people's mind.

Buzz groups produce:

- An energized, involved group / audience.
- Interactive input for the programme.

5.2 Meta-plan: A highly visible brainstorming and discussion technique

'Meta-plan' is a visual brainstorming technique, incorporating elements of brain writing, brain mapping, buzz groups, group discussion and play, for (sub) groups up to 12 persons. It is an effective and efficient way to involve all participants. It creates an open and informal atmosphere encouraging contributions from all participants. The outputs are visible and can easily be used for reporting. (Learn more about brain writing at http://creatingminds.org/tools/brainwriting.htm).

Required Stationary and other Tools

- ☑ Large sheets of paper.
- ☑ Post-its or cards and markers.
- ☑ Tape to stick the sheets to the wall.
- ☑ Most convenient are pin boards for sheets and cards, to be more flexible.
- ☑ A camera to make a report.

When to use meta-plan?

In general for groups up to 12 persons. Larger groups can be divided in sub-groups, each having it a meta-plan session. One session takes between 30 – 45 minutes, but in many cases a cycle of 3 – 5 sessions is required to fully explore and discuss a topic.

Process

- Start with a question

Write the question at the top of a large sheet of paper. Verify the understanding of the question or issue at hand. Starting with the right question is extremely important.

- Visualisation

Ask participants to write their ideas, comments, and remarks on post-it's/cards. They should use a marker and write readable cards. Only one idea should be written in each card, and participants may write more cards.

- Clustering

Collect the cards and randomly read out the cards. Let participants do the clustering and stick them in a wall according to the clusters formed.

- Informative contributions

If there is a need for more information, allow for an informative contribution. This should take no longer then 5 minutes. Ask participants to name the clusters. The result is a number of clustered answers –following participant's responses and criteria- to the question which was proposed to the group.

It is a good process to ensure everyone participates and responses are anonymous, which might be good when dealing with a delicate subject.

5.3 Brainstorming

Brainstorming provides an opportunity to give free reign to the imagination through drawing out as many ideas about a topic as possible in a given time.

It is a chance to give free rein to the imagination within the context of the topic. There are no right or wrong ideas and no judgement is placed on any comments.

Brainstorming allows individuals and groups to capture all possible ideas or perspectives on a given topic within a given (usually short) amount of time.

The outputs are the ideas, thoughts, questions, etc that are documented somehow, preferably visibly so that group members can all interact with the outputs as food for further ideas.

General Brainstorming Rules

- ☑ Don't judge or criticise any ideas.
- ☑ Let ideas flow, be imaginative.
- ☑ Free wheel, build on other peoples' ideas.
- ☑ Go for quantity not for quality.
- ☑ Clarify items.
- ☑ Expand on an idea without evaluating it.
- ☑ Record all ideas, no matter how trivial it might seem.
- ☑ Once all ideas are listed, asses and evaluate it openly with the contributing group in a facilitated discussion.

5.4 Energisers

During training workshops and training events your audience will not always be attentive. Towards the end of the morning is one bad time. The early afternoon after lunch is worse. Other difficult times come with heavy presentations, dull topics, and excessive heat. Try to avoid these. Bad times can be moderated with energisers. When energy is low you can use mental Energisers or Physical Energisers to wake up their brains.

- You move, all move

Keep the action simple and natural. Change your position. If you are talking, go to another part of the room and talk from there. Most of those not already asleep will shift in their seats, or bend their necks. Put up posters round the room, and invite all to get up, walk over and stand while you show and talk about them. Movement gets circulation going.

As and Bs — Stand in a circle. Ask everyone to look around and pick up another person, and to raise their hand when they have done that. That other person is their A. Then ask everybody to pick a second person and raise a hand. That second person is their B. When you say “go” everyone should get as close as possible to A and as far away as they can from their B. Then reverse it – close to B and far from A.

All move who…
Stand, or sit in chairs, in a circle, with one person (yourself first) in the middle. Say “All move who…” and then add, for example:

- Are wearing something blue;
- Travelled more than one day to get here;
- Can speak more than two languages;
- Got up this morning before 6 am;
- Had eggs for breakfast and so on…

- Numbers

Stand in a circle. Count in turn round the circle. Anyone with a multiple of five claps hands instead of saying the number. Anyone with a multiple of seven or a number with a seven in it turns around once instead of saying the number. Those who make mistakes drop out.

The numbers and actions can vary in many ways; for example less actively by saying a word instead of the numbers, or more actively by sitting in the floor.

- Swatting mosquitoes

The room is full of mosquitoes. They are around us and landing and biting. Swat them with your hands –in front, down by your ankles, behind your head, on your face, to the left, to the right, on your neighbour?
Option: at the same time make mosquito noises and shout in different languages — “Got it!”

Tips for energisers

- ☑ Respect those who do not want to take part.
- ☑ With any group that is stiff at first, start gently and gradually work up.
- ☑ Take part and set an example yourself.
- ☑ Be sensitive to culture, gender and disability.
- ☑ If people are tired you may ask ´do we need an energizer? And be greeted by “NO!!!!!!” Don’t be dismayed. Saying “No” itself wakes up. Shouted louder and louder it gets more and more air into the lungs. And to justify denying the need some may struggle more to stay alert.
- ☑ Stress the need for speed on some of the energisers.

- Mirrors

Pair off. One person is the actor, the other is the mirror. The mirror does whatever the actor does, mirroring the actions. Continue for a couple of minutes and then reverse roles. Demonstrate with a partner to set an example with appropriate vigour.

- Role games and group exercises

As noticed, keep a good balance in the course programme, leaving a relevant amount of time for open sessions, sessions for group exercises, buzz groups, and sessions for role game –which are usually fun and very much appreciated-.

Tip for role game: assign enough time for preparation, actual role game, and then a general insight and review of what happened.

- Balls and juggling

Get three small juggling balls and pass them out within the group. Everyone spreads out round the room and then the balls are thrown round the room from person to person - with the provision that when throwing you has to call out the name of the person you are throwing the ball too. ……. but be careful of things that can get knocked over.

Variant: If you have a bit of time to fill is to get those in the group who can juggle (even a bit) to coach others to juggle. Thus you need expert jugglers to do this.

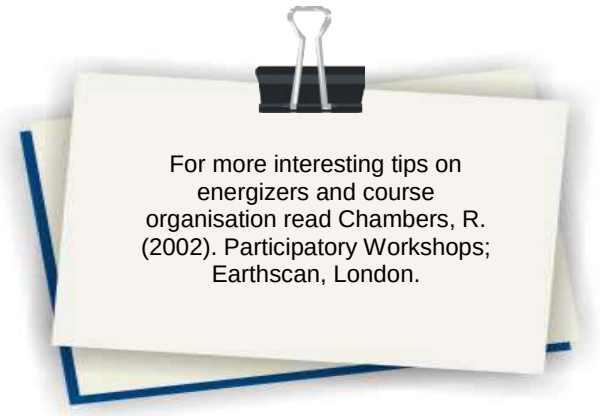
- This... and that...

Get the group to stand up towards the back of the room in a (relatively) clear space. Then ask the group to align themselves with a series of statements along the lines of 'Are you more (this) or (that)?' If they choose more 'this' they move to one side of the room and if they're more 'that' they move to the other side (or stay in the middle if they're neither or can't decide!).

Examples we have used include:

- Rock and Roll / Classical
- Ferrari / Rolls Royce
- Sun / Moon
- Beach / Castle

As well as re-energising and getting people moving, it also gets people to consider similarities (and differences) within the group.



- Do something physical

If there's room, stand in a big circle (you included) and throw a tennis ball to person in front of you who then does the same but to someone new (next to you). Once everyone has caught/thrown the ball the cycle is complete. Ask everyone to remember what they've done and do it again - quicker, then feed extra balls in for fun, see how many you can keep going.

6. Closing Session

There are many ways to close a learning event or meeting. The key is to think of the session as a journey that has a beginning, middle, and end. Indeed, when the participants walk out the door, they should feel that it is their journey now to carry forward.

Listed are reminders about closing a session:

- Restate the general direction of the session—ground covered
- Highlight key points
- Summarize discussion
- Highlight a vital point or lesson that emerged out of the session
- Clarify proposed actions
- Emphasize what the group has learned or accomplished
- Tell the group how much you enjoyed their involvement
- Congratulate the group for a job well done
- Offer some ideas that they can take with them
- Encourage them to act or use what they have learned
- Ask for feedback and give participants a chance to evaluate the session

7. References

Check your facilitation skills http://www.workshopexercises.com/Facilitator.htm

Note

This Facilitators' Guide is developed by Tom Siebold. It can be found at http://www.workshopexercises.com/Facilitator.htm

Sample Course Programme

Time/Date	Monday	Tuesday	Wednesday	Thursday	Friday
08:00 – 9:00	Registration Introduction, climate setting	Recap day 1	Recap day 2	Recap day 4	Recap day 4
09:00 – 10:00	Official Opening	Overview of climate change	Case studies	Flood and drought early warning system	Building community resilience
10:00– 10:30	**Tea Break**				
10:30 – 11:30	Introduction to water related disasters	Overview of climate change (exercise)	Flood risk assessment	Legal, policy and technology issues for IWRM and disaster mgt	Workshop evaluation and recommendations
11.30 – 1.00					Workshop closures
1:00 – 2:00	**Lunch Break**				
2.00 – 3.30	Concepts for water disaster management	Drought risk assessment	Flood risk mitigation	Institutional set-up and responsibilities	Field Visit
3.30 – 3.45	**Tea Break**				
3.45- 5.00	Concepts for water disaster management (Group discussions)	Drought risk mitigation	Flood risk management - Role play	Institutional set-up and responsibilities- exercise	Field Visit
6.00- 8.00	Welcome Cocktail	Free	Free	Free	Field Visit

Part B: Summary of Training Modules

Module 1: Water Related Disasters and Integrated Water Resources Management (IWRM) Concepts

The facilitator will lead the participants in appreciating the overall problem, discussing exactly what the problem is and determining its most important components. The reasoning is that if we can't identify the problem properly, we can hardly know what would be an appropriate solution. The problem is often defined as the gap between some present state of affairs and the desired state.

Water resources management has two key parts; first to manage and develop systems that lead to beneficial use of water; and second to control extreme (excess or acute scarcity) and often undesired occurrences of water resources and mitigate possible hazards it presents. The focus of the training is the latter but it also explores possibilities that some beneficial water use may be achieved in the course of development for mitigation.

Hydro climatic disasters make-up two-thirds of the natural disasters globally, of which a great proportion arise from flood and drought situations.

Within this context, water managers will need to plan and develop strategies for resilience and adaptation and often times working with other sectors and disciplines working within the framework of IWRM.

Lead questions for facilitator:

- How important is the disaster problem?
- What is the source of the disaster problem?
- What are the major dynamics causing and perpetuating the disaster problem?
- What is the relationship between water and disaster management?

Finally the module examines International effort for reduction of natural disaster initiated by the United Nation and coordinated by UNISDR (www.unisdr.org) within the Hyogo framework of Action. The facilitator is advised to check the latest global actions for Disaster Risk Reduction

Module 2: Disaster Risk Reduction (DRR)

Occurrence of natural hazards in a normal part of life, but disasters are consequences of the ways societies structure themselves, economically and socially, the ways that communities and states interact, and the ways in which relationships between the decision makers are sustained.

Disaster risk reduction entails measures design prevent, mitigate, prepare for, respond to, recover from the effects of disasters and reconstruct to build safer societies. In broad terms DRR include:

- Hazard prevention and minimization;
- Reducing exposure, severity and susceptibility;
- Emergency preparedness and coping capacity;
- Rapid and effective response; and
- Post disaster recovery and rehabilitation.

The module focuses on the basic processes of acquiring and using hazard information in a continuous and integrated multi-sectoral, multi-disciplinary process of planning, and implementation of interventions of both pre-disaster and post-disaster risk duration.

In summary the framework for disaster risk management entails four key elements namely:

- Risk identification (underlying risk factors, vulnerability and capacity);
- Risk management applications and preparedness;
- Awareness creation and knowledge management ; and
- Governance and institutional aspects.

This module looks at (i) policy and (ii) governance aspects and institutional aspects are discussed in module 6, while awareness creation and knowledge management are covered on module 8.

Lead questions for facilitator:

- Where do disasters occur and what causes them?
- What sort of damage does it do to people and the environment?
- How much information is available to predict approaching disasters
- In what manner would the different people be affected? Who would be most affected?
- How much warning would it be possible to have?
- How could people prepare for it?

Module 3: Impacts of Climate Change and Variability

There is abundant evidence that climate change is happening. Indeed climate change is more than a warming trend. Increasing temperatures will lead to changes in many aspects of weather, such as wind patterns, the amount and type of precipitation, and the types and frequency of severe weather events. Yet climate change will not uniformly apply across the earth, some areas will experience reduced frequency and magnitude of particular climatic drivers, while it will increase in other areas. Such climate change could have far-reaching and/or unpredictable environmental, social and economic consequences.

For a start, the facilitators will lead the participants to appreciate and distinguish the varied type of climate phenomena including climate change, climate variability and global warming. Global climate change and variability complicates the occurrence of natural disasters. In some areas, the frequency, intensity and severity of climate events have increased, and in return have resulted to increased cases of hydro-climatic disasters such as floods and droughts.

One of the critical issues regarding climate change is with respect to the extreme events such as floods, drought, heat waves, cold spells, strong winds and hurricanes.

Lead question for facilitator:

How can water resources management help in adaptation to changing circumstances and minimisation of disaster risks associated with climate change?

Climate change will impacts on water related disasters at various scales both in time and space acerbating impacts on almost all sectors of the socio-economic.

Fact: The ability of water management agencies to alter management practices related to climate change is generally limited.

Module 4: Drought Risks Management

The module builds on Module 2 on Disaster Risk Reduction.

- What is the participants' perception of drought?

Guide the participants to appreciate that drought is a normal, recurrent feature of climate, and in itself does not lead to disaster. Essentially drought results from extended deficiency in precipitation that lead depressed availability of water for particular activities, groups, or environmental needs.

There is no clear cut characteristic of drought phenomena but rather will vary widely according to regional and sectors. The module explains various definitions and manifestation of drought and sequence of impacts. Drought has immediate impacts on agricultural sector because of its dependence of soil moisture and consequently diminished food security situation, as the severity increases, the impacts are felt among other socio-economic sectors mainly those that are dependent on surface water sources. In very severe situation drought can have significant environmental, economic and social consequences.

No one can prevent drought from occurring but underlying causes of vulnerability can lead to unsafe conditions that are more susceptible to drought hazards. Drought risk management provide a framework for identifying the social, economic, political, physical, and environmental causes of drought impacts.

It directs attention to the underlying causes of vulnerability rather than to its result, the negative impacts.

For example, in drought conditions, the direct impact of a lack of precipitation may reduce crop yields and result to famine.

The underlying cause of this impact, however, may be that farmers did not plant appropriate crops because of cultural preference, lack government incentives, other seeds were unavailable or too expensive, or there was no drought warning.

Lead questions for facilitator:

- What are the factors or underlying causes leading to drought related disasters?
- What is the information and knowledge required on drought risks faced by communities?
- Who is responsible for monitoring and prediction service for these drought risks?
- How and when is information on drought risk disseminated to those at risk?
- Is there a capacity to respond to drought threats, if not what is required to develop capability and preparedness at different levels?

Module 5: Flood Risks Management

Build on the ideas presented in Module 2, but specific to Flood Risk Management.

Flooding is a chance or probability event leading to outpouring of water over land. Flooding is NOT a disaster but floods are a disaster. Indeed there are cases when flooding is desired and beneficial to communities.

Flood risk management is about determining the likelihood that an extreme event will occur and to estimate the social, economic and environmental implications should the event occur under existing conditions, and eventually, identification options and determination of measures to reduce flood risks.

Assessment of flood disaster requires knowledge of the existing land use and the kind of activities that are undertaken in these areas. This analysis is useful in order to consider the regulatory mechanism and build basis for an integrated approach to risk management as one of the possible alternatives for risk reduction. It is also important to assess the exposures based on the planned future land uses contemplated.

The facilitator must make it clear that information has no use unless it reached potential victims in an understandable manner. Outcomes of these analyses should also be translated into an understandable manner for the public and decision makers.

Based on the target of flood management, various options may be examined. Risk could be reduced adopting different approaches like moderating the flood peaks, delaying flood peaks, increasing capacity of river channels, reducing exposure for example by evacuation.

The Facilitator is encouraged to use participants' experience and well known cases to examine possible options of reducing flood hazard on the basis of functional efficiency, economic viability and environmental acceptability. Maps of the flood-prone areas should be prepared and detailed impacts outlined.

A participatory process should be used, leading to the development of an acceptable level of risk. Measures can be evaluated and implemented to meet this level.

This overall process assists the community in better understanding the various actions that can increase or decrease risk exposure, and can lead to greater community participation in the developed solutions to the flooding problem.

Lead questions for facilitator:

- Who are affected by floods?
- To what extent are they affected?
- Why are they affected?
- What is required to reduce their level of exposure and vulnerability?
- Who needs to do what?
- What capacities are required now and in the future?

Module 6: Policy, Legislation and Institutions for Disaster Management

This module pays attention to governance structures (highlighted in module 2), as one of the key aspects for disaster risk reduction.

Facilitator

You may start by asking the participants to describe what happens and compare:

- In moments of disaster by government, civil society and among communities; and
- Six months later.

The irony is that people and governments are seemingly addressing other 'urgent' problems and faster development until disaster strikes, at which point it is difficult to implement change or development progress.

In the immediate aftermath of a natural disaster, with memories of human and material losses vivid, mitigation investment is a very high priority in the eyes of communities at risk and also local and central governments. As time goes by and memories fade, so too does the priority for mitigation.

The thrust of disaster management is to establish a process and structure for a coordinated and effective integration of disaster reduction in development planning and sector policies, delivery of assistance and addressing the consequences of major disasters declared in the country under the appropriate national legislation.

Lead questions for facilitator:

- What are the long-run economic and welfare impacts of disasters?
- What economic and financial incentives - or perhaps disincentives - do governments face to make disaster risk reduction a development priority?
- Is it possible to create a sustainable funding for disaster management?
- What changes are required to encourage market instruments for disaster risk financing?
- Are there any win-win situations where water resources development could both reduce disaster risk and also give economic and social benefit?

Comprehensive disaster management will address coordinated and clear lines of roles and responsibilities, capacity on the part of national and local government to timely respond to disasters and integration of local level societies into effective disaster management.

Disaster Risk Reduction need to be part of other long-term considerations and an integral part of policies related to agriculture, water, food security, environment and development in order to shift disaster management from relief and emergency interventions to prevention of disasters, National policies should create and encourage practices that reduce vulnerability to hazards.

All this requires sustainable policies and governance systems and practice, which may necessitate capacity development to foster meaningful participation in policy and planning processes.

The module examines the objectives of disaster policy and institutional creation for disaster risk management based on function objectives.

Two things that the facilitator will need keep in mind:

- Disaster mitigation will not be the primary responsibility of water manager but rather examine means of building a partnership with disaster manager that benefit both water management as well as disaster mitigation; and
- In many cases, there will be a delay before national communication and assistance reaches the victims, hence the need for policy and legislation to allow development of community capacities to deal with emerging disasters.

Lead questions for facilitator:

- What kind of law, policy and institutions are required for disaster management?
- What are the disaster management functions?
- At what level is each of these functions best managed and by whom?
- What role would a national disaster management institution plays
- How would the national management institution interact with other agencies and especially water management agency?

Module 7: Economics of Disasters

This module may be seen as continuation of module 6, since financing is an important function for disaster management. It articulates the need for adequate governance structures to nurture institutional capacity for sustainable financing of disaster risk management.

Disasters undermine development efforts and increase levels of poverty. Yet it is the poor that mostly suffer the direct impacts of disaster and in this way create a cyclical pattern of disaster and poverty.

Hydro-climatic disasters impacts heavily on an entire nation. The impacts of disasters include; Loss of human lives, damage to infrastructure, damage to capital assets and investment, loss of earnings and unemployment, loss of productivity and an increase in prices of goods and services, a decline in economic growth, impacts public finance e.g. diverted expenditure and decline in tax revenue and increased levels of indebtedness. Moreover disaster proneness may act as a disincentive to investment.

The facilitator will discuss disaster impacts and why disaster is a development issue and broadly macro-economic vulnerability to natural hazards depending on:

- The type of natural hazard
- The overall structure of an economy, including natural resource endowments
- The geographic size of a country
- The country's income level and stage of development
- Prevailing socioeconomic conditions, including the policy environment and the state of the economy.

Facilitator

Large group discussion: Let the participants discuss any natural disaster loss they have gone through at a personal of institutional level. What was the situation immediately after of the disaster and in the period following up to 12 months? What support did the victims get with the recovery?

Financing disaster risk management come in two parts:

- Necessary investments for improved preparedness and mitigation, and
- Measures for transfer of risk and provide liquidity immediately following natural disasters.

Lead questions for facilitator:

- What are the long-run economic and welfare impacts of disasters?
- What economic and financial incentives - or perhaps disincentives - do governments face to make disaster risk reduction a development priority?
- Is it possible to create a sustainable funding for disaster management?
- What changes are required to encourage market instruments for disaster risk financing?
- Are there any win-win situations where water resources development could both reduce disaster risk and also give economic and social benefit?

Managing the risk of economic losses involves the private sector as well as the public sector. As part of this process, it is important to ensure that sufficient investment is made in risk-mapping, monitoring, assessment and dissemination and that this information is provided in an easily understood and usable form, as well as implement structural and non-structural measures.

Risk transfer mechanisms on the other hand shift financial risk from one party to another. The two basic tools for catastrophic risk are insurance and instruments for spreading risk directly to the capital market

The facilitator will discuss the post and pre (ante)-disaster instruments for financing disaster management. The facilitator will keep to mind that there are involved cost for monitoring, assessing and mitigating disasters even when disaster don't occurs and someone has to bear that cost.

The exercise will help to explore means of optimising water resources investments by considering disaster mitigation concerns.

Module 8: Emergency and Humanitarian Response

The response to a natural disaster warning must be immediate, comprehensive, and demonstrate very clear lines of command. There must also be a mechanism in place to quickly draw upon external resources available at higher levels of government, or even internationally, when the local level of response will not be sufficient. As such, effective emergency responses require advance planning, ability to mobilize sufficient resources quickly, and periodic exercises to identify weaknesses and problems.

Detailed response plans need to be prepared in advance and reviewed with all of the key agencies and players. This information is constantly changing and needs to be verified periodically and tested in exercises. Multiple contact points need to be established as the emergency may occur on a weekend, holiday, or after regular business hours. Mechanisms for coordination must be known.

The facilitator may involve the participants to examine inventory and expertise of disaster response required and when to trigger of emergency action. An emergency inventory with include professional expertise such as counselling, forecasting, reporting, medical personnel, emergency shelters and the availability of emergency supplies like water, food and medicine.

The response is incomplete if it does not go beyond to the obvious and immediate requirements. Fundamentally, it should change the thinking and offer lessons for the future and lead to sustainable strategies.

Governments need to demonstrate leadership and sometimes take bold steps to restore employment, address social issues and move the economy in a new direction. In that sense, natural disasters can be a positive motivator for change

Lead questions for facilitator:

- What are potential disaster and their humanitarian impact?
- What is the priority action during potential disaster emergencies?
- What is required to ensuring necessary preparedness and follow-up actions?
- What support might the affected people need to rebuild their lives?

Acronyms

ADB	Asian Development Bank
Cap-Net	International Network for Capacity Building in Sustainable Water Management
CRED	Centre for Research on the Epidemiology of Disasters
DEM	Digital Elevation Model
DFID	Department for International Development (United Kingdom)
DRR	Disaster Risk Reduction
DTM	Digital Terrain Model
EIA	Environmental Impact Assessment
EM-DAT	Emergency Database (of the Centre for Research on the Epidemiology of Disasters)
EWS	Early Warning System
GDP	Gross Domestic Product
GIS	Geographical Information System
GWP	Global Water Partnership
HFA	Hyogo Framework for Action
IATF/DR	Inter Agency Task Force on Disaster Reduction
ICT	Information and Communication Technologies
IFM	Integrated Flood Management
IMTR/RTC	The Institute for Meteorological Training and Research /Regional Training Centre (Kenya)
IRC	International Red Cross
IWRM	Integrated Water Resources Management
MDGs	Millennium Development Goals
NGO	Non-Government Organisation
Nile IWRM Net	Nile basin Capacity Building Network for Integrated Water Resources Management
OND	October, November, December
RBO	River Basin Organisation
SEA	Strategic Environmental Assessment
SIA	Social Impact Assessment
UK	United Kingdom
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNISDR	United Nations International Strategy for Disaster Reduction
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
USA	United States of America
USAID	United States Agency for International Development
WMO	World Meteorological Organisation
WMO-APFM	World Meteorological Organisation Associated Programme on Flood Management
WWC	World Water Council

International Network for Capacity Building in
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