# Social Aspects and Stakeholder Involvement in Integrated Flood Management

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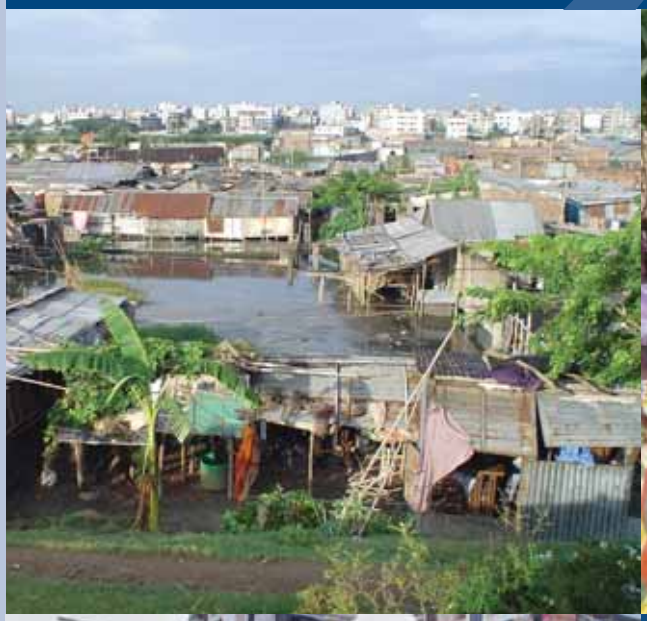

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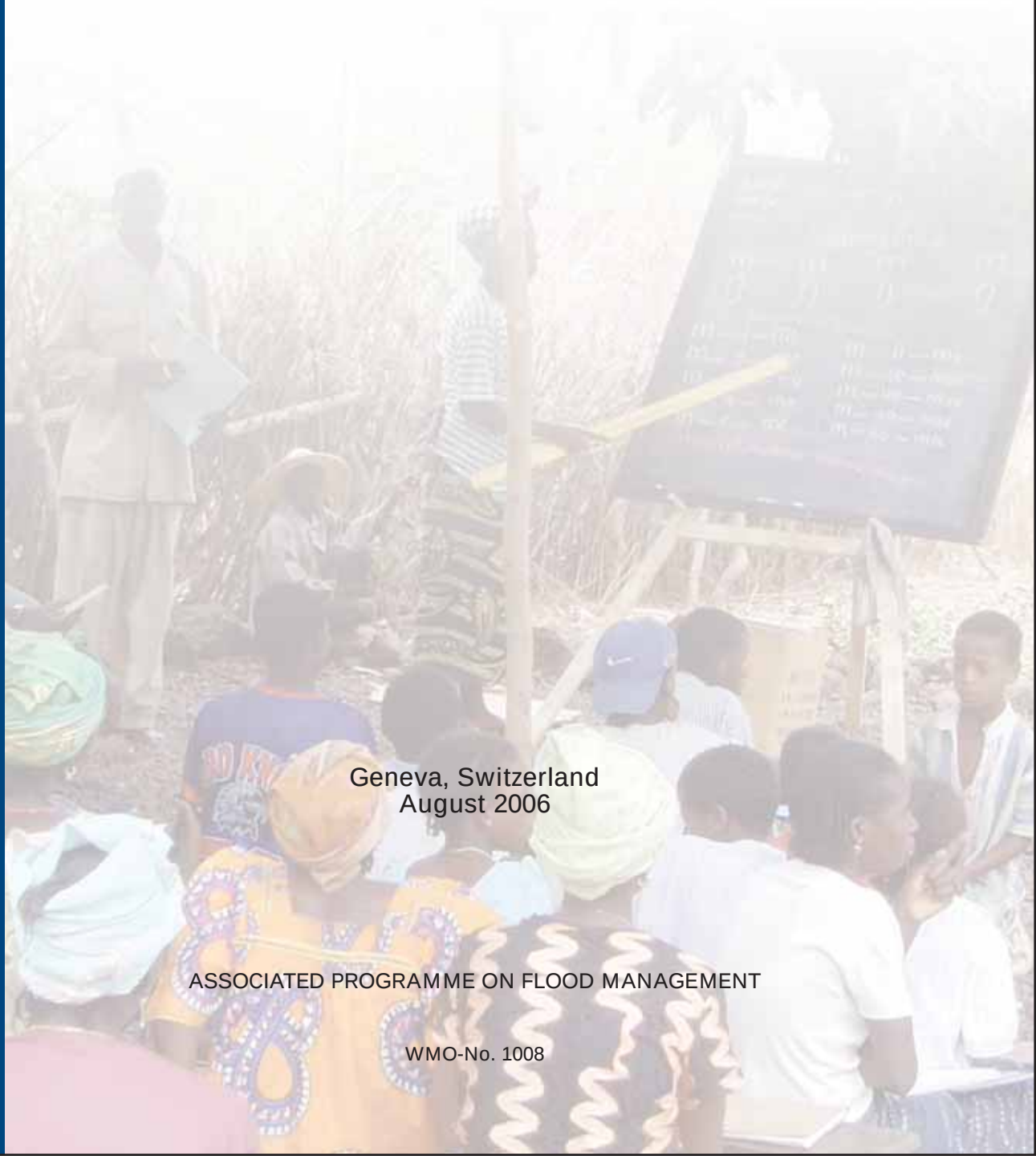

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ASSOCIATED PROGRAMME ON FLOOD MANAGEMENT

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The Associated Programme on Flood Management (APFM) is a joint initiative of the World Meteorological Organization and the Global Water Partnership. It promotes the concept of Integrated Flood Management (IFM) as a new approach to flood management. The programme is financially supported by the Governments of Japan and the Netherlands.

The World Meteorological Organization (WMO) is a specialized agency of the United Nations. It coordinates the activities of the meteorological and hydrological services of 187 countries and territories and as such is the centre of knowledge about weather, climate and water.

The Global Water Partnership (GWP) is an international network open to all organizations involved in water resources management. It was created in 1996 to foster Integrated Water Resources Management (IWRM).

The Asian Disaster Prepardness Center (ADPC) is an independent, non-profit foundation, serving as an international focal point for disaster prepardness and mitigation in the Asia and the Pacific regions, with the vision of "safer communities and sustainable development through disaster reduction".

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This publication forms part of the Flood Management Policy Series published within the framework of the WMO/GWP Associated Programme on Flood Management. The series comprises publications on various aspects of flood management policy, including economic, environmental, legal and institutional, and social aspects. The series as such supplements an in-depth perspective to the "Integrated Flood Management-Concept Paper" (APFM 2003). The series is based on expert groups formed for each publication to guide and advise the preparation process, and on a wide review and consultation process in the framework of conferences and direct correspondence with leading sector professionals in the area of natural resource management and development policy. The series is published in English, French and Spanish.

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NOTE

# PREFACE

Since time immemorial, civilizations have prospered on flood plains, deriving benefits from floods. At the same time flooding has resulted in untold miseries for millions of people around the world. Despite enormous environmental and economic benefits, floods continue to be the leading natural disaster causing loss of life and affecting sustainable development. Flood management measures in the past have largely been successful in mitigating the adverse impacts of floods but have often created disparities owing to inappropriate policies and inadequate attention paid to social issues. In many countries, in certain areas that are frequently flooded, "living with floods" has been a major strategy. However, the benefits of overall economic development in other parts of these countries have yet to reach such frequently flooded areas.

Integrated flood management (IFM) is based on the principle of reducing vulnerability through building resilience and developing a culture of prevention through preparedness rather than reactive responses alone. The multidimensional nature of flood management options owing to constraints, risks, uncertainties and conflicting objectives poses challenges and opportunities for the participatory approach towards decision-making, as such options should not only be technically appropriate but should also address broader socio-political issues. The need to deal with social concerns and involve experts and civil society in the decision-making process is key to IFM. These concerns can be qualitatively incorporated through the active participation of all stakeholders, including civil society at various decision-making levels and stages and through the implementation of flood management measures. Multi-stakeholder engagement is key to the success of IFM as it ensures strong stakeholder support and is a catalyst for proactive engagement in flood issues.

Community-based disaster risk management has been acknowledged and used successfully in many regions around the world. However, the participation of stakeholders and civil society in decision-making with regard to policy, planning and implementation is rarely envisaged. Stakeholder involvement is a time-consuming, resource-intensive exercise and requires strong skills. It calls for a judicious approach to the identification of appropriate stakeholders, building their awareness of the issues under consideration and enabling their participation through an equitable, fair, accountable and transparent process. This paper is an attempt in this direction and lays down a framework for a rational approach. It introduces the elements of stakeholder and society participation in decision- making and addresses the need for an enabling environment in which appropriate laws and institutional frameworks make for effective participation.

The WMO/GWP Associate Programme on Flood Management (APFM) and the Asian Disaster Preparedness Center (ADPC) have worked together on this paper, mobilizing available knowledge and experience. We hope flood managers will be able to re-orient flood management policy and planning and help create a flood-resilient society by factoring these social concerns into the decision-making process.

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# EXECUTIVE SUMMARY

Floods are a natural phenomenon and should not be considered a hindrance to economic development. Flood disasters result from the interaction between extreme hydrologic events and environmental, social and economic processes. Floods not only have negative consequences but positive impacts as well. They provide valuable natural resources, thereby supporting livelihoods and economic activities. Unfortunately, emphasis is generally placed on their destructive nature. Therefore, an integrated approach to flood management can play an important role in sustainable development and poverty reduction.

Integrated Flood Management (IFM) is a concept that addresses issues on human security and sustainable development from a flood management perspective within the framework of Integrated Water Resources Management (IWRM). IFM requires an understanding of societal vulnerability to flood hazards, of characteristic of flood risks and of society's perception of those risks. This publication presents approaches that help address the social issues in IFM and the need for stakeholder involvement in the process, targetting flood managers in particular.

IFM aims to reduce flood risks through a judicious combination of measures dealing with the magnitude of the hazard and the community's exposure and vulnerability to it. A clear understanding of existing and potential flood risks is necessary to establish proactive and preventive risk reduction measures, which make up the IFM approach. Local energies for preventive measures can be mobilized to build societal resilience if the risks the society faces are fully appreciated.

At the same time, various social factors determining a community's capacity to anticipate, cope with, resist and/or recover from the impacts of flooding must be clearly understood. A community's vulnerability is determined by a combination of prevailing social conditions and factors such as poverty and livelihoods. The effectiveness of flood management measures to reduce vulnerabilities and build disaster-resilient communities can be ensured by identifying the underlying factors contributing to flood risks. To enhance resilience it is necessary to make livelihoods more secure by adapting to likely flood risks and strengthening the community's natural resources base.

Exposure to flood risks has been handled largely through structural measures in the past. Land use regulations have also been attempted with some success. However, experience has shown that absolute safety from flooding is neither economically feasible nor environmentally desirable. Contingency plans for meeting situations where protected areas experience floods beyond expected flooding should be drawn to tackle such residual risks. One of the best means of reducing exposure to residual flood risks and adopting a strategy of living with floods is the effective implementation of flood emergency management plans. Participatory planning, which brings together all parties concerned at various levels, is essential.This emergency response mechanism requires cooperation across various sectors and administrative levels; well-honed preparedness plans; resource mobilization; and the continuous, timely and accurate flow of information. The post-flood recovery and reconstruction phase, a key component of such a plan, should learn from past mistakes and requires the understanding and cooperation of the affected community which can be ensured through its active participation. At the grass-roots level, community floodmanagement committees can prove effective in preparing and planning community response to emergencies.

A shared consensus has emerged in the past decade on the importance of participatory planning in disaster management. The broad acceptance of the community-based disaster risk management concept is based

on a community's engagement to ensure the effectiveness and efficiency of flood mitigation measures. Individual and community ownership, commitment and concerted disaster mitigation measures produce a wide range of appropriate and innovative cost-effective, sustainable solutions. However, this is not the case in the formulation or implementation of flood management policies. If at all, such participation in the formulation and implementation of flood management policies is at best peripherial. This publication focuses on stakeholder and civil society participation in IFM and highlights issues, such as stakeholder identification, understanding engagement mechanisms and awareness of potential pitfalls, that need to be tackled in designing the participatory decision-making processes in policy formulation, drawing up of basin plans and implementing flood management measures.

Stakeholder involvement programmes should include clear objectives and show an understanding of the benefits and pitfalls, as it is perceived differently by different people. An analysis of the stakeholders, their respective roles and the mechanism of their engagement should aim to ensure the sustainability of the process. The level of involvement of each stakeholder varies according to the given institutional framework and should be defined. Different groups of stakeholders have different needs and requirements depending on their areas of interest and respective roles and responsibilities, and therefore must be engaged through different methods. If not undertaken with due care and sensitivity, the participatory process can reveal inherent or perceived conflicts of interests that may stall the development process. Those conflicts of interest need to be anticipated and addressed from the outset.

Flood management policy transcends flood management agencies or departments involving various development agencies not confined to the water sector but beyond, such as land use planning. Various development activities have the potential to exacerbate the intensity and severity of floods. Poor land use planning of urban areas under development for example, can significantly increase flood magnitudes. Land use regulations restricting development activities that may heighten the risks can help reduce exposure of economic activities to flooding and mitigate flood risks. Such measures should be supported by an appropriate legal and institutional framework, along with suitable economic incentives and disincentives. Since the community is affected directly by such measures, it is best positioned to enforce them.

The key to IFM is the river basin approach. A basin flood management plan starts with setting goals that are largely guided by regional development objectives and driven by the need to reduce flood risks, secure livelihoods, sustain economic development and preserve environmental quality. The objectives and scope of the basin plan are set according to an evaluation of the problems and a detailed flood risk assessment, and various options for flood mitigation are worked out. It is important to understand that the river basin should be considered a flood management planning unit since flood risks are easily transferable and development activities within a basin have the potential to increase them. Further, the equity principle in development requires that flood management options be debated at the basin level and carried out under a flexible but well-defined basin flood management plan.

Implementation of a basin flood management policy and project-level planning requires the identification of priority action areas based on various financial assessment procedures coupled with an environmental and social impacts assessment. Evaluating the costs and benefits of various options through consultation with and the participation of civil society helps to establish local ownership and accountability.

IWRM has advocated the use of enabling mechanisms and the setting up of an institutional framework at the basin level to facilitate the process. As a subset of IWRM, IFM should make use of these institutions. River basin organizations, disaster management committees at various levels, community-based organiza-

tions and non-governmental organizations are the basic elements of such a framework designed to further dialogue and negotiations between various stakeholders. River basin organizations can be used as platforms for stakeholder engagement at the basin level for IFM.

There are certain prerequisites for ensuring the successful and sustainable involvement of stakeholders under any given situation. The most important of all is the need to build trust through information sharing and repeated interaction. Commitment, accountability, transparency of action, application of equality principles and tolerance for dissent are factors that determine, encourage and promote public participation. Good governance is the key to success of the participatory process and integrated flood management. At the national level, weak governance, characterized by unclear policies, ambiguous roles and responsibilities among line agencies results in overlapping responsibilities and gaps in task distribution. While the Government provides incentives, facilitates and establishes policies and regulations for the participatory approach, stakeholder groups must take certain initiatives and responsibilities.

The nature of the IFM approach requires extensive coordination between various stakeholder groups. Information sharing and networking is essential in order to ensure the efficiency and soundness of the approach and to anticipate and manage conflicts and enhance cooperation across jurisdictions and sectors. This requires an enabling institutional framework which facilitates effective coordination, cooperation and collaboration across jurisdictional boundaries, departments, institutions, disciplines, users and uses. An institutional framework defines the recognized roles of all IFM stakeholders and offers a coordinating mechanism for organizations and institutions. Since stakeholders have different sectoral, regional and local perspectives, and their institutional set-ups, cultural backgrounds and socio-economic conditions vary, it is necessary to provide capacity-building in areas commensurate with their role in the participatory process.

Clearly, there are no universal solutions facilitating the involvement of all stakeholders and civil society in making flood management decisions. It is crucial to adopt practices that suit particular circumstances under a given socio-economic setting.; Therefore, this publication does not attempt to provide guidelines for prescribing certain procedures, but rather a rational approach to community involvement.

# ACKNOWLEDGMENTS

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Case studies on flood management practices around the world collected by APFM pinpointed gaps in social inputs to flood management practices and provided the incentive for taking up this publication. Experience gained from the pilot projects on community approaches to flood management in South Asia and reducing vulnerability to flash floods in Central Europe were extremely useful in clarifying a number of intricate issues such as the need for the capacity-building to achieve successful stakeholder engagement in flood management. Particular thanks are due to Mr Q.K. Ahmad of Bangladesh Unnayan Parishad (BUP), Bangladesh; Mr Kamta Prasad of the Institute for Resource Management and Economic Development (IRMED), India; and Mr Pradeep Mathema of Jalsrot Vikas Sanstha (JVS), Nepal, who were instrumental in developing the concept of Community Flood Management Committees established and tested under the pilot project in South Asia.

The following people contributed to this paper:

- Mr Aloysius J. Rego, Asian Disaster Preparedness Center;
- Ms Hnin Nwe Win, Asian Disaster Preparedness Center;
- Mr Avinash C. Tyagi, World Meteorological Organization;
- Mr Hisaya Sawano, Technical Support Unit, WMO/GWP Associated Programme on Flood Management.

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- Mr Angel Luis Aldana Valverde, Centro de Estudios y Experimentación de Obras Públicas, Spain;
- Mr Eelco van Beek, Delft Hydraulics, the Netherlands;
- Mr Kenji Okazaki, National Graduate Institute for Policy Studies, Japan;
- Mr Simon McCarthy, Flood Hazard Research Centre, Middlesex University, UK.

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# ACRONYMS

| | |
|---|---|
| ADB | Asian Development Bank |
| ADPC | Asian Disaster Preparedness Centre |
| ADRC | Asian Disaster Reduction Center |
| APFM | Associated Programme on Flood Management |
| CBA | Cost-benefit analysis |
| CBDRM | Community-based disaster risk management |
| CBO | Community-based organization |
| CFMC | Community Flood Management Committee |
| DMC | Disaster Management Committee |
| EDCC | Emergency day care centre |
| EIA | Environmental Impact Assessment |
| FAO | Food and Agriculture Organization of the United Nations |
| FEMA | Federal Emergency Management Agency |
| GWP | Global Water Partnership |
| IFM | Integrated flood management |
| IFRC | International Federation of Red Cross and Red Crescent Societies |
| ISDR | International Strategy for Disaster Reduction |
| IWRM | Integrated water resources management |
| McA | Multi-criteria analysis |
| NGO | Non-governmental organization |
| RBO | River basin organization |
| UN | United Nations |
| UNCRD | United Nations Centre for Regional Development |
| UNDP | United Nations Development Programme |
| UNECE | United Nations Economic Commission for Europe |
| UNEP | United Nations Environment Programme |
| ESCAP | Economic and Social Commission for Asia and the Pacific |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| UNICEF | United Nations Children's Fund |
| VCA | Vulnerability and capacity assessment |
| WB | World Bank |
| WMO | World Meteorological Organization |

# INTRODUCTION

## Background

Historically, flood plains have been a preferred place for human settlement and socio-economic development because of their proximity to rivers, guaranteeing rich soils, abundant water supplies and means of transport, and because floods replenish wetlands, recharge groundwater and support fisheries and agriculture systems. At the same time, flood hazards produce the most severe impacts on the economy and people's safety. There is clear evidence that economic losses caused by flooding are increasing at the global level.[1*] This, in part, is a reflection of sharp population increases, expanding economic growth and development, greater investment in infrastructure, inadequate understanding of flood risks and a largely top-down approach to decision-making.

In response to rising flood damages and the adverse impact of floods on water resources management and sustainable development, there is a slow, but steady realization that a shift from flood control to flood management is inevitable. Reducing these risks by restricting the occupation of flood plains, however, limits the potential of these areas for socio-economic development.[2] In recent years the need to address both the negative and positive characteristics of floods through a judicious combination of structural and non-structural measures has been recognized. The result is the Integrated Flood Management (IFM) approach, which focuses on the physical, social, environmental and economic aspects of floods.

## From flood control to integrated flood management

Flood control and protection measures have played an important role in protecting people and socio-economic development from flooding. Until recently, they have been engineering centered, with little or no consideration being given to the social, cultural and environmental effects of the chosen strategy or to long-term economic sustainability. They have largely relied on structural solutions, such as embankments, bypass channels, dams and reservoirs. Although structural flood control measures over the last 50 years have been complemented with non-structural measures, such as flood forecasting and land use regulations, the need for a paradigm shift from flood control to flood management has been recognized only during the past decade.

This shift is enshrined in the IFM concept: a process promoting an integrated approach to flood management aimed at maximizing the net benefits of flood plains and minimizing the loss of life from flooding in a river basin within the framework of Integrated Water Resources Management (IWRM).

IFM aims at a fundamental re-orientation of social perception of floods from the "need to control" to the "need to manage" by shifting the focus from a reactive to a more proactive response. Flood plain occupants are no longer viewed as hapless victims: they play an important role in

* Superscripts indicate the number of the endnotes given from page 71 onwards.

helping themselves and actively participate in tackling the problem caused by floods. The agenda of disaster and emergency management agencies has also shifted from providing a response to a flood emergency situation to a more comprehensive approach in which the recovery phase incorporates mitigation and preparedness measures for the future.

IFM is a subset of IWRM and addresses the interplay between the beneficial use of floods, on the one hand and risks posed by extreme events to the sustainable development in flood-prone areas on the other. The basic tenets of IFM are described in the "Concept Paper"[3] and its components include the following:

- Adopting a basin approach to flood management;
- Bringing a multi-disciplinary approach to flood management;
- Reducing vulnerability and risks due to flooding;
- Enabling community participation;
- Preserving ecosystems.

Flood issues are influenced not only by the physical causes of flooding but the overall social economic and political setting of the area concerned. Therefore, those issues should be addressed within the framework of social and economic development planning, particularly water resources development. The social aspects and involvement of all stakeholders – including civil society – in integrated flood management activities from planning to implementation to ensure sustainability is an integral part of the IFM process.

Living harmoniously with floods is an important strategic option in IFM. Over the centuries people have been living with floods. Unfortunately, such areas have not seen much economic prosperity and improvement in the quality of life, compared to those where flood protection has been provided. There are two major concerns: ensuring minimum disruption and disturbance to socio-economic activities and livelihoods as well as equitable development in flood-stricken areas by improving the quality of life.

## Purpose and scope of the publication and target audience

The main objective of this publication is to help understand the importance of social aspects of and the need for stakeholder involvement in IFM and to help make society more resilient to flood risks while recognizing and deriving benefits from floods. The publication is primarily aimed at flood managers, its purpose being to enable them to understand the full range of social issues involved in flood management. At the same time, it provides useful information for policymakers, river basin managers, practitioners, civil society, NGOs and national, state, district and local government officials responsible for disaster management, to help them understand the intricacies of stakeholder participation in IFM.

Since stakeholder involvement is an intensive long-term process requiring dedicated financial resources, special attention is given to developing countries. At the same time, it has to be appropriately linked with similar stakeholder involvement in IWRM within a basin. This publication does not intend to provide a detailed explanation of the technical aspects of various measures but addresses the basic concepts of stakeholder involvement in flood management and issues

related to building community capacity so that communities can participate effectively in various phases of flood management, including decision-making.

Given the importance of improved understanding of the social aspects of flood issues and of incorporating the concerns of all stakeholders and needs of flood plain inhabitants in the implementation of IFM, this publication highlights the issues that need to be tackled in flood risk reduction and explores the means of facilitating the engagement and participation of all river basin stakeholders in the decision-making process.

Since IFM is a subset of IWRM, the social issues presented in this publication are addressed within the framework of IWRM. This publication does not intend to develop a parallel process of stakeholder involvement in flood management, but relies largely on the experience gained in IWRM, duly addressing special flood-related issues, wherever necessary. It attempts to answer questions relating to floods in the river basins and interactions with human security and environment preservation to ensure livelihoods and economic development for the well-being in the basin:

- How can the beneficial effects of floods be recognized and enhanced?
- What are the main causes of flood plain communities' increased vulnerabilities?
- What measures can be undertaken to reduce the vulnerabilities and risks of flood plain communities?
- How can various stakeholders be involved in the decision-making process from the policy planning stage to avoid likely conflicts?
- What role can civil society play in reducing flood risks?
- Why are participatory planning and management imperative in river basin management? How can they be sustained over time?
- What difficulties can be anticipated in implementing these measures?
- What kind of mechanism and enabling environment are required to develop a successful participatory approach?

To address the above-mentioned questions, the publication is divided into four parts: People and floods, Social aspects of flood risk reduction, Stakeholder involvement in integrated flood management and Enhancing stakeholder involvement. Chapter 1, People and floods, looks into the positive and negative effects of floods. Conditions responsible for and factors that contribute to the vulnerability of societies are discussed briefly for the benefit of non-specialist social scientists. Societal or community perceptions of risks that determine to a large extent the motivation to participate in the process are discussed briefly.

Chapter 2 on the social aspects of flood risk reduction covers various factors contributing to enhanced flood risks caused by development activities, flood reduction and mitigation measures and how participatory processes can contribute to flood risk reduction by means of preventive and preparedness measures.

Chapter 3 discusses the importance of stakeholder involvement in IFM, constraints and precautionary measures required in designing the participatory process from the onset, that is, from national flood policy development to basin management planning, project planning and emergency planning and implementation. Each step requires the proper identification of

stakeholders, an analysis of the roles each has to play and a discussion of how the participatory process can be sustained. Possible institutional mechanisms have been identified. Participatory approach experiences from similar areas of development activities have also been explored. Chapter 4 addresses various enabling mechanisms for successful stakeholder involvement.

## Linkages to other Flood Management Policy Series under the Associated Programme on Flood Management (APFM)

IFM aims to address the flood issues and related contributing social, economic and environmental factors. To further elaborate the concept, the Flood Management Policy Series focusing on specific aspects of flood management is compiled with a view to facilitating the implementation of IFM principles. Apart from the present publication, three other publications in the Flood Management Policy Series deal with legal and institutional, environmental and economic aspects of IFM.

The publication, *Legal and Institutional Aspects of Integrated Flood Management,*[4] stresses the need for an appropriate legal framework for IFM in particularly addressing flood issues for professionals working as an interface between the legal world and natural resources management. It also discusses the enabling legal mechanism for community participation in flood management. *Environmental Aspects of Integrated Flood Management*[5] advocates a balanced approach, preserving ecosystems while addressing a society's development needs and factoring in flood risks. The publication highlights the importance of stakeholder participation in the decision-making process. *Economic Aspects of Integrated Flood Management*[6] identifies the role that economic instruments can play in making choices within the overall IFM concept, including economic evaluation methods for different flood management scenarios.

IFM is based on the active and informed participation of all stakeholders. It is anticipated that IFM will employ the participatory process in planning, implementation and evaluation. The present publication complements the other three by assessing the relationship between development and flood disasters and their impacts on basin inhabitants' social status and explaining how to take decisions that meet societal objectives of poverty alleviation, sustainable development, risk reduction and preservation of ecosystems.

# 1. PEOPLE AND FLOODS

Floods are a natural phenomenon. However, flood disasters are the results of interaction between this natural phenomenon with the environmental, social and economic processes. An integrated approach to flood management therefore requires an understanding of societal vulnerability to flood hazards as well as a knowledge of the hydrological characteristic of flood risks and how the society perceives them.

## 1.1 Nature and causes of floods

The hydrological cycle, driven by solar energy, provides freshwater resources to the earth through annual precipitation, which is constant in a given location over long periods of times but varies from year to year. Part of the precipitation infiltrates into the ground and is stored as groundwater. Depending on the spatial and temporal distribution and intensities of these precipitations, annual flood pulses are generated in rivers and streams. The freshwater received in that manner is a lifeline for the survival of human beings, flora and fauna.

When the flows in rivers and streams surpass their carrying capacity, the water spills over to the adjacent lands, causing inundation, also called flooding. Therefore, flooding results from excessive rainfall or snowmelt or a reduction in a river's conveyance capacity owing to siltation, ice jams or inadequate design of waterways for cross-drainage works. Various other types of flooding and their potential impacts are briefly explained in Annex I. Anthropogenic changes in the catchment area and flood plains also affect the natural frequency, intensity and characteristics of flooding. Various meteorological, hydrological and human factors that contribute to flooding are listed in Table 1 below.

A river basin can be divided into three parts according to topographical and river channel characteristics: upper reaches, middle reaches and lower reaches. Upper reaches are the main water source and have steep sloping channels, which are generally confined within valleys and are prone to landslides and mudflows. The percentage of surface runoff from rain depends on a number of factors such as watershed gradient and geology and soil characteristics. Middle reaches, with broad valleys and generally stable channels, form narrow flood plains and are marked by fast moving, or flash floods. The lower reaches cover mainly the low elevation flood plains surrounding the mainstream and its tributaries and the river mouth where the river meets the sea. These flood plains can be narrow strips of land along the river channel extending a few tens to hundreds of meters or tens of kilometres, and sometimes a hundred kilometres in the alluvial reaches. The surface runoff from rivers and streams is drained into the oceans and seas, forming estuaries and confluence of rivers.

## 1.2 Positive and negative impacts of floods

When speaking of floods and their impacts, emphasis is generally placed on their destructive nature. Flood hazards are unique in the sense that they have not only harmful, but beneficial impacts. In IFM, it is important to look at the positive and negative impacts of

**Table 1. Factors contributing to flooding[7]**

| Meteorological factors | Hydrological factors | Human factors |
|---|---|---|
| • Rainfall<br>• Cyclonic storms<br>• Small-scale storms<br>• Temperature<br>• Snowfall and snowmelt<br>• Cyclones | • Soil moisture level<br>• Groundwater level prior to storm<br>• Surface infiltration rate affected by vegetation, soil texture, density, structure and soil moisture.<br>• Presence of impervious cover such as snow and ice<br>• Channel cross-sectional shape and roughness<br>• Presence or absence of over bank flow, channel network<br>• Synchronization of run-offs from various parts of watershed. | • Land-use activities such as urbanization increase run-off volume and rate<br>• Occupation of the flood plain obstructing flows<br>• Structural flood control measures such as embankments in the upstream<br>• Greenhouse gas emissions which may affect climate change and frequency and magnitude of precipitation events<br>• Decrease in conveyance of the river channels owing to build up of river debris, restriction of waterways, dumping of mineral, wastes and rubbish<br>• Mining and other industries alter water regimes, pollute water channels and affect ecosystems; can also alter water courses |

floods and consider the flooding of river basins to be a natural process rather than nature's interference and a hindrance to economic development.

### 1.2.1 Beneficial aspects of floods

Historically, flood plains have been a magnet for humans and have helped transform them from food gatherers to settlers. Floods provide a variety of services and help to develop fulfilling livelihoods and meet the nutritional needs of human beings. The beneficial aspects of floods, which provide crucial water resources, rich biodiversity, abundance of fish and fertility of soil to the flood plains, are taken for granted, overlooked or often forgotten. These benefits are briefly discussed below for inclusion in the context of IFM.

*Recharging water sources:* Floods are natural hydrologic processes and provide variable river flows and are an intermittent source of freshwater supply, filling natural depressions and recharging groundwater. Inundation of the flood plains helps recharge the groundwater, which is an important source of drinking water and is essential for agriculture. They are an important source for restocking local man-made water sources such as ponds, reservoirs, dams and irrigation channels, meeting round-the-year demand.

*Agriculture:* Floodwaters carry nutrients and sediments, which are deposited on flood plains, enriching the soil; artificial nourishment such as fertilizers is not required. Rice paddies are sometimes flooded deliberately to take advantage of this natural fertilization process.

*Fishery:* A river basin is an ecological unit interconnecting upstream spawning habitats with downstream rearing habitats for a variety of species and other aquatic systems. Seasonal habitats on the flood plain, created by variable flow regimes, are essential for various stages of the life cycle of species. Floods provide an ecological trigger for both the spawning and migration of certain species. Some species spawn on the flood plain itself, whereas others migrate upstream to spawn in the river channel, providing an abundant supply of fish and alternative income sources at the household level.[8]

*Rejuvenation of the river ecosystem:* The river ecosystem is a critical habitat for the biota: fish, wildlife and waterfowl. Seasonal variability and variable sediment and flow regimes help maintain ecological biodiversity[9] in rivers and flood plains. Wetlands or swamps located in flood plains serve as natural buffer zones for excessive flood flows and play host to many birds, fish and plants. Supplementary livelihoods in the form of recreational and eco-tourism activities can be made possible by the presence of the rich river ecosystem, bestowed with abundant flora and fauna. Surface runoff and flooding can help wash down pollutants and contaminants deposited on land caused by the intensive use of pesticides and fertilizers. They also flush out accumulated organic substances brought by untreated drainage water from farmlands, stockyards, factories and domestic use and restore the ecological health of stagnant rivers and streams by diluting them and providing clean water.

### 1.2.2 Negative socio-economic impacts of floods

Flooding of areas used for socio-economic activities produces a variety of negative impacts. The magnitude of adverse impacts depends on the vulnerability of the activities and population and the frequency, intensity and extent of flooding. Some of these factors are discussed below.

*Loss of lives and property:* Immediate impacts of flooding include loss of physical life, damage to property, destruction of crops, loss of livestock, non-functioning of infrastructure facilities and deterioration of health condition owing to waterborne diseases. Flash floods, with little or no warning time, cause more deaths than slow-rising riverine floods. In monetary terms, damages caused by floods are directly proportional to the extent, depth and duration of flooding, the velocities of flows in the flooded areas and the vulnerabilities of economic activities and communities. The more extensive the damages, the greater the rehabilitation and recovery costs, thereby depriving the society of development and welfare activities.

*Loss of livelihoods:* As communication links and infrastructure are damaged and disrupted, economic activities come to a standstill, resulting in dislocation and the dysfunction of normal life for a period much beyond the duration of the flooding. Closure of factories and businesses throw urban workers out of work. In rural communities, those depending on agricultural activities are the hardest hit. Agricultural labourers are put out of work for long periods owing to the loss of crop seasons. The spillover effects of the loss of livelihoods can be felt in business and commercial activities in adjacent non-flooded areas as well.

*Decreased purchasing and production power:* Damage to infrastructure also causes long-term impacts, such as disruptions to clean water and electricity, transport, communication, education and health care. Loss of livelihoods, reduction in purchasing power and loss of land value in the flood plains lead to increased vulnerabilities of communities living in the area. Production in agriculture, manufacturing and other sectors may suffer owing to the direct impact of flooding or to physical inability of the workforce to attend the workplaces, or due to ill health. Loss of livelihoods further reduces purchasing power and may indirectly affect production. Flooding can also result in loss of sales and trade. The additional cost of rehabilitation, relocation of people and removal of property from flood-affected areas can divert the capital required for maintaining production.

*Mass migration:* Frequent flooding, resulting in loss of livelihoods, production and other prolonged economic impacts and types of suffering can trigger mass migration or population displacement. Migration to developed urban areas creates overcrowding in the cities. These migrants swell the ranks of the urban poor and end up living in marginal lands in cities that are prone to floods or other risks. Selective out-migration of the workforce may create complex social problems. In a majority of cases where able-bodied males members are forced to migrate, the safety of women, children, the elderly and the disabled who are left behind becomes an important issue. It may damage the community function and social structure and further increase the vulnerability of the population.

*Psychosocial effects*: The huge psychosocial effects on flood victims and their families can traumatize them for long periods of time. The loss of loved ones can generate deep impacts, especially on children. Displacement from one's home, loss of property and livelihoods and disruption to business and social affairs can cause continuing stress. The stress of overcoming these losses can be overwhelming and produce lasting psychological impacts.

*Hindering economic growth and development:*[10] The high cost of relief and recovery may adversely impact investment in infrastructure and other development activities in the area and in certain cases may cripple the frail economy of the region. Recurrent flooding in a region may discourage long-term investments by the government and private sector alike. Lack of livelihoods, combined with migration of skilled labour, may have a negative impact on a region's economic growth. Loss of resources can lead to high costs of goods and services, inflation and loss of economic growth of the region or the country at large, delaying its development programmes.

*Political implications:* Ineffective response to relief operations during major flood events may lead to public discontent or loss of trust in the authorities or the state and national governments. Lack of development in flood-prone areas may cause social inequity and even social unrest. Such disparities and unequal economic growth can produce regional, social, economic and political tensions.

## 1.3 Understanding flood risks

IFM aims to reduce flood risks, which are defined as the expected losses from given flood events over a specified time period. It is imperative to understand the construct of flood risks which consists of:

- The magnitude of the flood hazard expressed in terms of frequency and severity (depths of inundation and related velocities);
- The exposure of human activities to flooding;
- The vulnerability of the elements at risk. (See Figure 1)

Most often, when defining risks, exposure to hazard and vulnerability are combined and expressed as vulnerability. In this publication, when defining flood risks, a clear distinction between the two is considered essential to analyse the flood problem, clearly distinguishing between strategies that can be adopted from an engineering perspective from those that require consideration of social issues. A thorough risk analysis, which includes an assessment of hazards, community vulnerability and development requirements for building societal resilience, must be carried out. IFM aims at reducing the flood risks through a judicious combination of measures that address the magnitude of the hazard, exposure and vulnerability. Flood risk reduction measures must be undertaken in conjunction with water resources management and development activities in the basin and regional and national spatial planning. In order to reduce the risks, changes in the upper, middle and lower reaches of the river caused by development activities should be taken into consideration. As such, the entire river basin should be taken as a single entity and managed according to its hydrological, rather than administrative or political boundaries. These measures need to be consciously designed to cause minimum impacts on the environment.

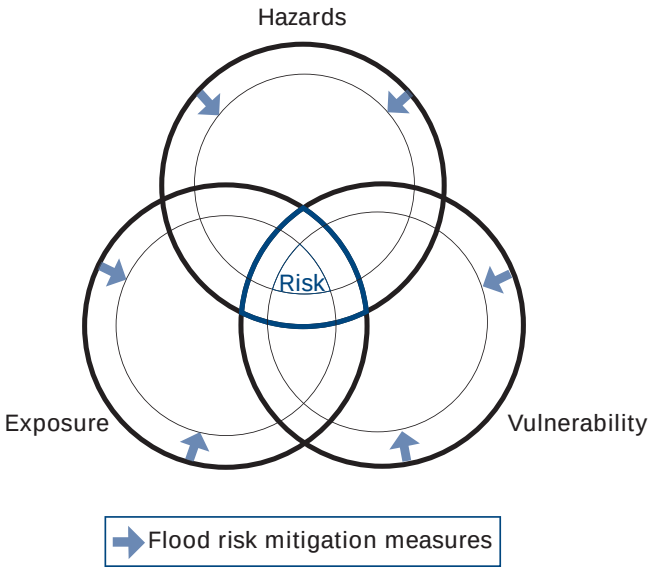


**Figure 1. Construct of flood risk and its reduction**

Floods are generally an outcome of a complex interaction between natural random processes in the form of precipitation and temperatures with basin/watershed characteristics. While normally the rainfall characteristics do not change substantially over time, watershed characteristics undergo a continuous change due to human activities and can therefore effect a change in flood magnitudes. Urbanization in the upper catchments induces higher runoff and thereby increases flood hazard magnitudes. This phenomenon is particularly evident in smaller catchments. Canalization and continuous embankments in the upstream reaches can also increase the flood

magnitudes in the downstream reaches of the river. Similarly, blockage of carrying capacity of the waterways downstream due to constriction caused by bridges across waterways is also likely to affect flood magnitudes in the immediate upper reaches. Dams and reservoirs can reduce the severity of flood hazard in their downstream by detaining floodwater during flood peaks. Development activities and flood management measures must therefore be designed in such a way that development activities do not contribute to an increase in flood magnitudes.

## 1.4 Risk perceptions

Planning for risk reduction in IFM requires a clear understanding and awareness of existing and potential flood risks. Unless the population is aware of the risks it faces, local energies cannot be mobilized to build resilience. Being aware of risks is an essential requirement for undertaking precautionary actions. As such, understanding of risks should be viewed as the first essential step in drawing up an action plan. For effective community participation in IFM including emergency preparedness, it is essential that the community is made aware of the flood risks and the factors that determine them.

Risk perception created by flooding among communities and within a community differs considerably. The new settlers/migrants or refugees in a flood plain may not be aware of the causes, frequency and likely magnitude of flooding in a given area and are vulnerable because of their lack of knowledge. People living in areas subject to infrequent or flash floods with a return period of more than a lifetime lack such knowledge. The demographic composition of the population, for example elderly citizens who may have experienced the strongest flooding in the region, also reflects on how the community perceives these risks. Perception about risks and corresponding responses within a community can also vary according to their relative educational level, economic status and political clout.

It is also necessary to be aware of the man-made factors that can add to the intensity and severity of floods, thereby increasing flood risks. Poor land use planning of urban areas under development can significantly reduce open spaces and prevent infiltration when the natural ground is covered with impervious material. This has effects on infiltration and the ground's natural retention, thereby increasing the runoff volumes in downstream reaches. Deforestation in the upper catchments areas changes the basin's sediment response causing land erosion, siltation and raised riverbeds. Certain agricultural practices also affect the river basin's hydrologic response and consequently, flood risks. Similarly, flood control measures or development projects undertaken in the upstream areas can have serious impacts on the downstream areas. High embankments built to protect flood-prone areas cause a significant rise in water level within the river channel. These higher flood levels are transmitted over long distances along the river, sometimes hundreds of kilometres, and thereby increase the risks due to flooding in downstream areas.[11] It is important to understand the pros and cons of various development projects and all planned flood management options relating to the risks.

Where large-scale structural flood control measures, such as dykes, reservoirs, levees and floodwalls have been constructed, protected communities generate a false sense of security over a period of time. These structures are usually built to provide protection from a certain flood magnitude. If a flood larger than the designed flood occurs or certain conditions undermine the

stability of the flood protection structure, protection measures are likely to fail. Therefore, it is vital for the protected community to recognize the limitations and level of the protection that these structures can offer and be aware of residual risks. Contingency plans for meeting such situations are therefore essential to respond and prepare for such residual risks.

## 1.5 Understanding vulnerability

Vulnerability to floods is a community's proneness to be impacted adversely by flooding and is represented by the inability or incapacity of a community or a group to anticipate, cope with, resist and/or recover from its impacts. It is the condition that determines the transformation of a hazard into a disaster. It not only impedes appropriate response but accentuates the severity of the impact that may be further exacerbated long after a disaster has struck. Vulnerability to floods is a combination of complex, dynamic and interrelated mutually reinforcing conditions that can be divided into three major groups as follows:

- Physical or material;
- Constitutional or organizational;
- Motivational or attitudinal.

Conditions of vulnerabily are outlined in Box 1[12] below.

**Box 1. Vulnerability conditions**

Physical/material conditions
- Initial well-being, strength and resilience (high mortality rates, malnutrition, disease)
- Weak infrastructure, such as buildings, sanitation, electricity supply, roads and transportation
- Occupation in a risky area (insecure/ risk-prone sources of livelihood)
- Degradation of the environment and inability to protect it

Constitutional/organizational conditions
- Lack of leadership, initiative, or organizational structure
- Lack of or limited access to political power and representation
- Lack of or poorly resourced national and local institutions
- Unequal participation in community affairs
- Inadequate skills and educational background
- Weak or non-existent social support networks
- Limited access to outside world

Motivational/attitudinal conditions
- Lack of awareness of development issues, rights and obligations
- Certain beliefs and customs and fatalistic attitudes
- Heavy dependence on external support

### 1.5.1 Contributing factors

Social factors contribute to or influence these conditions to determine community vulnerability. Some of these that are relevant to flood management such as poverty, livelihood opportunities, cultural beliefs, human rights, gender inequalities, and special needs of weaker social groups are briefly discussed below.

*Poverty:* The widening gap between rich and poor, rural and urban incomes and hence the disparity in living standards can be witnessed in the flood plains of developing countries. For small landowners with marginal degraded flood-prone lands, frequent flooding can decrease the returns from working the land. In some areas, contaminated waters and deteriorating soil quality are causing lower crop yields, thus reducing food security and earning potential of marginalized landholders after a devastating flood. The rural poor who depend on incomes from farming or other agricultural activities or make a living as hired farm labourers, with no reserves to put them back on their feet or pay for basic needs, are obliged to migrate to the cities and usually drive themselves into debt. Newcomers to an urban setting, not being able to afford safe, expensive, economically strategic locations in the city, are obliged to settle in makeshift dwellings in informal settlements on marginal lands near the river or other drainages and are subject to frequent flooding. Such settlements with temporary structures often lack public service infrastructures such as drinking water, sanitation and health facilities and are extremely vulnerable to flooding.

*Livelihoods:* The principal livelihoods of communities living in rural flood plains are mainly farming and fishing. However, recurring floods threaten the stability of the their livelihoods owing to the loss of farm products or limited access to the markets for their products in the absence of adequate transport infrastructure. The landless poor, working as hired labourers, particularly during long flood seasons, have trouble finding jobs to meet their basic needs. Alternative livelihood options, such as traditional handicrafts for women, seasonal fishing and shrimp farming, commercial and small-scale plantations of water-resistant plants or trees such as bamboo or banana to supplement their incomes and for other uses as well, can greatly reduce the vulnerabilities of flood plain communities.

*Cultural beliefs:* Some cultural beliefs and fatalistic attitudes towards life and a general resistance to adapt to new realities contribute to a community's vulnerability. In many societies, natural disasters are considered to be acts of God and there is nothing human beings can do to prevent it. Lack of faith in the social system and lack of confidence in themselves to be able to manage the change manifests itself in resistance to any such change. Sometimes mitigation measures are developed without accounting for the diverse culture, religious beliefs and customs of ethnic minority groups. Cultural beliefs entrenched in respect of nature, for example, rivers and trees, can be conducive to the adoption of certain measures such as living with floods. Education can play an important role in creating awareness and changing behaviour commensurate with time. It is important to acknowledge native customs and beliefs and indigenous knowledge, ability and willingness to read and heed nature. Often it is not sufficiently recognized that old traditions and experience from the past were manifestations of certain given conditions. With mounting development demands on natural resources, the response of the natural elements is changing and future behaviour may not always match the results experienced in the past. As such, limitations of indigenous knowledge due to changing risk scenarios and availability of new options based on technological advances should be kept in mind.

*Human rights:* Unequal distribution of resources and access to human rights can lead to conflicts and discontent, and in turn, the deterioration of social systems. For example, individuals who are denied the right to freedom of association and access to information may be precluded from discussing issues related to flood preparedness and mitigation planning, receiving essential fundamental services and taking preventive measures to protect themselves from flood hazards. At the same time, suitable response and recovery programmes can be designed and implemented if the affected communities enjoy the rights to express their concerns and needs to enable them to participate in decision-making processes.

*Gender:* In societies where the decision-making power resides solely in the men of the family, ignoring the wisdom and experience of women and denying or limiting them the adequate access to knowledge and capacity development schemes, which otherwise may be available to men, can deny the society the use of such human resources and contribute to women's vulnerability to security, health and well being, economic security and livelihoods. In the context of floods, there are specific vulnerability and impacts on women: additional stress and fatigue caused by continued responsibilities for cooking, water collections and distribution; child and aged care in limited spaces; and limited availability of fuel, food and supplies. In addition, women face loss of privacy while living in shelters or camps, constrained facilities for sanitation, threats of sexual abuse and trauma.

It has not been adequately recognized that the continuous stay of women at home gives them a special stake in protecting the house and the family properties. Together with the intimate knowledge of the surroundings and ability to monitor the flood situation, it can be put to beneficial use in developing preparedness strategies at the household level. Women are more likely to share information, ideas and resources as they build networks of families and friends at work, in schools and in their neighbourhoods. Often women groups take the lead in helping rebuild community solidarity after a disaster.[13]

*Weaker social groups:* In a society made up of various social groups, the needs of each group differ. Children, women, elderly and disabled people who are not able to overcome adverse physical situations have unique group features that add to their vulnerabilities. The majority of casualty figures during flooding are made up of children who get drowned, bitten by poisonous insects or snakes, carried away by high floods or electrocuted. Special requirements and capabilities of children during emergency situations should be incorporated into flood preparedness and management strategies. Exclusive programmes targeting children to reduce their vulnerabilities can be included in educational activities, the publication of picture books on what to do and what not to do and more practical activities such as teaching them how to swim. Similarly, the evacuation of old people and the provision of special medical care should be regarded as a priority during any emergency response. On the other hand, they are a valuable source of community memory and history.

Minority and ethnic groups that may not be woven smoothly into the fabric of the society have special needs. They sometimes tend to segregate themselves from others and are not in contact with those "in the know", limiting their awareness of flood risks. Therefore, it is imperative to consider the roles and needs of various social groups within the disaster risk management framework and the long-term impacts of flood events on each group.

# 2. SOCIAL ASPECTS OF FLOOD RISK REDUCTION

As discussed earlier, flood risks can be reduced by decreasing the magnitude of hazards, preventing exposure of people and their activities to flooding and diminishing the vulnerability of flood-prone communities. This chapter discusses means of preventing exposure to floods and measures aimed at reducing vulnerability.

## 2.1 Reducing exposure

Exposure to flooding can be generally reduced through:

- Structural flood mitigation works;
- Land-use planning and regulation;
- Flood emergency measures.

Structural measures include the construction of levees, floodwalls and bypass channels. These measures reduce the probability or degree of exposure to flooding but are not discussed further in this publication as they fall outside its scope. Structural measures such as flood-proofing, are discussed later, as their implementation requires the active involvement of civil society. Land use regulations attempt to reduce exposure to flooding by keeping people away from flooded areas. People's exposure to impending floods can be prevented through flood emergency measures that involve moving them away from the flooded areas to avoid casualties caused by drowning or the spread of disease. Economic activities that are likely to be adversely affected by flooding can also be halted through early warning.

### 2.1.1 Enhancing structural resilience: flood-proofing

Flood proofing is the provision of semi-structural measures to mitigate or minimize the damaging impact of flooding by avoiding exposure to floodwaters. Flood-proofing solutions can also be applied at the individual household or community level. Flood-proofing measures for individual houses and important infrastructures such as public buildings, hospitals and schools that attempt to keep water away from people and economic activities are also known as semi-structural measures. These measures provide possible options of living with floods and facilitate the active participation of communities. Flood-proofing has been practiced in many parts of the world for a long time and has become popular in recent years through a combination of traditional and new technology-based measures. It can create safe living conditions for individuals or communities that, owing to their strong attachment to the areas in which they live, do not wish to move to safer places. These measures feature low maintenance costs and should conform to local conditions. There is also a need to provide training to the communities to maintain these systems.

Key public infrastructures such as schools and community health care facilities which are also used as temporary shelters should be flood-proofed. Communication links and water supply sources, as well as buildings used to store emergency supplies, should undergo appropriate flood-proofing. One of the most common approaches to flood-proofing is raising the plinth levof buildings and homesteads. Raised homesteads allow floodwaters to flow under or around a

building, causing little or no damage. In certain situations entire villages are raised above flood level, or floodwalls are erected around the village. The level of raised plinths must be sufficient to ensure that the building remains above flood level. Emergency flood-proofing methods involve erecting temporary structures, building sandbag walls and protecting damageable contents. Flood-proofing feasibility and the decisions as to which method should be applied take into account costs, type of building, infrastructure location, flooding characteristics and the level of exposure to flooding. The United States Federal Emergency Management Agency (FEMA) breaks flood-proofing down into five groups:[14]

1. *Relocation:* moving away from the flood-prone area;
2. *Elevation:* raising the building above the flood level, either on piles or on a mound;
3. *Floodwalls:* concrete or steel walls to keep the flood out;
4. *Dry flood-proofing:* making the building water-tight;
5. *Wet flood-proofing:* allowing basement and ground floor to flood while keeping habitable portions of the building above flood level.

Table 2 outlines some flood-proofing methods.

It is advisable that flood-proofing techniques be formulated, designed and implemented under the supervision of experienced personnel to ensure adequate consideration of all factors that could have a bearing on safety and the effectiveness of techniques. Maintenance must be performed on a regular basis. It is imp rtant to remember that floods may exceed the level of flood-proofing protection provided. Therefore, securing property and vacating premises during severe flood events should be planned in advance and forecasts and flood warnings constantly monitored.

### 2.1.2 Land use planning and regulation

Land use regulation combined with building and infrastructure codes and design practices can help reduce the exposure of economic activities to flooding. Land use legislation enables the establishment of standards for the use, development and protection of land in such a way as to minimize the risk to the population and prevent the natural resources from being destroyed during the flooding. Flood plain zoning, where the degree of flood hazards within the catchment area is carefully matched with appropriate landuse measures, is a major non-structural measure that can prevent hazards from turning into disasters. Flood hazard and flood risk maps, which provide information on the past history of flooding and the likely or potential extent of future flooding in combination with other related information, are decision-making aids for use in IFM. For example, communities already settled in flood-prone areas will require certain incentives to move out of the flood's way: assistance in moving to safer areas offering appropriate livelihoods and/or good transportation connectivity to their farms or other means of business.

In regions undergoing rapid urbanization, policies related to land use management, integrating management and protection of natural resources, such as land, water and vegetation, and human activity, are particularly important. Development activities, if not undertaken carefully, can interfere with natural drainage, destroy flood retention systems such as wetlands and swamps and decrease the infiltration of rain water into the ground due to urbanization. Regulating development works or public infrastructures, such as the pavement of roads on a flood plain through specified regulations, is therefore essential. Urban development planning should be controlled

**Table 2. Flood-proofing techniques[15] [16]**

| Individual houses/public buildings | | | |
|---|---|---|---|
| **Flooding characteristics** | **Type of flood-proofing** | **Type of building** | **Description** |
| Deep flooding | Elevated buildings over earth filling/ piles/ poles/ stilts | Bamboo or wooden houses or houses made of easily disassembled materials or concrete building with firm pillars | The elevation height should be sufficient to ensure that the lowest floor level is higher than the expected floodwater level and allows free passage for floodwater, without damaging the interior of the building. |
| | Floating houses | Bamboo or wooden houses | This is applicable in cases of low flow velocity. |
| | Constructing barriers/ floodwalls between buildings and floodwaters | Brick or concrete buildings | Watertight barriers (berms, levees or reinforced flood walls) are built around or on the side of the building to stop floodwaters from reaching the damageable portions of structures. The barriers can be made of earth, concrete, masonry or steel.<br>All areas below the flood protection level are made watertight; walls are coated with a waterproofing compound or plastic sheeting. Openings, such as doors, windows, sewer lines and vents, are protected with sandbags or removable closures or shutters to secure the building against the entry of floodwaters. This technique may not be appropriate for homes with basements since they are more prone to under seepage. |
| Shallow flooding | Dry flood-proofing or sealing | Brick or concrete buildings | The building is sealed so that floodwaters cannot get inside. All areas below the flood protection level are made |

| | | | |
|---|---|---|---|
| | | | watertight. Walls are coated with waterproofing compounds or impermeable sheeting. The design should consider the buoyancy effect caused by the sealed basement. In some cases, basements could be wet flood-proofed to allow the water in to avoid buoyancy.<br><br>Openings such as doors, windows, sewer lines, and vents are closed with permanent closures or removable shields, sandbags and valves. This technique is not as successful in crawl spaces or basements of buildings since those structures are difficult to protect from under seepage. Dry flood-proofing is frequently used where there is insufficient space for a berm or levee. |
| | Wet flood-proofing | Brick or concrete buildings with available areas above flood level or basement | Wet flood-proofing allows the floodwaters to enter the structure. The building is modified so that utilities and furnaces are protected or relocated to an area above the anticipated flood level. Wet flood-proofing is often used when dry flood-proofing is not possible or is too costly. |
| Flood of any intensity | Temporary removal of goods | Goods, equipment,supplies | Goods removed to higher ground or safer areas for substantial reduction of damages. |
| | Watertight storage facilities | Storage tanks to keep goods, equipment, water or food | Storage tanks fitted with watertight caps to prevent goods and equipment from flood damage. |
| | Proper anchorage | Buoyant materials or structures, such as lumber, plastic or furniture | Anchoring structures that can be carried away by floodwater not only to reduce losses but also to prevent possible wreckage and debris downstream. |

| | | | |
|---|---|---|---|
| | Utilities service protection | Water supply, water distribution system | Utility systems checked for leakages and repaired regularly to prevent any contamination. |
| | Extra coating/ installation of fuse/ prop up using poles | Electric wires, electrical systems, electricity lines | Proper fuse protection for individual buildings, additional coating for exposed wires and propping up of electricity lines in public places to keep them away from water can reduce the likelihood of fire caused by electric short circuits and electrocution. |

through regulations, disincentives or incentives for developers. Developers who are prepared to include features in their town planning that would reduce peak flows could be given discounts on land taxes based on planning and design endorsed by the authorities.

Deforestation and loss of vegetation in the watershed is known to increase the incidence of mudflows, shallow landslides and sheet erosion, thereby causing higher sediment yield which results in the siltation of detention reservoirs and sedimentation in river reaches and in turn decreasing their conveyance capacity. Watershed management and appropriate forest management practices can help prevent these conditions as shown in Box 2. Farmers adopting slash and burn cultivation can be made aware of the adverse impacts of their actions on downstream communities. With the assistance of the government and other relevant agencies, alternative livelihood arrangements for them can be made. In some cases, offering incentives and trade-offs can be more effective.

These measures can be successful only if an appropriate legal and institutional framework, along with suitable economic incentives and disincentives, are put in place and are effectively implemented on the ground. Good governance is an essential ingredient. Proper law enforcement requires political will and can significantly help restrict unlawful development activities, such as the illegal reclamation of lands from water bodies. The involvement of stakeholders in deciding the kind of land use management measures that should be adopted can also facilitate their implementation since they are the ultimate beneficiaries and can therefore be useful allies in implementing regulations. The right blend of law enforcement, education and incentive schemes is vital.

### Box 2. Soil conservation in the Loess Plateau of China[17] [18]

The Loess Plateau in the upper and middle reaches of the Yellow River is one of the most severely eroded areas in the world. Soil and water loss in the plateau is the outcome of a number of natural and human activities. Soil and water conservation techniques for large-scale soil loss control were developed and undertaken at high priority. These soil conservation measures consist mainly of engineering and biological measures and conservation farming.

Engineering measures:

- Slopes: terraces, ponds and land levelling for afforestation
- Gullies: interception banks to protect gully heads, check dams, silt trap dams and small reservoirs
- Farmland: terracing and silt trap dams to increase agricultural output
- Formerly cultivated sloping land: restoration of forest and grass on slopes

Biological measures:

- Improvement/restoration of vegetation covers by introducing suitable species of trees, grass and bushes in appropriate combinations
- Development of grass and forest areas to conserve soil and water
- Development of animal husbandry, forestry and orchards

Conservation farming for moisture and earth retention

- Fallow fields, limited tillage, cultivation along contours, contour furrow-and-ridge planting to detain water and soil

### 2.1.3 Flood emergency measures

One of the most important measures designed to reduce exposure to floods, particularly when dealing with residual risks and living with floods, is the evacuation of flood-prone populations from likely flooded areas. Local authorities are best placed to take a decision on when to evacuate, a perfect example of a critical decision taken in the face of uncertainty and under time pressure. Fatalities caused by flooding occur when the event is not considered dangerous, time is too short to reach safe haven or a place believed to be safe is not. However, convincing the public of the likely impacts of impending flooding of rare severity is difficult and requires awareness building. Exemplary action by the authorities in charge, which in public perceptions are likely to know more, is very useful. Once the authorized organization has given the order to evacute, a rescue operation should be undertaken to move people out of potential flooded areas on to safer ground or relief camps. Evacuees should be provided with basic needs and attention given to the injured. These operations require human financial resources backed by appropriate organizational mechanisms and skills. Unfortunately, rescue means are lacking in most developing countries. This deficiency can be partially compensated by sound evacuation plans prepared in close consultation and coordination with the communities and local government. Special mechanisms to take care of the weak, the elderly or disabled, for example, should be established in communities and be part of community flood management strategies. While a slow rise in flood levels provides ample time to plan an evacuation, flash floods put the entire onus of

evacuation on the individual, with the community providing the information about the impending event through community-based warning and alert systems and designated relief shelters. Evacuation plans should be formulated in the overall framework of flood emergency management as discussed below.

## 2.2 Flood emergency management

Absolute protection from floods is a myth. No matter what strategies are adopted to reduce flood risks, there will always be some residual risks. Flood emergency management through flood preparedness, emergency response based on flood warning and post-disaster recovery form an integral part of flood risk reduction. Flood emergency management is aimed at managing and minimizing the damaging effects of flooding, once the flood waters come in contact with human and economic activities. The objective is to avoid the exposure of critical activities and temporarily shift people and such activities from flood-prone areas, thereby reducing the negative impacts of flooding on the community. Flood emergency management plans should form part of a comprehensive multi-hazard strategy towards risks in the region. Flood emergency management can be divided into three stages:

1. Preparedness: pre-flood measures to ensure effective response;
2. Response: measures to reduce adverse impacts during the flooding;
3. Recovery: measures to assist the affected community to rebuild itself.

Emergency management requires cooperation across sectors and administrative levels. In addition to resource mobilization, continuous, timely and precise information flow is vital for handling emergency situations. The development and implementation of flood emergency management strategies call for regular review and revision. Lessons learned and good practices of one flood year need to be integrated into future plans.

### 2.2.1 Flood emergency preparedness

Preparedness is defined as "activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations".[19] Early warning systems, education and public awareness, coordination among governmental and non-governmental agencies and effective stakeholder participation are key components of preparedness planning.

*Raising public awareness*

Awareness of existing risks is the first step towards preparedness. Local energies can be mobilized to build resilience, for instance to move to a safe place in the case of flood event or to minimize vulnerability before an event, only if there is sufficient awareness of the risks. Awareness can be raised through a number of mechanisms: education, regular training, particularly in areas exposed to infrequent hazards or with new settlements. Flood hazard maps, depicting flood-prone areas, evacuation routes and safe shelters, can play a critical role in awareness building. Women and children should be included in education strategies, as they are disproportionately affected by natural disasters. Special efforts should be made to reach out to minorities

and ethnic groups who may not otherwise be well informed about hazards and risks and their mobility may be limited or affected owing to cultural, social and economic constraints.

*Emergency preparedness plans*

Preparedness begins at the community level since community members are the first responders. Improving the ability of a community in a vulnerable area to respond to floods is the prerequisite for flood risk reduction. The local inhabitants should be facilitated and empowered to plan and implement their own flood preparedness measures that reflect local conditions and real needs on the ground. A brief list of flood emergency preparedness activities is provided in Box 3. Preparedness plans should be adequately linked to local district, state and national disaster management entities. Community-level plans should also be suitably linked to flood management and development issues at the basin level. The emergency planning process and its relationship with the basin planning process is discussed subsequently in 3.2.4.

A common platform should be established for local communities in the basin to meet and share emergency preparedness plans. This facilitates the exchange of information between the communities within the basin on their common concerns and needs, it helps to create synergies for collaborative activities between neighbouring communities and to make trade-offs and compromises.

*Coordination mechanisms*

Government agencies from local to national levels share flood emergency operation responsibilities. Accordingly, various departments mandated for emergency response should form disaster response committees and meet regularly, at least once a year, well before the flood season, to exchange information on their jurisdictional responsibilities. Requirements relating to food, emergency shelters, evacuation of people, health services and emergency building materials are assessed. Paramilitary and voluntary organizations, which form the backbone of disaster response and international humanitarian organizations, should also be involved in such an exercise. Disaster response committees should review experiences after a major event and learn lessons to make future adjustments and improvements in existing plans. At the community and municipality level, mock exercises of evacuation and emergency situations strengthen the preparedness coordination mechanism .

**Box 3. Flood emergency preparedness activities at various levels**

1. Individual, family, household level
   - Knowing the risks: electrocution, poisonous animals, waterborne diseases, drowning
   - Installing protective railings around house to protect children from falling into the water and to provide support for the elderly
   - Scouting for safe areas and knowing how to get there
   - Knowing what to do when a warning is received
   - Knowing whom to contact in case of emergency
   - Keeping life jackets or buoys or tyres
   - Keeping a first aid kit

- Storing clean water and food
- Listening to daily flood forecasts
- Moving valuable items to higher ground
- Getting ready for evacuation
- Protecting the livestock

2. Community/village level
   - Identifying and maintaining of safe havens, safe areas and temporary shelters
   - Putting up signs on routes or alternate routes leading to safe shelters
   - Informing the public of the location of safe areas and the shortest routes leading to them
   - Having all important contacts ready: district or provincial and national emergency lines; and having a focal point in the village
   - Making arrangements for the damage and needs assessment team and health team
   - Setting up community volunteer teams for a 24-hour flood watch
   - Improving or keeping communication channels open to disseminate warnings
   - Distributing the information throughout the community

3. Municipality, district, province and national levels
   - Determining the roles and responsibilities of each agency in response, relief and recovery
   - Preparing maps (flood risk/inundation/vulnerability maps, resource maps) to provide essential information and data on the current situation and to plan for assistance in those areas
   - Making sure that critical roads are built up to a certain standard height to serve two purposes: to create safe areas for flood-affected communities and continuing transportation critical for flood relief
   - Identifying new safe areas and maintaining existing shelters, making sure they have sanitary and other basic necessities
   - Implementing public awareness activities in order to create a proactive and prepared society, which can cope effectively with hazards and their aftermath
   - Educating the public on what to do and what not to do to prevent harmful activities in the flood plain
   - Educating the public on environmental management, water resources utilization and land use planning
   - Stockpiling relief goods
   - Preparing resource inventories – how much is available locally and how much is needed from the outside
   - Planning resource mobilization
   - Setting up emergency teams such as health teams, search and rescue team
   - Planning to assist in emergency response at the local level
   - Conducting drills for search and rescue teams
   - Making sure that the communication channel to the community is functioning well
   - Issuing orders for various agencies and organizations to get prepared
   - Inspecting flood mitigation infrastructure such as dykes, levees and floodwalls
   - Dissemating public safety information through the establishment of early warning systems, specifying the source and actions to be taken immediately after receiving warnings

### 2.2.2 Flood emergency response

When flooding is inevitable, it is important to take measures which reduce the adverse impacts of such a situation on the daily life of people affected. This is the stage in which the effectiveness of the preparatory work conducted during the pre-flood season is tested. Early warning, protection of critical infrastructures, assessment of immediate needs, provision of safe shelters for the affected population and adequate facilities are the key components of flood emergency response.

*Early warning*

Successful emergency operations depend to a great extent on the availability and reliability of and the lead-time provided by warning systems. Continuous monitoring of hydrological and meteorological conditions and resulting phenomenons helps to forecast hazardous situations that could develop within a certain lead-time. Flood early warning is a message informing authorities of the impending danger of floods, that is, the water level rising above the warning level. By forecasting the water level, it can be estimated how much time it will take for a river or tributary to reach the warning level. The longer the lead-time, the more useful the warning, since there is sufficient time to consider and carry out a number of responses. The reliability of the warning and the confidence that it carries with the likely respondents is an important factor that determines its effectiveness. Warnings must be provided and conveyed in an unambiguous, easily understandable manner and in local language through a legally designated single authority. The role of mass media, such as radio stations, newspapers, and television, needs to be recognized and utilized properly to ensure that the warning message reaches the intended audience or vulnerable community with little or no distortion. Nowadays various sophisticated and high-tech tools are available to disseminate the warning to the local community. However, action should be taken to ensure that flood warnings are also issued through a medium that is readily accessible to the poorer communities. There should also be a mechanism within the communities to ensure that the message reaches all individuals, especially the weaker groups or groups with special requirements such as elderly or disabled people.

*Protection of critical infrastructure*

Flood fighting in critical spots to protect major infrastructures such as dykes, levees, hospitals, schools, bridges, or individual houses and to prevent landslides and disastrous river-bank erosions, requires mobilizing men and machinery from unaffected contiguous areas. This includes emergency flood-proofing measures such as sandbagging or building temporary earth or wooden fortifications.

*Rapid needs assessment*

In flood emergency response, local government agencies are expected to assess the immediate needs of the affected communities, conduct the evacuation of the public in high-risk areas, activate local search and rescue teams, take immediate remedial measures to repair or restore damaged infrastructure, such as bridges for transportation purposes, and seek help from state or national authorities when the scale of the disaster exceeds their capacity. As soon as the flood situation becomes critical, a rapid assessment of the latest situation should be made to confirm immediate needs, and updates provided as the situation unfolds. Common damage assessment and needs analysis should be undertaken by the coordinating agencies and information shared with local, state and national authorities and volunteer organizations. The most important feature of emergency response is the timely and efficient coordination between responsible government

agencies, local communities and NGOs. Coordination and cooperation between institutions, humanitarian groups and individual volunteers need to be addressed, particularly in major disasters. Lack of coordination, cooperation and data exchange on needs and available resources between these well-meaning organizations may result in anomalous situations, in which some communities are engulfed with aid materials while others ignored. Particular importance should be given to isolated communities, away from the glitter of media. Without a proper, immediate assessment of community needs, most of the services provided are wasted instead of serving the victims.

*Safe shelters*

Safe shelters need to be identified in advance and evacuation routes leading to designated shelters clearly marked. They should be equipped with food, water and sanitation in order to cater to emergency needs. In relief distribution, it is necessary to have clear and concise answers to three basic questions: who is responsible, how to get the relief items to the affected areas and who is entitled to relief provided. Organization of shelters and distribution of aid among the affected population should be mainly in the hands of local community organizations, such as community flood management committees, which will be discussed subsequently. They not only help to accelerate and streamline smoothen operations but also reduce potential conflicts and discontentment among those affected by the flood. Organizational responsibilities vested in local response agencies will ensure that women and young girls are safe from sexual harassment while staying at temporary shelters or stranded in remote locations. There is a strong link between the well-being of women and children. Therefore, improving the situation of women is the best way to ensure the protection and survival of children when disasters strike. Strong social structures, such as special community support or community flood management committees to deal with psychosocial problems, help the community to cope with psychological trauma. Certain priorities should be set to prepare exclusive response programme to meet the specific needs of infants, elderly people, pregnant women, and the disabled, as illustrated in Box 4.

**Box 4. Emergency day care centres in Vietnam's Mekong Delta**

An innovative programme in the Mekong Delta of Vietnam has been successfully developed, pilot tested and run, initially by the United Nations Children's Fund (UNICEF) and then, by the Women's Union. In response to a large number of children's deaths, UNICEF Vietnam began supporting Emergency Day Care Centres (EDCCs) in 2001 in the three most flood-prone provinces in the delta. During flood events, parents who need to travel long distances to work can leave their children, aged from 1 to 6 years, at EDCCs to be looked after for a minimum fee of US$ 3 per month. The fee is waived in about half of the cases since the programme is aimed primarly at low-income families. EDCCs are established in private homes donated for this cause and in health commune stations and schools located on higher ground.

One area that requires attention, particularly in flood-prone locations, is the lack of an exit strategy in relief operations. Poor planning and the lack of such a strategy can make the community overly dependent on relief handouts for their survival rather than addressing their vulnerabilities.

### 2.2.3 Post-flood recovery and rebuilding

A well-designed flood recovery process can help flood-devastated nations, communities and individuals regain their original socio-economic status. The post-flood recovery and reconstruction phase creates challenges to and opportunities for development planners, engineers and builders, aid agencies, disaster management practitioners and most of all, the governments of a flood affected countries and surviving communities so that post-flood recovery and rebuilding do not add to future flood risks. It also provides an opportunity to move vulnerable activities away from the risk areas and flood-proof infrastructures during re-building.

Vital lifeline facilities such as water supply, electricity supply, roads and telecommunications, hospitals and sewage systems have to be repaired as soon as possible. Naturally this can mean provisional repair. Since time is an important factor in the recovery process, often local capacities cannot cope, making external support necessary. Restoring education and health systems, rebuilding damaged houses, restoring contaminated water sources and providing psychological care through counselling should be given top priority during the flood recovery phase.

Once basic lifeline services are restored, long-term development goals and plans should be consulted. The recovery period should be viewed as an opportunity to explore ways to improve the flood risk situation and incorporate enhanced resilience of the rebuilt assets. There is a general tendency to reconstruct the *status quo ante,* which often means that previous errors in development activities are repeated. During the recovery process, provisional solutions are turned into lasting, definitive solutions. Reconstruction provides a great opportunity to reduce vulnerability at little or no extra cost. This phase is a particular challenge to the competent local authorities since reconstruction, which should result in higher, sustainable safety levels, requires planning time in the face of the flood victims' urgent needs. The reconstruction phase should gradually lead to definitive prevention work. It is important that the reconstruction process use local labour and locally available materials as far as possible in order to create jobs and help put the economy back on its feet. Whether the recovery process reduces vulnerability or reproduces risks will also depend on resource availability, existing socio-economic conditions and the political agenda.

Assets and infrastructure should be rebuilt according to the latest standards ("no regret reconstruction"). This implies a waiting period for the objects close to the high-risk areas or any other hazard source, since these areas might fall within the new risk zones prohibiting reconstruction or may be needed for preventive protection work. Building permits should be granted only after reassessment of the hazards. Authorities face great pressure in such situations. If the time pressure is too great, temporary solutions, which do not predetermine final ones, should be chosen. The most commonly used recovery support is the provision of financial aid to rebuild the lives of survivors and to restore their basic livelihoods. Support can be lent in the forms of grants, loans and credits, distribution of construction materials, land, seeds and other essential farming equipment, which should be linked to the observance of risk reduction practices.

*Documentation of lessons learned*

To improve prevention and preparedness, it is essential to learn lessons from past disasters. Damage analysis should begin even before the clean up operations, while traces of flood processes are still visible. Documenting the extent of the flooded area and the level of flooding by updating hazard maps is key to preparing for future flood events and determining evacuation routes, shelter locations and future land use planning. If started at an early stage, the documen-

tation and results of lessons learned can already be used in the reconstruction phase. Besides documenting the disaster, it is necessary to document rescue operations in order to optimize future operations. Since local authorities are usually occupied with the more urgent repair works, external experts, with inputs from the community organizations involved, could carry out the documentation and analysis.

## 2.3 Reducing vulnerability and enhancing resilience

As discussed earlier, a community's vulnerability is determined by prevailing material, organizational and attitudinal conditions. When reinforced through certain social factors such as poverty, gender or livelihoods, they create a variety of complex factors that contribute to vulnerability. The effectiveness of the measures to reduce vulnerabilities and to enhance social resilience can be ensured by properly assessing vulnerability and identifying the underlying factors contributing to its increase. The decision as to what specific interventions should be carried out in a particular area to address vulnerability depends on the following factors:

- Economic activities and degree of development of the area;
- Frequency and intensity of floods in that area;
- Nature of land and land use, for example farms that might need to be flooded occasionally or developed lands that should be safeguarded all year round;
- Anticipated impacts of development activities of one place on another;
- Demand for utilization of basin resources.

Conditions determining vulnerabilities, particularly material conditions, can be improved by economic development and are influenced by a variety of public development policies, largely beyond the ambit of flood management policies. Some of the strategies aimed at mitigating conditions while addressing flood management policies are listed in Table 3 below.

### 2.3.1 Enhancing resilience of and through livelihoods

Resilience is the capacity or the ability of an individual or a community to cope with detrimental conditions. To enhance resilience, it is essential to improve the security of livelihoods, which depends on skills and the availability of alternate livelihood options during critical times. Ensuring that livelihoods are adapted to likely flood risks is one approach. Here the focus is on identifying and implementing alternate wet season livelihoods and/or means to supplement incomes. Special skill improvement programmes and development training for the weaker sections of society need to be undertaken. For example, livelihood support training can provide women with the means to carry out income-generating activities from home, contributing to family livelihood stability. Providing professional tools, such as boats, fishing nets and reconstruction materials, as well as tailor-made packages that address the needs of individual families to re-establish their livelihoods, can enhance the productivity of vulnerable communities. This can be strengthened through post-disaster government/voluntary compensation schemes such as loans and micro credits designed to help poor communities get back on their feet and avoid reliance on external assistance.

## Table 3. Vulnerability reduction strategies

| Vulnerability conditions | Cause | Strategy |
|---|---|---|
| **Physical/ Material** | | |
| • Initial well-being | • Malnutrition, lack of clean water and sanitation, exposure to waterborne diseases, lack of medical facilities and knowledge of how to protect oneself, no food stock saving | • Raising awareness of flood-related health issues such as the importance of clean water and sanitation and how to achieve it, distribution of water purifiers, pills and food, setting up of emergency health units in flood-prone areas. |
| • Weak infrastructures | • Unsafe, flimsy houses, lack of flood-proofing knowledge<br>• Non-compliance with building codes or lack of building codes<br>• Lack of sanitation<br>• Lack of lifelines (electricity, water, roads)<br>• Lack of means of transportation | • Granting government-subsidized building of safer houses for the poor, creating awareness of affordable flood-proofing practices<br>• Enforcing building codes<br>• Improving of infrastructures<br>• Promoting transportation facilities |
| • Occupation in a risky area (insecure/ risk-prone source of livelihoods) | • Lack of skills, poverty<br>• Lack of access and control over means of production<br>• Lack of market access | • Providing skill improvement training, market access and other means of fighting poverty |
| • Degration of the environment | • Illegal logging and fishing, improper garbage disposal | • Regulating logging and fishing practices and installing waste treatment systems through incentives and trade-offs, water quality monitoring, raising public awareness of environmental conservation and management (why and how) |
| **Constitutional/ organizational** | | |
| • Lack of leadership, initiative, organizational structures | • Lack of capacity development and institutional set-ups | • Training courses for community leaders. Organizational set-ups with clear assignment of responsibilities |
| • Lack of or limited access to political power and representation | • Lack of legal frameworks and national government support, totalitarian regimes, fear of failure, lack of initiative | • Training of community leaders in community organizing, skill improvement training to reduce poverty |

| | | |
|---|---|---|
| • Lack of or poorly resourced national and local institutions | • Lack of support from national government, lack of, or poor human, financial and material resources | • Strengthening local institutions through training, seeking external help for more effective technology transfer and financial support, seeking government and international support, establishing support networks for information and knowledge sharing |
| • Unequal participation in community affairs | • Unequal opportunities for women and ethnic minorities<br>• Lack of organizing skills, lack of information on local hazards and associated risks, no support from national government to enhance participation | • Sensitizing the government to set public participation policy in disaster management and planning, awareness raising at the community level<br>• Establishing legal and institutional frameworks, compelling development activities to seek community participation, advocating adoption of the public participatory process at the national level |
| • Inadequate skills and educational background | • Lack of capacity-building resources | • Training for community supported by local and national government |
| • Weak or non-existent social support networks | • Lack of support from the government after disasters, lack of social institutions such as NGOs, lack of unity and cooperation | • Application of social welfare system, third-party involvement (RBOs and NGOs), participatory risk and need assessments at community level |
| • Limited access to outside world | • Remote locations, lack of communication facilities, lack of knowledge and willingness to learn | • Strengthening basic infrastructures such as communication and transportation facilities, awareness raising of community |
| **Motivational/attitudinal** | | |
| • Lack of awareness, certain beliefs and customs and fatalistic attitudes | • Remote location with no communication facilities, lack of education | • Raising awareness of disaster mitigation and preparedness, participatory risks and needs assessments at community level, improving basic infrastructures such as communication and transportation facilities |
| • Heavy dependence on external support | • Lack of confidence to overcome the situation and external support for independence; only ad hoc support for disaster.<br>• Devastating impacts of disasters in which community members lose everything, poorly planned relief activities, indolence, lack of skills to obtain alternate livelihoods, extreme povert | • Micro-credit schemes, skill improvement training<br>• Appropriate exit strategies for relief operations |

### 2.3.2 Flood insurance

Flood insurance is an important risk management tool that can be applied at various levels: individual, corporate and government. It provides a mechanism for sharing potential economic losses with others. The basic principle is to spread the risks over time, and among individuals and organizations, which pay insurance premium against a specific risk. Insurance can play an important role in a nation's social and economic recovery by channelling funds for rebuilding purposes through insurance payments. It eases the burden of the government for having to bear the entire cost of damage caused by floods. However, flood hazards affect all persons at risk simultaneously, thereby making flood insurance commercially unviable. In some developed countries, flood insurance is a legal requirement for all flood plain residents. For insurance to be a practical option, risks and the corresponding premium should be reasonable. The government, however, can develop special schemes for the urban and rural poor featuring a minimum premium. Innovative means and models have been developed in some countries whereby the government pays part of the premiums.[20] Coupled with the appropriate land use control and flood emergency management measures, flood insurance can serve as a useful tool to deal with residual risks. However, it may not be the ideal solution for the poor since insurance premiums can be too high, hindering their participation in such an insurance scheme. Flood risk reduction through insurance is best achieved by enforcing preparedness and flood mitigation measures through incentives in the premiums. Further flood insurance details are explained in the paper, "Economic aspects of integrated flood management".[21]

# 3. STAKEHOLDER INVOLVEMENT IN INTEGRATED FLOOD MANAGEMENT

Flood management is a complex process touching upon a variety of social, economic, cultural and political ethos and the physical and technical realities. Decision-making in flood management has largely been a top-driven, engineering-oriented process. In some countries public consultations have been carried out as part of a legal obligation with little or no participatory elements.

In recent years the need for increased cooperation and collaboration across sectors and public participation has become more widely accepted. The effectiveness of an IFM approach depends largely on mobilizing and rallying for greater stakeholder participation from the start. Greater participation of all stakeholders in flood policy development is considered vital since it enables inhabitants of flood-prone regions to choose the level of risks they are ready to take. A shift from paternalism to informed consent whereby professionals formulate the options for flood management methods, inform the public and seek input and feedback from the public in final decision-making is advocated.[22] The International Strategy for Disaster Reduction (ISDR) advocates the generation and wide dissemination of basic public information on flood risks along with measures on how to reduce them. The combined participation of government agencies, technical specialists and local residents in carrying out risk assessment is identified as a critical function that promotes public participation at local and national levels.[23]

A shared consensus has emerged in the past decade on the importance of participatory planning in disaster management. Individual and community ownership, commitment and concerted actions in disaster mitigation produce a wide range of appropriate, innovative and feasible mitigation solutions, which are cost-effective and sustainable. The International Decade for Natural Disaster Reduction (IDNDR) from 1990 to 1999 initiated a paradigm shift in global disaster management practices with a change of focus from post-disaster relief to more proactive preparedness and mitigation-based approaches.

## 3.1 Stakeholder involvement in flood management

Stakeholder involvement in the decision-making process is perceived differently by different people and depends on the objectives of the process. Stakeholder involvement should de designed to include clear objectives, understanding of the pros and cons and an analysis of the stakeholders that need to be involved. The role of each stakeholder and the mechanism of their involvement need to be carefully designed so that they can be sustainable in the long term. The basic issues to be used in designing and sustaining the participatory process in flood management are discussed below.

### 3.1.1 Objectives

National development plans are usually composed of sectoral and provincial plans that need to be reflected in basin flood management plans. The IFM approach requires management strategies relating to water resources, land use, disasters, the environment and floods to be sensitive

to flood risk issues. It calls for coordination between different sectoral planning processes at various levels. IFM principles can be best adopted through participatory process which involves stakeholders in shaping, developing, identifying and implementing flood management strategies along with monitoring and evaluation during its implementation. The objectives of stakeholder participation in IFM are as follows:

- Provide all stakeholders, including the public, with full opportunities to share their views and influence the outcome;
- Build consensus and public support for the outcomes;
- Build stakeholders commitment;
- Ensure implementation of basin flood management plans with full public support;
- Ensure sustainability of plans and associated decisions;
- Build resilience of flood-prone communities.

### 3.1.2 Benefits

The participation of different stakeholders, particularly people who are affected by the implementation or non-implementation of flood management measures, should be seen as part of the process and not an external burden for the following reasons:

- It brings together a diverse range of stakeholders to share needs, information, ideas and knowledge and harmonize the objectives of individual groups in reaching common societal goals.
- It provides all stakeholders and the public with appropriate information so that they can understand the process, the issues and the values.
- It enhances understanding between stakeholder groups, thus reducing potential conflicts and promoting effective cooperation.
- It identifies public concerns and values and helps produce better consensual decisions.
- It ensures that the priorities of those affected by the plan are addressed.
- It builds resilience in communities through cooperation and coordination.
- It ensures the sustainability of measures adopted.
- It brings autonomy and flexibility in decision-making and implementation.

### 3.1.3 Potential pitfalls

Moving from a top-down approach to a combined top-down and bottom-up approach may prove to be cumbersome for decision makers who are unfamiliar with such an approach. Far from building consensus, the participatory process can generate conflicts and has the potential of stalling development. It is important, therefore, to identify the pitfalls and limitations of stakeholder participation so that remedial measures can be included in the planning and implementation processes from the start. Pitfalls will differ in varying socio-economic, cultural and political settings and include the following:

- High expectations leading to disappointment if the process is terminated prematurely or implemented unsatisfactorily;
- The complexities of involving all stakeholders may render the process unwieldy and costly;
- Insufficient involvement of the real decision makers leading to sub-optimal results;

- The process is time consuming and requires long-term commitment. A prolonged process may cause people to lose interest after a while. In such situations, more often than not the only people who remain are those who are opposed to the process;
- Lack of financial and human resources and the high costs of bringing together many stakeholders over a large geographical area may delay or prematurely terminate the process;
- People tend to discuss various options only in terms of content without addressing their economic viability.

It therefore is crucial to identify the potential pitfalls of a given situation, design the process carefully, set a reasonable but definitive time frame in consultation with the stakeholders to ensure that consensus is reached and activities are implemented within a set time frame.

### 3.1.4 Stakeholder analysis

It is necessary to identify the players who should be involved in the participatory process. According to the global village concept and the way in which developments in one part of the world influence lives in another, almost every one is concerned by the consequences of a possible disaster unfolding in any part of the world. However, too many stakeholders can render the process unwieldy and unproductive. For effective integrated flood management and river basin development, it is important to carefully identify all relevant stakeholders. Stakeholders involved in IFM can be divided into seven groups:

- Government ministries, departments and agencies;
- Flood-prone communities;
- Other basin communities ;
- Scientific institutions;
- Registered NGOs;
- Voluntary organizations;
- The private sector.

In a welfare state, governments have the prime responsibility of ensuring the safety and well-being of its citizens. Flood management, which is closely linked to other development activities in the basin, particularly water resources management is no exception. Development activities carried out by various government agencies have an effect on flood risks within a basin. It is, therefore, important that all relevant departments at the national, state, district and municipal levels be part of the stakeholder group devising flood management strategies and take part in flood management planning. Most of these agencies are also involved in flood disaster preparedness. Institutions engaged in disaster management are important stakeholders, as their interaction with flood-prone communities, NGOs and voluntary organizations is crucial during flood emergency operations.

Flood-prone communities are at the core of all flood management activities and are major stakeholders. In addition, other basin communities also influence flood risks through land use change and can play an important role. The behaviour of communities involved in watershed and forest management can also influence flood management policies and practices in the basin. Communities affected occasionally by controlled flooding aimed at preventing flooding of strategic areas should also form part of flood-prone groups. NGOs can influence the behaviour of

stakeholders, particularly basin communities, by building awareness and disseminating information and can help flood-prone communities organize themselves. Technical NGOs can provide information about the complex and uncertain state of knowledge and processes to the man on the street in readily understandable language and help them voice their concerns. They can also provide important input by presenting unbiased scientific studies. In flood emergency situations a number of humanitarian and voluntary organizations come forward and play a crucial role during emergency response. Similarly, the private sector, which is directly or indirectly affected by flooding is an important stakeholder. The areas of interest and responsibilities of stakeholders in the flood management process, their anticipated interest and tasks in IFM are described in Annex II.

In designing the participatory process, the level of involvement of each stakeholder, depending on the given institutional framework, differs and should be defined. Different levels would require the involvement of different stakeholders. Experience shows that involving all stakeholders to participate fully in all decision-making stages is neither realistic nor useful in a given situation. Each stakeholder category in the above list has a specific role to play and can be said to have an orbit of influence with respect to a particular activity (Figure 2.).[24] [25]

The decision-makers, who are at the centre of a orbit of influence, are the starting point in a decision-making process. The first orbit contains the stakeholders who are partners in decision-making. Final decisions must be made with theie concurrence. Orbit 2 features the creators, who are deeply involved in the decision being made and in developing alternatives and are therefore constantly involved. Orbit 3 consists of the advisors, who are active but not constantly involved and are called upon periodically for advice. Orbit 4 features the reviewers, those who wish to be kept informed before a decision becomes a policy, rule, law or fait accompli. However, they do not feel the need to be active throughout the process. Orbit 5 contains the observers. These are people who do not want to be surprised. They watch and react only if an issue concerns them. However, they could be party, but not entirely involved. The outer orbit holds those who are not seen in the process, but who will react if they are suddenly surprised and feel threatened.

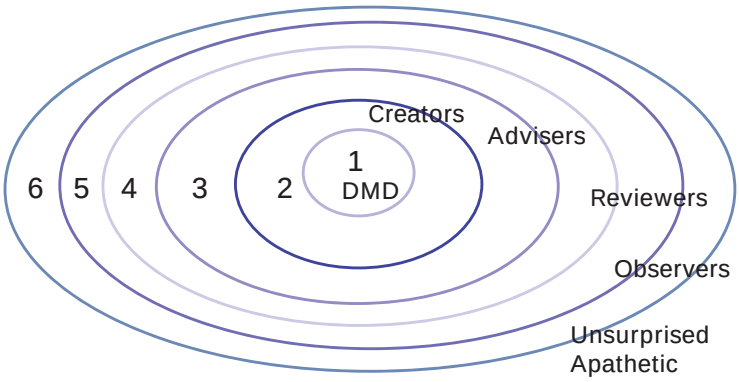


**Figure 2. Orbits of stakeholder influence**

Depending on the type of decision and the level of decision-making, the position of various stakeholders can change within the orbits. At the basin level of policy development, planners

at the national and state levels and policy planning ministries at the national level would form the decision-making group, whereas in emergency planning the national disaster management committee would be the key decision maker. In basin flood management planning, for example, River Basin Organizations (RBOs) and flood management and water resources departments are partners in decision-making and make-up the first orbit. Other line departments of development ministries and disaster management authorities may be in the second orbit with the flood-prone communities. Other basin communities are included in the third and are consulted on various options of a basin plan. NGOs, scientific, academic and private institutions and voluntary organizations may make up the fourth orbit.

It is important to keep a record of the decision-making process at each level of consultation and participation to ensure transparency, as it helps take the process forward when a new set of people take over the process and makes it easier to replicate at a future date with adjustments made to suit needs as they arise over time.

### 3.1.5 Participatory mechanisms

To achieve effective, meaningful participation, it is important to implement a well-defined, transparent, strategic approach. Different stakeholder groups have different needs and requirements, based on their areas of interests, respective roles and responsibilities. There are various participation methods with varying degrees of stakeholder involvement: provision of information, public hearings, consultations, collaboration in decision-making and delegation of responsibilities, as illustrated in Figure 3. The greater the extent of participation and control over decisions, the lesser the number of stakeholder representatives engaged in the process. This kind of mechanism has been employed in several river basin institutions. The political, economic, cultural, institutional and legal situations within a given region determine the mechanisms chosen to achieve the desired participation level .

The lowest level of public participation consists of the dissemination of information on decisions taken by the decision makers on a particular issue. The next level involves public hearings on those decisions when feedback and agreement are sought from the stakeholders. Consultations involve soliciting stakeholder views on proposed action and engaging them in a dialogue. Unlike information dissemination, consultations are characterized by a two-way information flow, from decision makers to people, and from people to decision makers.[26] Collaboration, in which people, including vulnerable groups such as the poor, women, indigenous people and ethnic minorities come together with the authorities to share, negotiate and control the decision-making process in project design and management, calls for a greater degree of involvement in decision-making. As in consultations, it is based on two-way flow of information and ideas. Delegation involves joint decision-making. Here stakeholder involvement is intensive but is carried out through a representative mechanism. Under self-management, the community or individual takes its own decisions

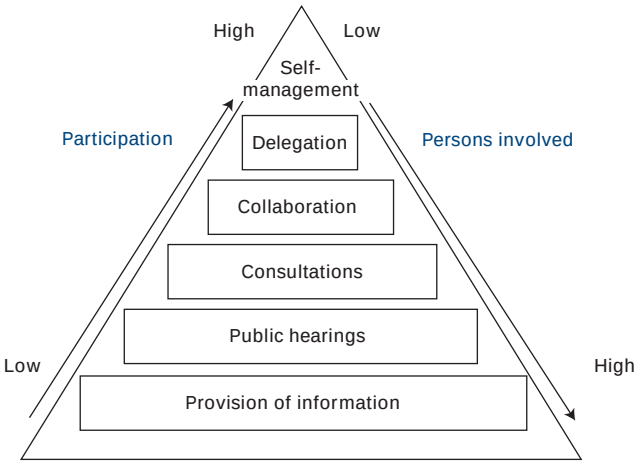


**Figure 3. Levels of stakeholder participation[27]**

Table 4 below describes the level of participation and the methods applied at various stages of the planning process. It also outlines the relationships between various stakeholders for each participatory approach.

## 3.2 Participatory planning: responding to the challenge

Flood management plays an important role in sustainable development. Flood management activities should be carried out under a flexible but well defined basin flood management plan guided by basin flood management goals within the framework of national flood management policy. The planning process and how the challenge of participatory processes is addressed at various levels of planning and implementation are discussed below.

### 3.2.1 National flood management policy

National flood management policy is a reflection of national development goals, perception of risks at the national level and a country's ethical choices and environmental objectives based on its socio-economic conditions. National flood management policy sets goals such as reducing risks, economic losses and fatalities and/or increasing national economic efficiency. It should include an overall assessment of flood hazard and its impact on socio-economic well-being, a definition of the required degree of risk mitigation, equity principles to be followed, prioritization of pre- and post-event measures, types of incentives and disincentives to be used and a discussion on how to deal with residual risks. The policy should define the responsibility of individuals in bearing the risks. It is particularly important to define the roles and responsibilities of communities, local state and national government's declaration of principles establishing an institutional framework for coordination among various sectors and institutions.

Flood management policies are, however, constrained by existing legal and institutional set-ups, financial and economic situations, physical and technical limitations and political compulsions. At the same time flood issues can be dealt with indirectly through public policies that may appear to have little immediate relevance to floods, such as economic and social policies addressing the

### Table 4. Levels and methods of participation[28]

| Participation methods | Purpose | Description |
|---|---|---|
| Provision of information | To spread knowledge about decisions | The authorities or decision makers make the final decision. These decisions are shared with the public/ stakeholders before implementation. The stakeholder involvement is limited to receiving information. No further involvement is envisaged. |
| Public hearings, conferences | To be heard before decisions are taken | The authorities make the initial decisions and the public/ stakeholders are informed of the plan/decisions and their feedback or agreement is sought. A public hearing is announced, welcoming all participants. Final decisions are based on the opinions expressed in the public hearing. Stakeholders are involved in implementation. |
| Consultation through workshops | To influence the decision-making process | The authorities, decision makers, development agencies or RBOs draw up a plan which is shared with the public and other stakeholders. Objections and suggestions are sought, modifications are made accordingly and implementation is carried out with their consent through consensus. |
| Collaboration through advisory groups | To influence the decision-making process | Community leaders or special representatives and stakeholder institutions make up an advisory group and work closely with the authorities or decision makers. Increased interaction among people leads to an open, informal, atmosphere and enhanced information sharing. The advisory group is informed regularly of progress made during the development and the implementation of plans. Advisors offer suggestions and recommendations based on needs and gaps identified at the community level. |
| Delegation (community cooperatives, development trusts, local councils) | To make decisions jointly, agree on decisions | Stakeholders' needs are determined from the onset by the stakeholders themselves and the authorities / RBOSs and the communities through their representatives decide means of intervention together.<br>Stakeholder involvement is extensive and continues beyond the implementation stage and includes monitoring and evaluation to help pinpoint the plan's shortcomings for future improvements. |
| Self-management (Local communities, individual) | To make their own decisions | A community or an individual makes its own decision with or without support from the outside. Community. flood management committees organize themselves to respond to emergency situations. |

vulnerability of flood-prone communities. These must be factored in the flood policy through a strategic collaborative planning framework involving stakeholders within and outside of government institutions.

Therefore, flood policy should be viewed from a perspective that transcends flood management agencies or departments. The manner in which flood issues influence and are influenced by development activities, and the involvement of other development agencies dealing with water resources, hydropower, drinking water, agriculture, irrigation, transport and communications, for example, is essential. Representatives of those line departments and financial and land use planners could make up the first orbit of stakeholders. Similarly, state and local government representatives, eminent public personalities, academics and experts from outside the government institutions representing social, economic and environment disciplines, as well as parliamentary representatives of flood-prone areas could make up the second orbit. Depending on the countries' size and the extent of the flood problem, a wider group of stakeholders involving NGOs, various professional and technical associations can be included in the consultation process during the preliminary policy draft stages through workshops and/or electronic mail. The draft policy should include a social impact assessment clearly showing the policy's impact on social issues such as poverty and changes in community structure. Strategic environmental assessments should also be conducted to identify and assess the environmental effects of proposed policies. Draft national flood policy prepared by the stakeholders should be the subject of open and informed debate made possible by the media before its submission to the decision-making body.

### 3.2.2 Basin flood management plan

The key to IFM is the river basin approach. A basin flood management plan starts with setting goals that are largely guided by regional development objectives and driven by the need to reduce flood risks, secure livelihoods, sustain economic development and preserve environmental quality. Some of the guiding principles of effective flood management laid down by the Asian Development Bank are given in Annex III. Various steps in drawing up a basin plan are briefly listed in Box 5. After designing the process for stakeholder participation in basin planning, the first step is flood risk assessment, which is followed by problem analysis including assessment of vulnerability. Based on these, the goals and scope of the plan are defined. While problem analysis may not require inputs from all the stakeholders, particularly the community and the general public, setting the goals and drafting an action plan require close consultation with all stakeholder groups.

At the basin level, decisions regarding the degree of risk that people are prepared to take and pay for with respect to preserving the environment must be decided. By involving the stakeholders' ethical considerations regarding equitable development, distribution and sharing of risk and decisions as to who should finance flood risk mitigation can be made.

In anticipation of a likely conflict of interest or situations in which one section of a flood-prone community might be impacted adversely by activities in another part of the basin, there may be a need to build consensus with regard to setting objectives or deciding strategies. This requires identifying all the stakeholders concerned. In certain cases decisions may have to be taken to plan deliberate flooding in certain areas if extreme flooding situations are to be avoided in eco-

### Box 5. How to draw up an IFM basin plan[29]

***Step 1: Process design***

- Identify the stakeholders
- In the absence of a river basin organization (RBO), set up a flood management committee
- Draft shared visions reflecting shareholders' needs and concerns
- Launch a public awareness campaign to keep the public informed and ensure citizen participation in decision-making, implementation and review
- Identify information required and develop data collection methodology

***Step 2: Risk assessment (to be presented in the forms of maps, tables and graphs)***

- Create a database inventory determining:
  - Current land-use practices
  - Potential future land-use patterns
  - Patterns of human settlement
  - Location of resources (natural and artificial)
  - Map the natural courses of the river
- Undertake hazard assessment from a multi-hazard perspective
- Check to ensure that the risks identified are the same as those perceived by all stakeholders
- Facilitate the risk assessment at the local level

***Step 3: Problem analysis***

- Conduct vulnerability and capacity assessment (VCA) to determine the people and areas at risks
- Identify the human factors that contribute to flooding
- Identify the flood plain areas in terms of their risk level with respect to different magnitudes of floods
- Identify the boundaries of the flood plain in terms of a particular design flood

***Step 4: Setting goals***

- Determine objectives based on risk assessment results and vision
- Decide the scope of the plan (geographical area, economic resources, affected population, political boundaries)

***Step 5: Draft an action plan***

- Evaluate various possible measures to address flood risks within the given scope such as land-use planning, building codes, zoning, conservation, drainage improvement, etc.
- Develop an action plan listing specific activities, roles and responsibilities of key stakeholders
- Conduct environmental and social impact assessment to determine the impact of the proposed plan
- Set the timeline and the expected results
- Carry out economic analysis and financing arrangements
- Set monitoring, evaluation and review procedures
- Widely disseminate the draft plan, particularly to all those who are directly effected

***Step 6: Approval of the Plan***

- Approval of the plan

nomically more important protected urban and industrial areas. In such circumstances the involvement of basin communities and flood-prone communities becomes essential.

Ideally, a basin flood management plan should be developed by a river basin organization. Several RBOs themselves are forms of participation, for example, the French water parliaments.[30] Unfortunately, few RBOs have a mandate for flood management issues. In the absence of river basin organizations or similar institutions, a flood management committee for the basin should be set up. Institutions associated with different development ministries and departments at various government levels with jurisdiction in the basin should form the core of such a committee. They make up the innermost orbit of stakeholders. The exact model would, however, depend on the institutional set-up and political and economic situation.

A comprehensive multi-hazard risk assessment is key to setting goals and developing a basin flood management plan. Hazard assessment studies identity water-related risks, such as mud flows and landslides in the basin, the development pressures on such areas and their trends and the impacts of these flood hazards on the development process. These studies should also include an analysis of the river ecosystem including its functions and the services provided by it. The manner in which these ecosystem services are impacted by various land uses, and by development activities and flood management measures should be examined and considered when seeking solutions. Development activities that can have an impact on flood hazards should also be identified.

The objectives and scope of the basin plan are set taking into account the evaluation of the problems and the flood risk assessment, and flood mitigation options worked out. The principle of equity in development and the need to reduce flood risks through various options must be debated at the basin level. A public consensus campaign, if launched at the start of the basin flood management plan development process is useful throughout several stages.

From the initial phase of the process from the basin planning design to the finalized draft plan, each step involves the creation of a common level of knowledge among various stakeholders, which results in a divergence of views. After debate and discussion, convergence is reached through consensus. This process is repeated each step of the way, as illustrated in Figure 4. With each step of basin planning, the time spent reaching a consensus and making decisions and the time taken to resolve conflicts between stakeholders become shorter.

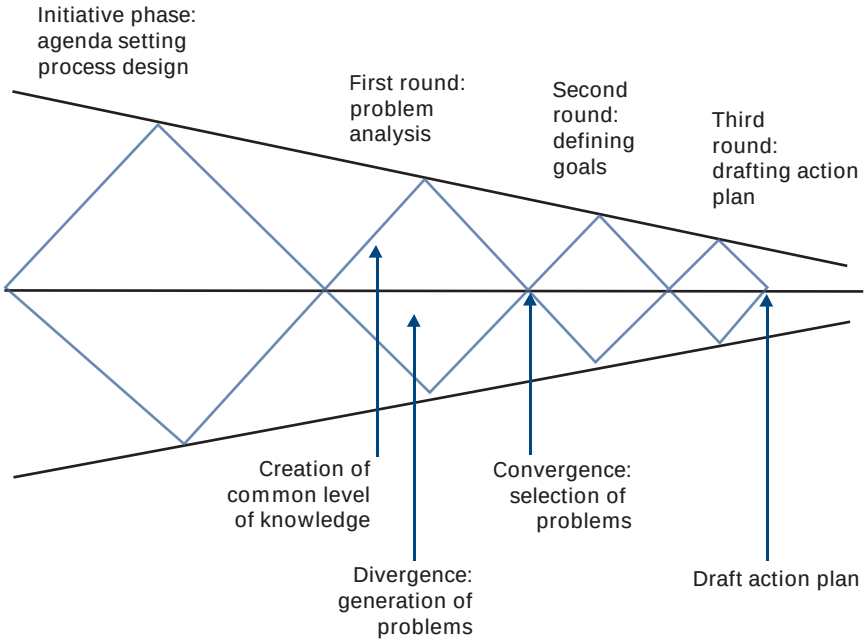


**Figure 4. Divergence and convergence in a participatory process[31]**

### 3.2.3 Project planning

After the basin flood management plan has been approved, individual projects are designed and implemented in accordance with the time frame established in the plan and the availability of financial resources. Different projects, implemented under the umbrella of the basin flood management plan, are mutually supportive, with shared goals at the basin level. Depending on the objectives of each project, a lead organization that would implement the project is identified early on, during the planning stage. For instance, if the project is to improve the flood forecasting system, meteorological and hydrological agencies can be identified as lead agencies. Conflicts and misunderstandings can surface if information is not shared between implementing organizations or if projects are implemented in isolation.

The first step in project-level planning is to identify priority action areas, employing various economic tools for making choices such as multi-criteria analysis (McA) and cost-benefit analysis (CBA). The basic data for prioritization is the outcome of the flood risk and local needs assessment conducted during the basin planning stage. In designing individual projects and their implementation within the framework of the basin flood management plan, it is important to involve the stakeholders and beneficiaries from the beginning to make sure that the project is suitable and to match it with the needs. The project beneficiaries should be able to provide feedback on the project's effectiveness in order to make further improvements.

Based on stakeholder engagement at the detailed analysis and design stage of the project, new facts or implementation difficulties may sometimes require revisiting the basin flood management plan, which should remain flexible. However, that should not be misused in order to postpone implementation of the basin plan. An appropriate mechanism should be built in at the basin planning stage, in order to avoid such situations.

Environmental Impact Assessments (EIAs), which are legally compulsory in many countries, are used to: identify the environmental and social impacts of proposed projects in order to predict environmental impacts at an early stage in project planning and design; find the ways and means to reduce adverse impacts, shape projects to suit the local environment; and present the projections and options to decision-makers.[32] Consultation and public participation is the key to conducting effective EIAs. Participation during project preparation can take place by developing the EIAs' terms of reference and in the assessment itself. While decision-making authority is retained by governments, interaction with people and eliciting feedback allows affected populations to influence the decision-making process by raising issues that should be considered in scoping, project design, mitigation, monitoring and management plans and the analysis of alternatives.

An action plan for each project is then developed, together with information on detailed activities, budgets, time lines and parties responsible for implementation. Consultation during preparation of the project proposal lays the groundwork for participation during project implementation. Local NGOs or representatives of affected groups may take part in monitoring and evaluating the measures recommended by the EIA during project implementation. Public participation and proper consultation thus enable the establishment of local ownership and accountability.

### 3.2.4 Flood emergency planning

Flood emergency planning is required at several levels: national, state, district, subdistrict and commune. Coordination is required among the following:

- Between government agencies, for example, disaster management committees at different levels and their member line departments, especially water resources management, public works, health, armed forces and police, economic and finance, planning, education, rural development, transport, communication, environmental and natural resources, where disaster management committees can take the lead and coordinate the planning process;
- Between the national, state, district and local levels of these agencies, where a national disaster management body acts as the key facilitator for coordination during the planning stage and the respective district or commune disaster management entities act as the key implementers of emergency measures;
- Among all emergency response agencies, such as government agencies, community flood management committees and other humanitarian NGOs, where national and local flood emergency management plans are shared with NGOs and vice versa.

Participatory planning is a prerequisite for emergency planning. At each level, all stakeholder groups concerned must come together to develop an emergency plan. Risk and vulnerability assessments, distribution of specific roles and responsibilities, resource analysis and mobilization are critical components of emergency planning which call for the participatory process. Results are then shared with all the stakeholders. Basin communities residing in flood-prone areas should be informed of the local risks to motivate them to take action to develop their own resilience.

The emergency preparedness plan is a detailed document containing sub-plans that address, among other things, preparedness for, response to and recovery from flood emergencies. Its primary aim is to clearly identify the responsibilities of various players during an actual flood. The risk assessment conducted at the local level in the form of flood hazard maps provides basic

information on the likely extent of flooding, identifying flood-prone areas and the population residing in such areas. The plan should clearly spell out the responsibilities involved in disseminating flood forecasts and warnings, and identify the authority that will order and organize evacuations under various scenarios. Local authorities play the key role in flood emergency management with respect to flood warning, provision of labour and equipment, evacuation, management of safe havens and assessing and addressing relief camps needs. These functions need to be worked out during the development of the flood emergency plan.[33] The involvement of key response agencies in determining and assigning responsibilities for flood emergency management confirms their commitment, clarifies their perceived roles and actual responsibilities and reduces duplication of tasks among stakeholders, thereby enhancing process coordination and effectiveness.

Although flood emergency plans are generally developed to cater to emergencies arising at a specific geographical location, the development of such plans should be undertaken in parallel with basin-wide flood management planning. One of the most important interactions between the two planning processes takes place during the assessment of flood risks. While basin-level flood risks are a sum total of all local flood risks, basin-level flood management policies and development activities have definitive impacts on local flood risks. It is therefore important to establish a mechanism ensuring the constant interaction between the two processes. Interaction between basin flood management planning and flood emergency management planning is illustrated in Figure 5. Community flood management committees can serve as community representatives, focal points or community partners for basin-level planning. Flood emergency management plans should be revisited as the basin flood management plan is implemented. Implementation of both plans is complementary and requires capacity-building at the community level. Participatory planning for emergency situations can help build trust among stakeholders, bolster cooperation, facilitate information sharing and encourage communication on a regular basis.

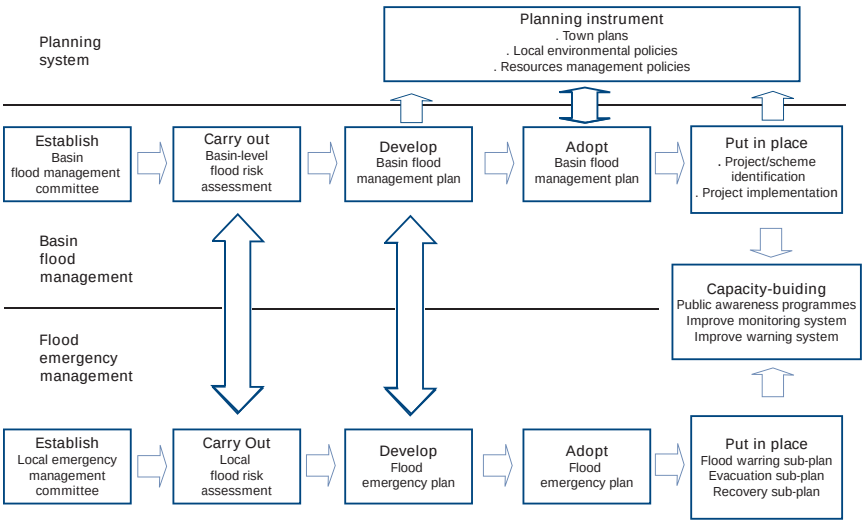


**Figure 5. Interaction between basin flood management planning and flood emergency planning[34]**

## 3.3 Institutional structures

Participatory processes are an essential part of IWRM requiring multiple levels of participation at the planning, implementation and operation stages. IWRM has advocated enabling mechanisms and setting up of an institutional framework to facilitate the process. As a subset of IWRM, IFM has to make use of these institutions. RBOs, disaster management committees at various levels, community-based organizations and non-governmental organizations are the key components of an appropriate framework aimed at facilitating dialogue and negotiations between various stakeholders.

### 3.3.1 River basin organizations (RBOs)

The role of RBOs in spearheading the implementation of integrated watershed and basin development approaches has long been recognized. Objectives of the institutional set-up and governance of RBOs vary according to a particular basin's political and socio-economic conditions and geographical coverage.[35] Notwithstanding these differences, RBOs should work toward a common goal: using integrated water resources management for sustainable development in their respective river basins. From a participatory planning perspective, the key roles of RBOs in meeting their objectives are:

- Ensure coordination among various government institutions at the national, state , disctrict and local levels;
- Provide mechanisms for dialogue between different stakeholders sharing the benefits and concerns related to the basin;
- Ensure enhanced stakeholder participation in planning, implementation and evaluation of activities;
- Facilitate sharing of information and knowledge and capacity-building of key stakeholders.

In Australia, regional organizations such as the Upper Parramatta River Catchment Trust[36] have been set up, on a catchment-wide basis to facilitate and coordinate the flood management and mitigation activities of local government councils. As illustrated in Box 6, institutions such as the Mekong River Commission (MRC) in Southeast Asia, established by Cambodia, Laos PDR, Thailand and Vietnam, serve as river basin organizations in international river basins. They work with the governments of all riparian countries, organizing regular forums, meetings and conferences and implementing programmes on various aspects of river basin management: water resources management, flood and drought management, environmental management, navigation system improvements and overall economic development in the basin.

New river basin organizations should, as far as possible, be built on existing organizational structures and traditional institutions, rather than completely new governing arrangements established specifically for that purpose.The challenge to RBOs lies in clearly defining its scope without overlapping with existing administrative and community governance structures and in providing an interface between all relevant institutions within their jurisdictions.

### Box 6. Mekong River Commission's Basin Development Plan[37] [38]

The Basin Development Plan (BDP) of the Mekong River Commission (MRC) establishes a planning framework for development programmes capable of balancing efficient use of resources with protection of the environment and the promotion of social justice and equity.

BDP aims to:

- Optimize mutual and sustainable benefits for all riparian countries;
- Ensure proper utilization of basin resources;
- Protect the communities living in the area and the resources from natural hazards such as floods and desertification;
- Prevent man-made disturbances such as industrial pollution, poorly planned development and trans-boundary conflicts;
- Promote collaborative development programmes among riparian countries;
- Encourage broad public participation;
- Cultivate knowledge sharing and capacity-building.

Eight related sectors are covered in the programme: irrigated agriculture, watershed management, fisheries, hydropower, navigation, transport and river works, tourism and recreation (water related), water supply (domestic and industrial uses) and flood control and management. Within this overall programme, MRC has developed and launched the Flood Management and Mitigation subprogramme, which has five major components: (1) establishment of a Regional Flood Management and Mitigation Centre; (2) structural measures and flood-proofing; (3) mediation of trans-boundary flood issues; (4) flood emergency management strengthening and (5) land use management.

Linkages have been established between the various programmes to ensure synergies. Stakeholder participation is perceived to be crucial for the success of these programmes . Such participation is accomplished through the common platform established for effective dialogue between the riparian countries, improving public education and awareness, and establishing appropriate institutional and legal arrangements.

### 3.3.2 Disaster management committees at the national, state and district levels

Many countries now have an inter-ministerial mechanism to coordinate disaster management at the national level headed by a senior minister responsible for disaster management. At the state and district level this structure is replicated, with a senior civil servant or an elected representative heading the committee. These are important structures that provide a platform for interdepartmental coordination and facilitate cooperation between agencies responsible for different aspects of disaster management. In general, disaster management committees are comprised of representatives of government departments and of the National Red Cross Society which is either a full member or invitee. Other relevant NGOs should also be represented to take part in the coordination of activities. These committees are instrumental in bringing all governmental line agencies to the table and support community participation in decision-making.

### 3.3.3 Community-based organizations (CBOs)[39]

A community-based organization is best positioned to effectively carry out activities and plans affecting the lives of the communities: socio-economic development, natural resources management, environmental conservation or disaster management. CBOs may have different focuses – farming, fishery, micro-credits, flood emergency management–but are made up of community representatives and one of their aims is to ensure that decision makers take notice of community concerns. Their main tasks are to:

- Provide a platform for the community to come together and discuss development issues;
- Analyze the causes of problems and solutions;
- Communicate with decision makers to share planned action and obtain their endorsement;
- Galvanize community members to implement planned solutions;
- Mobilize internal or locally available resources and external resources (outside the community) to implement identified solutions;
- Raise community awareness and promote community action on environmental and disaster issues and livelihood options;
- Build capacity of community members;
- Carry out monitoring and evaluation.

At the grass-root level, CBOs such as community flood management committees (CFMCs) can prove effective in preparing and planning community response to emergency situations.[40] Located at the ground level and in touch with the community, these organizations have the advantage of being familiar with local conditions and indigenous means of protecting the community and their surroundings. CBOs can also introduce to the community modern techniques of preserving the environment and natural resources and of mitigating damages caused by natural hazards. They can serve as an intermediary between decision makers and the community. For instance, certain technical skills, such as the maintenance of structural flood mitigation measures, can be mobilized by CBOs through external partners and stakeholders (government departments, NGOs, private sectors and international development agencies), if not available within the community.

Capable staff who possess leadership and planning skills to mobilize and lead the communities, to handle negotiation with external parties (decision makers and other interest groups) and to manage community conflicts, are crucial assets for a community-based organization. Invariably, CBOs face lack of resources. Inadequate financial and human resources threaten their sustainability. For financial stability, their senior staff should develop abilities in fund raising and external resources mobilization as well as in financial management. If required, external assistance has to be sought and the CBOs should become aware of where they can obtain such help. One mechanism for this is to partner with national and international NGOs who undertake larger scale fund mobilization. National government should also support their activities.

### 3.3.4 Non-governmental organizations (NGOs)

Non-governmental organizations (NGOs), also referred to as civil society organizations, serve as intermediaries in channelling development resources to the community by providing technical assistance and strengthening their capacity. Through their community-based partners, they identify community needs, organize the community and give voice to the poor. They have greater

flexibility, have more field presence than official agencies and reach people effectively, especially women, ethnic minorities and the poor.

NGOs operate in a number of ways and can have various goals. They have their own organizational, and thematic agendas, operating within a chosen geographical area while cooperating with advocacy, policy dialogue and lobbying networks. Important NGO networks dealing with the environment and international economic policy allow NGOs to coordinate their action in many countries and at international conferences and negotiations.[41] NGOs have been most effective in the policy sphere when they work together in coalitions, pooling their resources and coordinating their lobbying efforts. The role of NGOs as a facilitator to network between the decision makers and the other stakeholders should be promoted. Frequently, NGOs operate in isolation with insufficient coordination among NGOs working in the same geographical area and in the same field, which could create an overlap of activities. This problem can be solved by setting up NGO forums or a coordination council established by them or coordinated by government or semi-government agencies.

However, NGOs have limited financial resources and their field presence is often limited to the duration and area of a particular project. Sometimes their focus can be too narrow. They cover environmental, social or disaster management but seldom cover all three. In some centralized regimes, NGOs are often regarded as troublemakers, particularly when they challenge decisions or adopt an activist approach. This can be the result of the limited, narrow objectives of a particular NGO lacking an overall view of the issues.

## 3.4 Learning lessons from participatory planning in other sectors

In designing a participatory planning process it is useful to draw on experience gained from other similar areas of activities where efforts have been made in a country or region with similar socio-economic backgrounds to involve various stakeholders in an attempt to move away from the top-down, professionally driven model. Some of the related sectors in which participatory planning processes have shown promising results are the environment, natural resource management, agriculture and irrigation. The motivation for participation in these areas of activities may differ from that of the complex flood management process, since it does not result in the sharing of immediate benefits, unlike most of the others. However, the experiences can easily be adapted. Similarly, lessons learned from regional and national initiatives undertaken in the management of other natural hazards such as earthquakes and cyclones can also prove useful.

### 3.4.1 Environmental and natural resource management

In contrast to centralized processes where management is oriented to a single objective and the returns for the locals are limited to low-value secondary products and temporary concessions, participatory approaches are based on a broader valuation of natural resources, taking into account the multiple values of the environment and the social and economic needs of local users. The structure of incentives and the choice of technologies are geared to the environment and natural resources sustainability over the long term. The following conclusions relevant to IFM can be drawn from successful participation in environmental and natural resources preservation .

- *Government commitment* – The commitment of the national government in particular, and the state government and the local government organizations in general, to participatory environmental management and preservation can ensure the effective introduction of environmental reforms.
- *Stakeholder analysis and consultation* – Identifying and consulting stakeholders at the earliest possible stage is important not only to ensure that all the important issues are addressed, but also to strengthen commitment to implementing necessary reforms.
- *Decentralization* - A wide range of different institutional arrangements, from private contractual agreements to joint public/private partnerships, can be used in devolving authority over watershed and forest management to the local level.
- *Security of tenure* – Owing to the long gestation period of forest conservation investments, security of tenure is a particularly important incentive for communities to invest in time and resources.
- *Establishment of equitable rules and incentives* - Arrangements for sharing costs, benefits and management responsibilities and mechanisms for resolving conflicts among various interest groups help motivate participation.
- *Local capacity –* Capacity-building is essential to strengthening management capacity at the community level.

### 3.4.2 Agriculture and irrigation development

In countries where water is a scarce resource, local small-scale irrigation schemes play a major role in agricultural and economic development. Projects planned and implemented with full farmer participation are more viable than those that are imposed from outside. Involving farmers in planning gives them a sense of ownership, making them willing to participate in the operation and maintenance. Community-managed schemes, accompanied by an appropriate devolution process which clearly defines when the transfer of responsibilities from the central government to local agencies should take place, are more sustainable than centrally managed schemes. Lessons learned from FAO projects[42 43 44 45] in Zambia, Pakistan and Afghanistan can be summarized as follows:

- *Gradual devolvement of responsibilities*: Community-based activities should be developed gradually and the pace of shifting responsibilities to the communities should be carefully assessed. There is a limit to how much a community can do on its own. The public sector will continue to have an important responsibility in providing basic services to enable communities to take charge.
- *Flexibility:* Predetermining and quantifying material project outputs in project design should have sufficient budgetary and planning flexibility. Tools and methodologies selected should be flexible enough to meet the changing needs and priorities of farm household members.
- *Sustainability:* Community action planning is a continuous, gradual process. An appropriate strategy for financial and technical support must be developed and sustained beyond the project's duration.
- *Synergy with existing institutions:* It is important to build on and to strengthen local inter sectoral coordination mechanisms, rather than create parallel structures.

### 3.4.3 Community-based disaster risk management (CBDRM)

Community participation has been recognized as an essential element of community-based disaster risk management that builds a culture of safety and ensures sustainable development. It addresses specific local needs of vulnerable communities to realize the full potential of local resources and capacities and actively engages them in disaster risk identification, analysis, preparation, response, monitoring and evaluation. Communities are involved in the decision-making and implementation of disaster risk management activities. The following lessons can be learned from the experiences of successful CBDRM approaches:[46] [47] [48] [49]

- *Involving the grass roots in developing solutions:* A project that makes use of the community's knowledge by conducting consultative community workshops to identify priority action areas develops synergies. The probability of the community promoting flood preparedness measures increases when external assistance is available to the community as it develops new measures. Even though local communities often need a catalyst to take an active role in developing disaster preparedness solutions, they can take the process further themselves.
- *Appropriate technology*: Low-cost technology acceptable to the community should be transferred to the community, making use of local capacity and local materials.
- *Synergy with other administrative structures:* Existing, traditional community structures should be used to find solutions to flood mitigation. A transparent management structure through the establishment of a series of advisory committees at the district and community levels is useful.
- *Inter-institutional communication linkages:* It is important to develop linkages between communities, government, national disaster management agencies and donors focusing on disaster preparedness to ensure sustainability. For example, appropriate institutional mechanisms for the transmission of warnings with arrangements between monitoring and warning organizations, such as National Meteorological Services, to various government ministries, institutions and voluntary and community organizations are essential to ensure effective community response.
- *Setting up volunteer groups:* The establishment of a local volunteer-based system ensures an immediate coordinated response in case of emergency. The adoption of a "training of volunteers by trained volunteers strategy" to reach out to more volunteers should be considered. Conducting regular drills and exercises for the volunteers and demonstration drills for the community is very effective.
- *Public awareness:* This is a key component of disaster a preparedness. Activities that build public awareness through volunteer work, films, video shows, folk songs, publicity campaigns, radio and television, posters, leaflets, booklets and skits serve a useful purpose.
- *Resource mobilization:* There is need to set up a CBDRM development fund to ensure the continuation of programme activities. Local contributions in terms of money, labour and materials play a major role in the project's success. Where flood preparedness demands are greater than available financial resources, it is essential to train volunteers and local communities to mobilize funding from outside the community. Sharing of resources between the government, non-governmental and voluntary organizations is effective.

The key outcome of CBDRM is the decentralization of disaster management responsibilities. Once considered helpless, disaster victims are now viewed as stakeholders who play an active role in disaster management planning and decision-making. Building community cohesion, recognizing the special needs of excluded individuals or social groups such as women, disabled

persons, elderly people and ethnic minorities and providing opportunities for increased stakeholder involvement in decision-making can increase community resilience and reduce their risks.[50] On issues related to environmental management and decision-making, the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters has established a number of environmental rights to which the public (citizens and their associations) is entitled. It provides for the right to participate in planning from an early stage and to receive environmental information that is held by public authorities.[51] At the national level, a positive correlation between integrated participatory planning and an enhanced level of local self-reliance has been achieved in many countries.

# 4. ENHANCING STAKEHOLDER INVOLVEMENT

Enabling stakeholders' involvement in decision-making is required during both phases of the process: launching and maintaining the participatory process. In order to initiate or ensure the sustainability of the process, it is important to analyze the given socio-economic, cultural and political situation, make the most of opportunities and address challenges. This requires an enabling legal and institutional framework and continuous efforts to build capacity of different stakeholders.

The process should be appropriately designed, giving due consideration to various elements as discussed in the previous chapters. There are certain prerequisites for ensuring the successful and sustainable involvement of stakeholders in a given situation. The most important of all is to build trust through information sharing and repeated interaction. Social science expertise, out reach personnel and resources are needed to establish and sustain the participatory process. Commitment, accountability, transparency of action, the application of equality principles and tolerance towards dissent are factors that determine, encourage and promote public participation. While the government provides incentives, facilitates and establishes policies and regulations relating to the participatory approach, each stakeholder group must take certain initiatives and responsibilities.

## 4.1 Opportunities

IFM requires a multi-faceted, continuous approach to realize its objectives and an effort to mobilize all stakeholders and resources in the process. In order to initiate the participatory process, specific contexts, which may act as enabling triggers, need to be explored and gainfully utilized. Some of these contexts are highlighted below as opportunities to initiate, consolidate or strengthen the participatory approach to IFM and build stakeholder capacity for participation in the process.

- *Highly aware communities* – Communities that have a good understanding of the risks to which they are exposed often join together to influence decisions relating to disaster management and mitigation. They seek ways to continually improve their knowledge and participation skills.
- *Better information-sharing techniques* – Progress in information technology exposes individuals or institutions to practices applied elsewhere, opening up a whole new way of thinking and providing options for future interventions beyond the local experience base.
- *Effective programmes or mechanisms* – A successful programme with specific visible impacts or a mechanism enjoying sufficient resources can create a ripple effect in another area or on another group. Experience gained from the participatory process in another development area, such as forestry, the environment or irrigation, can provide an incentive for using the participation process in flood management.
- *River basin organizations and other network support agencies* – Participatory mechanisms such as RBOs can facilitate coordination and learning between different stakeholder groups and the exchange of information and experiences.
- *Limited resources* – Limited financial, material and human resources available to governmental agencies in many under-developed and developing countries open up doors to greater co-operation between the government and non-governmental agencies in sharing resources.

## 4.2 Challenges

When stakeholder involvement in IFM is being launched and maintained, potential hurdles and setbacks can be created by various factors. They need to be guarded against, and if possible, addressed in a systematic and persistent manner.

### 4.2.1 Launching the participatory process

*Political will:* The participatory process can often be perceived as a threat to the power and authority of existing institutions taking decisions related to flood management. Sharing the decision-making power with the people may not be viewed favourably. Without the commitment of the political leadership at all levels, the necessary enabling environment, such as allocation of necessary resources to promote public participation, cannot be created and recognized as a priority area in flood or water resources management. Politicians and decision makers need to be aware of the importance of institutionalizing participatory planning in IFM. This is the first step in putting an enabling environment in place.

*Need for financial commitment and budget allocations:* Participatory processes are resource intensive, calling for human, time and financial resources. Proper institutional and legal arrangements are needed to maintain financial flows ensuring the success of the participatory process. As such there is a need to sensitize financial institutions and enhance their participation in basin development and management. Involving financial authorities in the decision to start a participatory process is important, as they should be made fully aware of the advantages and limitations of the process. Local governments and RBOs should also mobilize and allocate financial resources to participatory river basin development.

*Attitude towards flood management:* Flood management functions have always been considered the sole responsibility of the government and flood-prone communities are viewed as victims that need help. Most often a community that faces flood risks likes the authorities to take certain physical measures. Preference for structural flood protection measures needs to be changed by implementing more educational programmes and informing the public of the benefits of non-structural measures.

*Risk perception:* The perception of risks by stakeholders can differ significantly depending on their experience and knowledge. Underestimating risks can lead to a lack of will or motivation to take initiatives. Sharing the results of risk assessment studies with the public and all stakeholders can improve the risk perception level and enable them to realize the importance of the participatory process.

### 4.2.2 Maintaining the participatory process

*Harmonization of water management, spatial planning and environmental activities:* Development activities in water management, spatial planning and the environment fall under the jurisdiction of various ministries, departments and agencies. Although the importance of integrated approaches and techniques have been recognized, much remains to be done to conceptualize and implement programmes that harmonize development within a basin. The biggest challenge lies in enhancing the cooperation and coordination of activities carried out by different administrative entities to facilitate collaborative programmes.

*Trans-boundary issues in international river basins:* The number of administrative entities in trans-boundary river basins increases manyfold. Different socio-economic and political conditions, not to mention institutional arrangements, add to the complexities of managing flood issues at the basin level. It is difficult to bring together national, state, district and local governmental institutions from different countries together. Substantial investments in time and money is essential since it requires information sharing, repeated meetings and talks to ensure confidence building before such an attempt can be made. Cooperation in the exchange of information on impending floods can be a good starting point.

*Level of competency of local authorities, RBOs and water users:* Local authorities and RBOs are not always adequately equipped with technical know-how and therefore tend to avoid discussion and sharing data and information. Local authorities, RBOs and water users need to build capacities in managing public services in a participatory manner. Strong support from federal agencies and technical NGOs is essential.

*Regional versus specific local needs:* There may be a conflict between local flood management needs and wider flood and water resources management requirements at the basin level, which can pose difficulty in developing a holistic approach for the entire river basin. A phased approach could be considered if circumstances allow.

*Time constraints:* It takes time to build trust, for new institutional arrangements to function and for stakeholders to grasp knowledge and information so that they can participate effectively. Often the process may fail because not enough time is allowed for the stakeholders to digest the new information owing to the pressure of producing results within a certain period of time or to budget limitations. At the same time such a process should not result in endless debate, which will cause stakeholder exhaustion. To avoid this, setting up a clear time frame of the process and the visibility of outcomes in a timely manner is essential.

### 4.2.3 Political and governance issues

Good governance is a major prerequisite for successful integrated flood management. At the national level, weak governance, characterized by unclear policies, ambiguous roles and responsibilities among line agencies, creates overlapping responsibility and gaps in task distribution. The enforcement of rules and regulations relating to flood mitigation measures, such as land use regulation and management, housing and infrastructure construction codes and the provision of information on flood forecasting and warning, rely to a great extent on the effectiveness of the government and its policies. Weak enforcement can produce poorly planned development in the flood plains despite the best of the policies and legal provisions, raising the risks and vulnerabilities of the flood plain population. In international river basins, good governance can help promote cross-border cooperation, which is of great importance in emergency operations.
Trust in government agencies is an essential ingredient of successful integrated approaches to flood management with active community participation and support. To be able to do so, it is necessary to identify the needs of the communities and to work closely with them. The local government's ability to be prepared and mobilize resources when needed greatly increases its credibility. At the same time, government commitment and accountability, transparency of action, application of equality principles and tolerance towards dissent are factors that determine, encourage and promote public participation.

## 4.3 Stakeholder capacity-building

Stakeholders with different sectoral, regional and local perspectives are involved in the IFM process and contribute to its success or otherwise. They have different institutional and, cultural backgrounds and socio-economic conditions, which calls for different capacity-building approaches depending on their respective roles, and their orbit of influence. Capacity-building is an on-going process and requires financial resources. The cost of education and capacity-building programmes should be recognized as a maintenance cost of effective flood management and treated as such with respect to the budget.[52] Capacity-building, in fact, should be viewed as an integral part of IFM implementation. It should be incorporated into field activities and well timed so as to ensure that all involved stakeholders acquire the necessary knowledge and skills in order to strengthen the communities' resource base in terms of knowledge, social organization and financial capital.

### 4.3.1 Capacity-building needs at different levels

Capacity-building is aimed at effective participation in decision-making, active and informed engagement in participatory processes and sustainable IFM implementation. Capacity-building should go beyond raising stakeholder awareness and aim at developing the capability of stakeholder groups to understand all facets of the issues. It is crucial to acknowledge that different skill sets are needed at different levels for different stakeholder groups depending on the roles they are expected to play. The variety of stakeholders, their respective interests, needs and gaps with regard to skills, knowledge and ability to adequately take part in participatory planning processes should be carefully analysed. The facilitating organization should first develop skill sets in identifying stakeholders and their interests and develop engagement methodologies and negotiating strategies to build confidence in the process. In developing stakeholder capacity three levels should be considered: institutional, community and individual.

*Institutional capacity-building* aims at introducing a fundamental change in the ways the institutions are accustomed to function. It requires putting people first. At all stages–regional, national and local–it is critical to build up capacity to manage the organizational aspects of stakeholders participation and to form partnerships with other groups with experience in participatory processes. Techniques include formal training, learning through implementation, for example developing skills more organically as part of the process, and/or organizational reforms. It may be necessary to prioritize training in participatory planning and management to support various departments and agencies. There may be a case for introducing new social science specialists within the institutions to handle the whole process or it could be carried out in operation with existing governmental or non-governmental specialist institutions.

*Community capacity-building* starts with identifying a community's level of knowledge, their attitudinal behaviour and understanding of risk perceptions. It focuses on building awareness of flood risks in a catchment community, flood plain management activities to mitigate flood hazards and local environmental issues aimed at improving natural resources. This can be achieved through a variety of measures, including the dissemination of public awareness materials, community meetings, sharing information on websites, TV and radio programmes, commemoration of well-remembered flood events and support for programmes undertaken by schoolchildren. Social or cultural forums as a platform for these activities and/or creating new forums aimed at bringing members together if none exist should be identified and used for that

purpose. Community events should be used to disseminate the information. An effective way is to promote cross learning between communities and arrange exchange visits to other communities that have successfully initiated or implemented innovative programmes.

*Individual capacity-building* focuses on creating opportunities for those individuals already playing a key role in government departments, RBOs, CBOs and NGOs and enables them to develop their understanding, knowledge base and leadership skills. This can be achieved through formal training programmes, study tours, attachments to and internships in other similar organizations. The capacity-building of individuals should be treated as a collective skill enhancement toward organizational development.

### 4.3.2 Capacity-building areas

Different stakeholders have and require capacity-building in particular areas commensurate with their role in the participatory process to meet their needs. In order to ensure the sustainability of their involvement in IFM planning and implementation, stakeholders need to develop four generic skills:

- Facilitating cooperation with other agencies as the lead organization;
- Participating as a stakeholder in the process led by someone else;
- Undertaking planning;
- Carrying out implementation.

The national planning body should understand the advantages of involving all stakeholders in policy development and should concentrate on raising public awareness. Water resource management agencies should sharpen their skills in educating the public about fundamental hydrological processes, water resource management principles and water-related hazards. At the same time, local authorities and community organizations should learn how to identify community needs and how to organize and motivate their participation.

In turn, RBOs should enhance their ability to rally for public participation, acting as a liaison or intermediary between the community and the responsible authorities. They should establish a basin-wide water partnership through an enhanced knowledge base focusing on capacity-building. NGOs need to possess a basic knowledge of the issues involved, skills in organizing the communities and educating them through various mechanisms and facilitation. They can act as mediators to bring together local communities and government agencies and facilitate fruitful discussions. As such, they need to be fully aware of such issues. Technical NGOs such as irrigation associations and regional or national water research centres should understand what kind of information is required at the community level and try to provide it by converting scientific data into comprehensible information. The most important community skill is training in flood risk assessment, warning and emergency response, flood-proofing activities and organization of relief activities. Organizational skills in community forums, including fund-raising methods, are also important at the local level.

Disaster management organizations at the national level have a special responsibility in promoting sustainable arrangements for training key personnel within and outside their systems in vari-

ous skills related to preparedness, planning, mitigation, vulnerability reduction, response and community-based disaster risk reduction.

### 4.3.3 Capacity-building mechanisms

Capacity-building for stakeholders can be provided by a well-structured training programme and curriculum based on needs, acceptable standards and operating procedures, and trained facilitators and capable trainers. National and local training institutions can serve as key resources to train government and non-governmental agencies. NGOs with appropriate skills can also play a role as educators and facilitators of public education and the public learning process with regard to flood management. The flexibility and extended reach to the community enables them to reach a wider audience. The following means can be employed to enhance stakeholder capacity for greater participation in IFM:

- *Training sessions and workshops:* They provide a formal learning environment to explore specific topics interactively. Training programmes and courses are most effective when they cater to a target group's specific capacity-building needs.
- *Information technology:* Advancements in information science and communication technology have facilitated communication and networking among interest groups. Good practices and experiences from one part of the world can be shared with another through Internet information exchanges and electronic groups. Facilitating information exchanges and networking can build the capacities of local stakeholder groups.
- *Networking for information sharing:* This can be achieved through the establishment of formal networks of water resources management, environmental management, development, emergency-disaster management agencies, river basin organizations and water user groups which all share a special interest in river basin management and development. The most commonly used mechanisms for information sharing within those networks are list-servers, periodic conferences and forums, and electronic and conventional newsletters and journals.
- *Internships of key personnel in other organizations:* Personnel exchange programmes, allowing employees from one agency to work for a fixed period of time in another, can expand the horizons and the outlooks of individuals and organizations which take part in the programme. In similar programmes, cross visits of community leaders from one area to another should be encouraged.
- *Public awareness raising:* Well-designed public information campaigns can effectively convey a message to a vast and diversified audience in a large geographical area. Local social and cultural events such as fairs, exhibitions, and sports events can be used effectively for that purpose. Television and local radio can also be used to carry the campaign.
- *Learning by doing:* Mock drills and scenarios outside the relevant community or basin can serve as very useful tools in acquainting participants with the requirements of the process.
- *Role playing:* This is an enlightening and interesting way to help people see a problem from another perspective. It allows the participation of a full range of representatives of community groups, interest groups or key stakeholders. However, this method has proved to be more effective with informed participants.

Networking mechanisms can be useful in sustaining the participatory process through information and experience sharing, technical support and humanitarian assistance. Some of the most common network mechanisms, which are already serving as information-sharing platforms and

coordinating mechanisms for certain stakeholder groups, are listed in Table 5 below

## 4.4 Legal and institutional framework

The establishment of legal mechanisms for more effective community representation is imperative. The key legal mechanisms that can ensure public participation in the process are as follows:

- *Right to information:* ensuring regular, precise, comprehensive and timely information;
- *Right to participate:* legal provisions ensuring participation of all relevant stakeholders;
- *Accountability:* provision of accountability in the process by flood management and mitigation agencies, the community and other key stakeholders;
- *Transparency:* ensuring that all processes and decisions are transparent.

The nature of the IFM approach calls for extensive coordination between various stakeholder groups. Information sharing and networking are among the most crucial factors ensuring the efficiency and stability of the approach, anticipating and managing conflicts, and furthering collaboration across jurisdictions and sectors. This requires an enabling institutional framework, which facilitates rather than hinders effective coordination, cooperation and collaboration across jurisdictional boundaries, departments, institutions, disciplines, users and uses. An institutional framework delineates the recognized roles of all stakeholders in IFM and offers a coordinating mechanism for organizations and institutions. Such a framework should facilitate the development of a multi-disciplinary perspective to flood management, define accountability and show flexibility by accommodating learning by experimenting.

### 4.4.1 Harmonized legal framework[53]

Within the IFM framework, flood management and mitigation policies should take into consideration the natural environment, societal needs and prevailing attitudes. Such policies and legal frameworks should be closely linked to the national development agenda and based on a vision of social, economic and ecological sustainability. Through the establishment of appropriate policies and regulations, the stakeholder participation process can be institutionalized thus ensuring its sustainability and wide utilization. Specific provisions for community involvement are normally limited to a requirement to disclose and provide information about the risks a community faces. Community participation in preparedness planning is implied but only rarely legally mandated.

There are several related legal frameworks in the context of IFM that are of relevance and can play a role in shaping and influencing public participation, including the following:

- Water laws, river laws;
- Disaster management laws;
- Land use planning laws that regulate development;
- Regional and municipal bylaws that require compliance with building and safety codes;
- Natural resource management and environmental protection laws.
- Specific acts relating to freedom of information.

**Table 5. Networking mechanisms**

| Mechanisms | Stakeholders/members | Participation method |
|---|---|---|
| Cross-boundary emergency assistance and response teams | Highly trained search and rescue teams, emergency health teams, volunteers<br>(Dispatch teams from one country to another depends on agreements between the two nations.) | Joint exercises, joint training programmes, drills, public awareness raising activities, workshops, meetings |
| Scientific and research institutions network | Academic institutions, researchers, scientists, relevant line ministries, end-users (usually a limited number depending on the focus of the networks; whether agricultural, water resources management (WRM) or other | List-servers, e-mail, forums, conferences, meetings |
| Regional development and disaster management centres | Community members, disaster management committees (DMCs), development agencies, line ministries, national scientific and research centres, NGOs, national WRM centres and institutions, special national committees/platforms, local authorities | Joint projects and programmes, forums, workshops, meetings, conferences, public awareness raising activities |
| Network of national NGOs, mass organizations, social and humanitarian organizations | Community-focused social groups such as farmers, youth and women | Community-focused activities, awareness raising activities, response to crises (disasters) through specialized groups |

The legal framework laying down the requirements for disaster management and mitigation activities defines and legitimize the roles and responsibilities of government and non-governmental agencies and spell out policy. These legal instruments prescribe and call for inter-ministerial and interdepartmental cooperation, and by having a legal mandate, provide a conducive environment for such coordinating mechanisms, though much more needs to be done on the ground to make these arrangements operational and effective. In short, more effective legal requirements should be developed to facilitate the introduction and implementation of IFM and participatory planning requirements therein.

### 4.4.2 Provision of conflict management mechanism

Stakeholders, each with their own perspective on issues of concern, understanding of flood risks, development priorities, interests and approach, sometimes create conflicting viewpoints. Unless these issues are addressed and resolved in a fair, transparent and systematic manner, the participatory process may be stalled. Professionals and institutions responsible for managing

conflicts first have to understand the underlying issues, perceptions and the values associated with a given perspective to be able to design or negotiate consensus (Table 6). Factors that can contribute to conflicts within a river basin are:

- Population pressures leading to urbanization, thereby contributing to increased flood hazards downstream;
- Transfer of risks downstream owing to a reduction in natural storage upstream;
- Unplanned development infrastructures, such as roads and bridges obstructing natural drainage and increasing flood risks upstream;
- Alteration of natural flow regimes owing to structural measures and their impacts on ecosystems downstream;
- Land-use changes upstream contributing to flood hazards downstream;
- Lack of sharing of data and information;
- Developments such as land reclamation from water channels resulting in floods of higher intensity and frequency in another part of the basin;
- The poor, particularly the urban poor, having to face higher risks;
- Uneven access to resources, that is information and data, financial, human and material resources resulting in varying degrees of protection.

For practical purposes, conflict management strategies in community participation programmes should isolate extremes and facilitate shared ownership of solutions, and should be appropriately incorporated in the legal framework.

For river basins contained within a national border, emerging conflicts can be relatively easily resolved as national issues, but even here, especially in democratic societies, serious conflicts can emerge between different jurisdictions. Upstream and downstream communities with unequal access to resources and flood protection measures can develop resentment against each other. A process of participatory dialogue and conflict resolution is a win-win situation for all and benefiting stakeholders will not lose out; at the same time under-privileged stakeholders will be able to improve their situations through the process.

For international river basins that cross national boundaries and extend over several countries, conflicts can only be settled with the participation of riparian countries sharing the basin. Historical factors, such as boundary disputes and water utilization concerns, physical differences such as language, religion, culture and ethnicity, political systems (democratic versus authoritative, perspectives and development orientation of party in power) and socio-economic variations such as living standards, education, GDP and per capita incomes are responsible for, and need to be considered in addressing riparian conflicts.

Under these circumstances, unbiased third-party involvement can provide a common ground for stakeholders in reaching a settlement. There is a need to demonstrate the costs of non-cooperation and the benefits of cooperation, including financial benefits, and the advantages of information exchange and sharing of resources. The unique needs of each individual country should be addressed. The neutrality displayed by the third party will gain the trust of the involved parties. The timing of the intervention is key to successful deliberations and conclusions. The prospects for success grow when riparian countries, facing conflicts between the countries and issues that are beyond their control owing to limited capacity and resources, approach a third party. Once

**Table 6. Sources of conflict[54] [55]**

| Type of conflict | Main causes | Possible solutions |
|---|---|---|
| Relationship conflict | Poor communication, misperceptions, duelling egos, personality differences, stereotyping | • Increasing communication<br>• Involving third-party mediators |
| Data conflict | Lack of information, contradictory information or deliberate misinformation, different interpretations, different assessment procedures | • Improving exchange of information and perceptions<br>• Developing a strategy to obtain the information |
| Values conflict | Disagreement over what is morally right or wrong, good or bad, just or unjust; forcing one set of values on others, not allowing diverging thoughts or behaviour | • Providing information on different beliefs and shared values |
| Structural conflict | Unspecified roles and responsibilities, unreasonable time constraints, unequal power or authority, unequal control of resources, geographical or physical constraints | • Redefining roles and responsibilities<br>• Realigning rewards and punishments<br>• Adjusting distribution of power or control over resources |
| Interest conflict | Due to substantive issues (money, physical resources, time), procedural issues (dispute-resolution techniques), psychological issues (perceptions of trust, fairness, desire for participation, respect) | • Identifying the interests of conflicting parties and addressing them to reach a compromise |

this process is viewed as a response to a request and not as a donor-driven process, riparian countries' participation and contributions will improve significantly. In managing conflicts arising from water resources management and flood mitigation issues, two mechanisms are particulary effective: incentives and trade-offs.

# ANNEX I: TYPES OF FLOODS AND THEIR IMPACTS

*Riverine floods*

River floods occur when the river run-off volume exceeds local flow capacity. They are triggered by heavy rainfall in upstream areas, snow melt or tidal influence. Failure of flood control works upstream can sometimes lead to riverine floods. Ground conditions such as soil, seasonal variations in vegetation, snow-cover depth and imperviousness which are affected by urbanization, have a direct bearing on the amount of runoff.

In most of the major river basins, the flood plains are subjected to annual flooding, a natural process that occurs during the monsoon season when extra discharge water spills over the river banks. In this case, the river level rises slowly and the period of rise and fall spans long periods, as much as few weeks. Direct impacts caused by river floods include: damage to property and crucial infrastructures such as a bridges and roads; disruption to livelihoods and economic activities; threats to the lives of people and animals by possible drowning in deep water, poisonous animals carried along with the floodwater and electrocution from fallen electricity poles; contamination of drinking water supplies and shortage of food owing to destroyed crop fields and loss of livestock.

In riverine floods, the slow ascend of water make it possible for timely forecasts and sustainable early warning systems to save lives and properties. A “living with floods strategy” has been adopted by communities living in the flood plains to deal with extended periods of inundation and at the same time to enjoy the benefits and potential of the wetlands.

*Flash floods*

Flash floods occur as a result of the rapid accumulation and release of runoff waters from upstream mountainous areas, which can be caused by heavy rainfall, cloud bursts, landslides, the sudden break-up of an ice jam or failure of flood control works. They are characterized by a sharp rise followed by relatively rapid recession causing high flow velocities. Discharges quickly reach a maximum and diminish almost as rapidly. Flash floods are particularly common in mountainous areas and desert regions but are a potential threat in any area where the terrain is steep, surface runoff rates are high, streams flow in narrow canyons and severe thunderstorms prevail. They are more destructive than other types of flooding because of their unpredictable nature and unusually strong currents carrying large concentrations of sediment and debris, giving little or no time for communities living in its path to prepare for it and causing major destruction to infrastructures, humans and animals, rice and crop fields and whatever stands in their way.

*Coastal floods*

Tsunamis, mainly triggered by powerful offshore earthquakes and sometimes by volcanic eruptions, and high tides and storm surges caused by tropical depressions and cyclones, can cause coastal floods in areas such as large estuaries, extensive tidal flats and low-lying land near the ocean and sea. Coastline configurations, offshore water depth and estuary shape can influence the intensity of coastal floods. Sufficient warning time can prevent damage depending on the cause of the flood. For instance, the occurrence of storm surges can be forecasted by predicting storm paths and potential landfall sites. Tsunami early warning systems can be set up in places where major fault lines are located.

In addition to the immediate impacts of coastal floods, that is, the destruction of property and loss of lives, their long-term impact can be felt in the significant reduction of income caused by destroyed seaports and beach resorts, salinity intrusion and in the subsequent decline in tourism.

*Local floods/Urban floods*

Very high rainfall intensity and duration during the monsoon season, sometimes caused by seasonal storms and depressions and exacerbated by saturated soil, can generate water volumes in excess of local drainage capacity, causing local floods. Local drainage capacity is primarily made up of a secondary drainage system or local storm drain system composed of storm drainpipes, curb inlets, manholes, minor channels, roadside ditches and culverts. This system is intended to convey storm flows efficiently to the community's primary drainage system, such as the main river channel or the nearest large body of water. In urban areas, drainage systems can be categorized by either of the following conditions:[56]

- Storm drains become outdated through changes in design criteria;
- Storm drains have exceeded their anticipated service life (disjointed segments, damaged or deteriorated pipes);
- Storm drains are partially or completely clogged (debris, sediment and utility conflicts);
- There are no storm drains.

Local floods are generally confined to small geographical areas close to reservoirs, lakes or ponds rather than rivers, but their effects can be very destructive, especially to inhabitants.

# ANNEX II: STAKEHOLDERS INVOLVED IN IFM

| Government ministries and agencies | Areas of interest and responsibilities |
|---|---|
| • Agriculture and fisheries | • Planning for seasonal crops, decisions relating to frequency of flooding the fields for replenishment of nutrients, controlling the usage of pesticides and fertilizers, vaccination of livestock, management of rice and seed banks<br>• Planning for fish spawning, enforcement of rules on restricted fishing in certain parts of the basin |
| • Water resources management | • Monitoring water quality and quantity, construction and maintenance of flood mitigation structures, ensuring the proper utilization of water resources |
| • Public works | • Building and maintenance of urban infrastructures, flood damage assessment, repair of flood-damaged structures |
| • Transport | • Improved river navigation systems, construction and maintenance of bridges, roads, railways and waterways, flood protection of such structures and subsequent repairs |
| • Communication and broadcasting | • News releases on latest flood situation, providing weather and flood forecasts on radio and TV, education and public awareness of flood issues |
| • Environment and natural resources | • Conservation of natural resources, identification of renewable energy, rapid environmental assessment after a flood event, enhancing public awareness of environmental preservation |
| • Home affairs and foreign affairs | • Liaison with countries sharing transboundary basins, international non-governmental organizations, and external donors and funding agencies |
| • Health departments | • Provision of health services, overseeing medical relief efforts such as the distribution of medicine during floods, treatment of injuries and illness, prevention of epidemics, raising public awareness of waterborne diseases and of the importance of clean water and personal hygiene |
| • Rural development | • Construction, maintenance and repair of rural infrastructures |
| • Land management and urban planning | • Enforcement of proper land use planning, development planning in urban areas of the river basin |
| • Military and police force | • Flood fighting, search and rescue, relief distribution |
| • Economics and finance | • Budget allocations for flood mitigation at various levels and river basin development |

| Government ministries and agencies (cont'd) | Areas of interest and responsibilities |
|---|---|
| • Planning | • National state or district development plans in which flood management should be incorporated |
| • Women, children and veteran affairs | • Development of special flood protection programmes for vulnerable groups, welfare of these groups, public awareness campaigns targeting these special groups |
| • Culture and religion | • Maintenance and protection of important religious and cultural sites, public awareness raising religious centres offering safe haven for flood victims, organizing voluntary groups. |
| • Education | • Schools as centres for dissemination of information on water resources management and flood preparedness to the public, safe shelters, and as a place for public awareness activities targeting children and teachers, incorporation of flood risk management concepts into school curriculum |
| **Government disaster management institutions** | **Areas of interest and responsibilities** |
| • Disaster management offices at national, state and district levels | • Development and implementation of disaster management plans at various levels, public awareness campaigns, capacity-building for disaster management practitioners and the communities, issuance of warnings, construction and maintenance of safe shelters and areas, preparing for flood emergency management and coordination with external aid agencies |
| **Flood-prone communities** | **Areas of interest and responsibilities** |
| • Landowners or farmers | • Understanding the local hazards in order to protect crops, land and other property from flood damage, complying with land use management laws, understanding the consequences of malpractice of land use issues, knowing how to voice their concerns |
| • Rural and urban residents | • Understanding existing risks; knowing how to protect lives and properties; recognizing the signs of impending hazards (indigenous knowledge); responding to flood situations; being aware of escape routes and location of shelters; understanding the links between water, land use management and floods, temporary shelters and information sources; participating in emergency drills |
| • Fishermen | • Being aware of flood situation and knowing what to do to save their livelihoods, understanding key environmental concerns, knowing how to voice their concerns |
| **Other basin communities** | **Areas of interest and responsibilities** |
| • Water user associations | • Having a good understanding of land use regulations, having knowledge of drainage conditions, understanding functions of flood moderation requirements of multi-purpose reservoirs, knowing how to voice their concerns |

| Other basin communities (cont'd) | Areas of interest and responsibilities |
|---|---|
| • Watershed and forest management committees | • Knowing potential hazards of inadequate watershed and forest management policies and practices relating to landslides and mudflow risks in the areas, knowing where to find hazard information and how to react, helping provide assistance to victims in such situations |
| • River basin organizations | • Development and implementation of basin development plans, improvement of facilities for preserving water retention, working closely with governments of riparian countries and relevant line agencies, providing a common platform for the basin communities such as government agencies, communities and NGOs, in order to meet and share ideas, information and lessons learned |
| **Scientific institutes or organizations** | **Areas of interest and responsibilities** |
| • Meteorology and hydrology | • Monitoring weather conditions, water levels in rivers and tributaries, generating and issuing flood forecasts |
| • Water resources management research centres and institutes | • Monitoring of water quality to find means to preserve the water eco-system, monitoring of resources in the river basins (consumption rates, how much reserves left, how to preserve, recycle), sharing findings with relevant government and non-governmental agencies and other users, ensuring that data disseminated are user friendly |
| • Environmental research institutes | • Environmental impact assessments, impact monitoring, environmental preservation and pollution control research, raising public awareness of environmental preservation, sharing findings with relevant governments, non-governmental agencies and other users |
| • Irrigation and agricultural research centres | • Finding ways to improve crop yield with minimum usage of fertilizers and pesticides, improvement of crop varieties in the region to withstand flood inundation, provision of training to farmers and other users in farming techniques in flood-prone areas |
| • Climate change and hazard-related research institutes | • Resaerch on climate change and its impacts on increased frequency and severity of floods, public awareness raising of hazards and their impacts, capacity-building programmes |
| **Registered non-governmental organizations** | **Areas of interest and responsibilities** |
| • Flood and emergency management centres or groups, human and environmental interest groups | • Understanding and advocating IFM in national, state and district development plans, assisting national, state and district authorities to develop and implement suitable flood management programmes, facilitating participation of communities in such decision-making processes, raising public awareness, performing community need assessments, assisting them in conveying their needs to decision makers, planning flood emergency preparedness and response, providing capacity-building for all stakeholders, working closely with the community to develop and implement community-based flood preparedness programmes, coordinating with other NGOs |

| Registered non-governmental organizations (cont'd) | Areas of interest and responsibilities |
|---|---|
| • Technical and professional societies or associations | • Providing capacity-building at various levels, technical know-how to local government in monitoring and evaluation of flood management plans and technical support to flood and emergency management groups |
| • Humanitarian relief organizations | • Distributing relief supplies to flood victims |
| • Development agencies (international, regional, national, local) | • Advocating adoption of IFM at the basin or national level, greater public participation in IFM planning, linking macro-scale international capabilities and experience to the individual needs of a particular country or a community |
| • National Red Cross Societies | • Establishing and maintaining Red Cross volunteer networks; providing community-based emergency preparedness, first-aid training and flood fighting and emergency response; making quick damage and loss assessments after a flood event, providing capacity-building for the community and volunteers |
| • Mass organizations (Women's Union, Youth Union, Farmers' Union) | • Ensuring the welfare of special focus groups, protecting them and providing assistance in maintaining their livelihoods, raising public awareness of the focused groups, undertaking specific tasks, for instance women's groups managing emergency kindergarten, youth groups forming search and rescue groups, Farmers' Union establishing grain banks in villages |
| **Volunteer organizations** | **Areas of interest and responsibilities** |
| • Red Cross volunteers | • Coordinating with various voluntary organizations, faciliting community-based emergency preparedness, search and rescue, carrying out flood fighting and emergencyresponse, performing rapid damage and loss assessment after a flood event, providing capacity-building for the community and volunteers, educating the public on basic flood response and preparedness |
| • Other voluntary organizations | • Distributing relief supplies to flood victims, faciliting community-based emergency preparedness, flood fighting and emergency response, implementating focused activities related to flooding, for example, rapid environmental assessment by a team of volunteers from a local university, retrofitting of individual houses by volunteer groups of engineers |
| **Private sector** | **Areas of interest and responsibilities** |
| • Transportation and shipping companies | • Facilitating transport of commuters and goods, ensuring maintenance of vehicles, vessels and roads in accordance with the law, assisting in relief and emergency response operations as needed |
| • Construction companies, private developers and real estate agencies | • Proper land use management, such as ensuring conformity to existing rules, protection and flood-proofing of buildings, coordination with flood insurance companies, understanding the risks of unplanned development, costs and benefits of flood protection |

| Private sector (cont'd) | Areas of interest and responsibilities |
|---|---|
| • Waste management and utilities | • Providing standardized waste disposal systems, preventing interruption of utility services, providing adequate safeguarding measures, carrying out post-flood recovery operations |
| • Industrial sector and industrial organizations | • Installing appropriate waste disposal schemes, providing alternative jobs for the community, proper land use management, building awareness of risk caused by diffusion of stored toxic chemicals |
| • Logging companies | • Having sufficient understanding of deforestation and environmental impacts and being able to rectify the problems, for example, replanting trees in upstream areas, avoiding logjams through proper management |
| • Agriculture and aquaculture production farms | • Understanding the impacts on the environment and preserving it through installation of appropriate waste disposal methods |
| • Small local businesses | • Understanding the risks in the area and employing schemes such as flood-proofing and flood insurance to protect them against risks |
| • Hydropower | • Operating reservoirs to keep flood risks in view and maintaining environmental flows. |

# ANNEX III: THE ASIAN DEVELOPMENT BANK'S GUIDING PRINCIPLES FOR EFFECTIVE FLOOD MANAGEMENT [57]

- Effective flood management requires a comprehensive approach striking a balance between flood mitigation, environmental conservation and the sustainable utilization of available water resources for the benefit of all people of a nation.
- The preservation of life and the protection of the welfare of households should be given the highest priority in the design of flood protection works.
- The conception and design of flood protection should be based on careful analysis of risks so that the passage of greater-than-design floods can be managed in a predictable and safe manner.
- Flood-proofing and emergency evacuation measures, including flood forecasting and warning, should accompany all structural interventions.
- Flood containment to a high standard of protection is recommended for urban and other densely populated areas where the potential for ever larger losses is increasing due to population growth and large investments in infrastructure and community services.
- To safeguard against catastrophic failure of flood control embankments, particular attention should be given to construction quality and maintenance, and "fuse plugs" or other means should be included to release excess water before floods reach unsafe levels.
- Many communities have developed traditional means of coping with frequent, low-intensity floods; government flood mitigation projects should incorporate these low-cost traditional means where possible to minimize the adverse impacts of floods.
- All stakeholders, which benefit economically, socially, and culturally from river basin water resources must have a say in how floods should be managed to minimize their adverse impacts while maximizing their beneficial impacts.
- Capacity-building for organizations in charge of managing river basins and raising public awareness through better education should be recognized as an effective means of reducing risks and loss of life from floods.
- There is scope to develop effective and affordable flood damage insurance for crops and property, which should be used where suitable geographical and socio-economic conditions exist.

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# TERMINOLOGY

| | |
|---|---|
| Anthropogenic changes | Changes originated by humans |
| Capacity-building | Efforts aimed to develop human skills or societal infrastructures within a community organization needed to reduce the level of risk. (ISDR) |
| Catchment area | The area from which rain flows into a particular river or lake. |
| | The area from which water runs off to a river. (FLOODsite) |
| Cost-benefit | A technique to compare the various costs associated with an investment analysis with the benefits that it proposes to return. Both tangible and intangible factors should be addressed and accounted for. (GAO) |
| Debris | Any accumulation of loose material arising from the waste of rocks. It may occur in the place where it is produced, or it may be transported by streams to ice and deposited in other localities. (UNESCO/WMO) |
| Design flood | Flood hydrograph or instantaneous peak discharge adopted for the design of a hydraulic structure or river control taking into account economic and hydrological factors. (UNESCO/WMO) |
| | Hypothetical flood used for planning and flood plain management investigations. A design flood is defined by its probability of occurrence and usually refers to the biggest previous flood in a certain location. (ADPC) |
| Ecosystem | A dynamic complex of plant, animal and microorganism communities and their non-living environment, interacting as a functional unit. (WFED) |
| Environmental impact assessment | A tool used to identify the environmental and social impacts of a project prior to decision-making. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment and present the predictions and options to decision makers.(UNEP) |
| Exposure | Quantification of the receptors that may be influenced by a hazard (flood), for example, number of people and their demographics, number and type of properties. (FLOODsite) |
| Flood | (1) Rise, usually brief, in the water level in a stream to a peak from which the water level recedes at a slower rate. (2) Relatively high flow as measured by stage height or discharge. (3) Rising tide. (UNESCO/WMO) |
| Flood control | Protection of land areas from overflow, or minimization of damage caused by flooding. (UNESCO/WMO) |
| Flood forecasting | Estimation of stage, discharge, time of occurrence and duration of a flood, especially of peak discharge, at a specified point on a stream, resulting from precipitation and/or snowmelt. (UNESCO/WMO) |
| Flood hazard map | Map produced according to scientific criteria that indicates hazards with information on degree and spatial extent of flooding. (Adapted from Loat/Meier) |
| Flooding | (1) Overflowing by water of the normal confines of a stream or other body of water, or accumulation of water by drainage over areas which are not normally submerged. (2) Controlled spreading of water for irrigation, etc. (UNESCO/WMO) |
| Flood plain | Nearly level land along a stream flooded only when the streamflow exceeds the water-carrying capacity of the channel. (UNESCO/WMO) |

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| | Area of land adjacent to and formed by a stream that is covered by water in times of flood. (Loat/Meier) |
| Early warning | The provision of timely and effective information by identified institutions that allows individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response. (ISDR) |
| Governance | The exercise of economic, political and administrative authority to manage a country's affairs at all levels. It comprises the mechanisms, processes and institutions through which citizens and groups articulate their interests, exercise their legal rights, meet their obligations and mediate their differences. (UNDP) |
| Hazard | A physical event, phenomenon or human activity with the potential to result in harm. A hazard does not necessarily lead to harm. (FLOODsite) |
| | A potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. (ISDR) |
| Infiltration | Flow of water through the soil surface into a porous medium. (UNESCO/WMO) |
| Integrated Flood Management (IFM) | A process promoting an integrated rather than fragmented approach to flood management, integrating land and water resources development in a river basin within the context of Integrated Water Resources Management, with the aim of maximizing the net benefits from flood plains while minimizing loss of life from flooding. (APFM) |
| Integrated Water Resources Management (IWRM) | A process promoting the 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. (GWP) |
| Intervention | A planned activity designed to effect an improvement in an existing natural or engineered system (including social, organization/defence systems). (FLOODsite) |
| Inundation | Flooding of land with water. (FLOODsite) |
| Land use planning | Branch of physical and socio-economic planning that determines the means and assesses the values or limitations of various options in which land is to be utilized, with the corresponding effects on different segments of the population or interests of a community taken into account in resulting decisions. (ISDR) |
| Livelihoods | The combination of physical, financial and social assets, income, capabilities and activities required by households for a means of living. (ADPC) |
| | The means by which an individual or household obtains assets for survival and self-development. Livelihood assets are the tools (skills, objects, rights, knowledge, social capital) applied to enacting the livelihood. (UNDP) |
| Mitigation | Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards. (ISDR) |
| Multi-criteria analysis | A set of procedures of analysis of complex decision problems involving non-commensurable, conflicting criteria on the basis of which alternative decisions are evaluated. (WELCOME) |
| Preparedness | Activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations. (ISDR) |
| Residual risk | The risk that remains after risk management and mitigation measures have been implemented; may include, for example, damage predicted to continue to occur during flood events of greater severity than the 100 to 1 annual probability event. (FLOODsite) |

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| Resilience | The ability of a system/community/society/defence to react to and recover from the damaging effect of realized hazards. (FLOODsite)<br><br>Social resilience:<br>The capacity of a community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures. (FLOODsite) |
| Response/relief | The provision of assistance or intervention during or immediately after a disaster to meet the life preservation and basic subsistence needs of those people affected. (ISDR) |
| Return period | Long-term average interval of time or number of years within which an event will be equaled or exceeded, for example. flood peak discharge. (WMO) |
| Reservoir | Body of water, either natural or man made, used for storage, regulation and control of water resources. (UNESCO/WMO) |
| Restoration | Return of an ecosystem to a close approximation of its condition prior to disturbance. (NRC) |
| Risk | A function of probability, exposure and vulnerability. Often in practice, exposure is often incorporated in the assessment of consequences. (FLOODsite) |
| Risk assessment | Comprises understanding, evaluating and interpreting the perceptions of risk and societal tolerances of risk to inform decisions and actions in the flood risk management process. (FLOODsite) |
| Risk perception | The view of risk held by a person or group; reflects cultural and personal values, as well as experience. (FLOODsite) |
| Stakeholders | Parties/persons that are involved in, effected from or have a relationship with a particular project, system or activity |
| Sediment | Material transported by water from the place of origin to the place of deposition. In watercourses, sediment is the alluvial material carried in suspension or as bed load. (UNESCO/WMO) |
| Sedimentation | Process of settling and depositing by gravity of suspended matter in water. (UNESCO/WMO) |
| Social resilience | See “Resilience.” |
| Storm surges | Elevation of sea or estuary level caused by the passage of a low-pressure centre. (UNESCO/WMO) |
| Structural measures | Any physical construction to reduce or avoid possible impacts of hazards, which includes engineering measures and construction of hazard-resistant and protective structures and infrastructure. (ISDR) |
| Sustainable development | Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of “needs”, in particular the essential needs of the world’s poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment’s ability to meet present and the future needs. (WCED) |
| Vulnerability | The conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards. (ISDR) |
| Watershed | Total area of a drainage basin bounded by the divide. (Bates/Jackson) |

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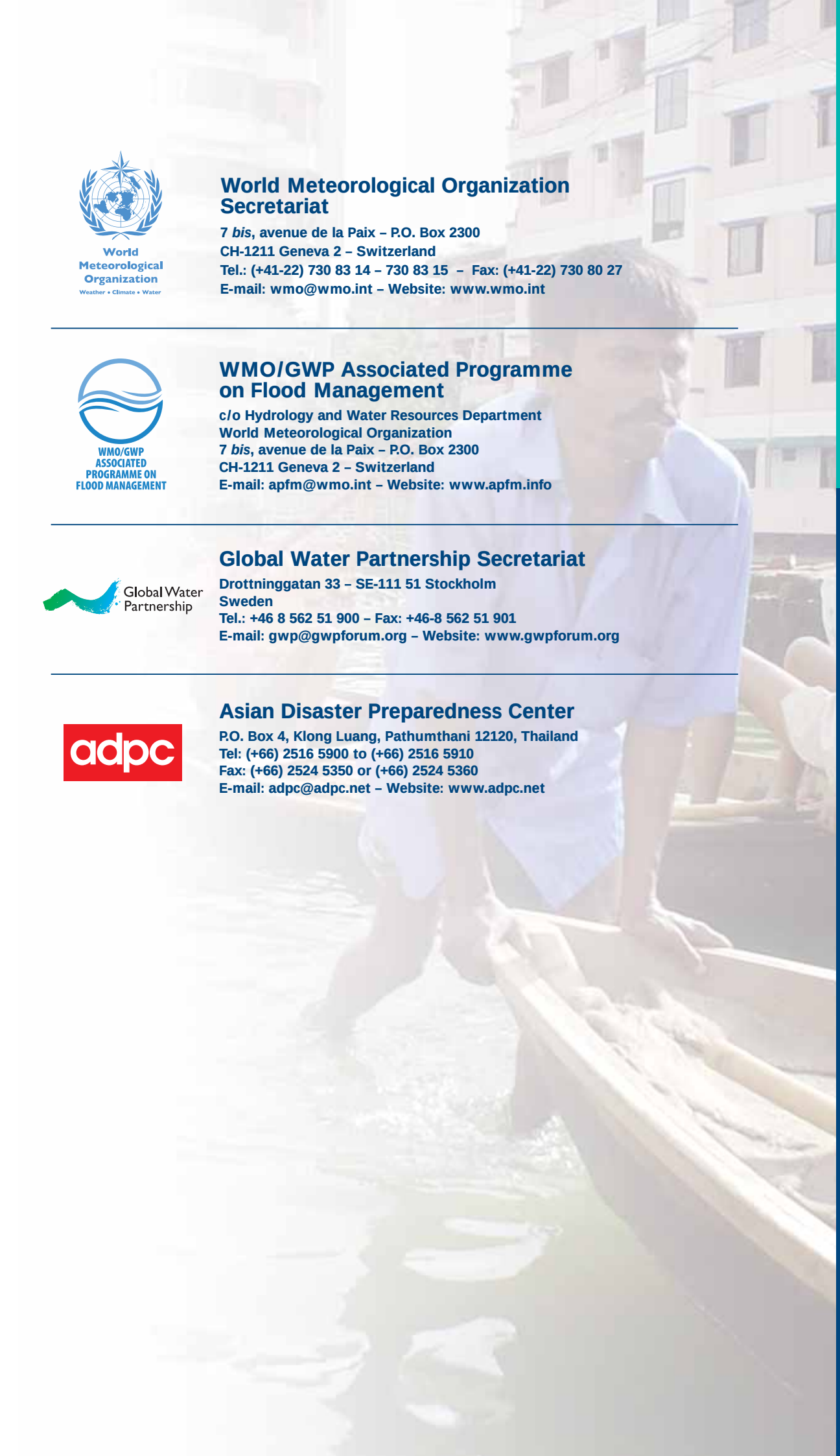


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