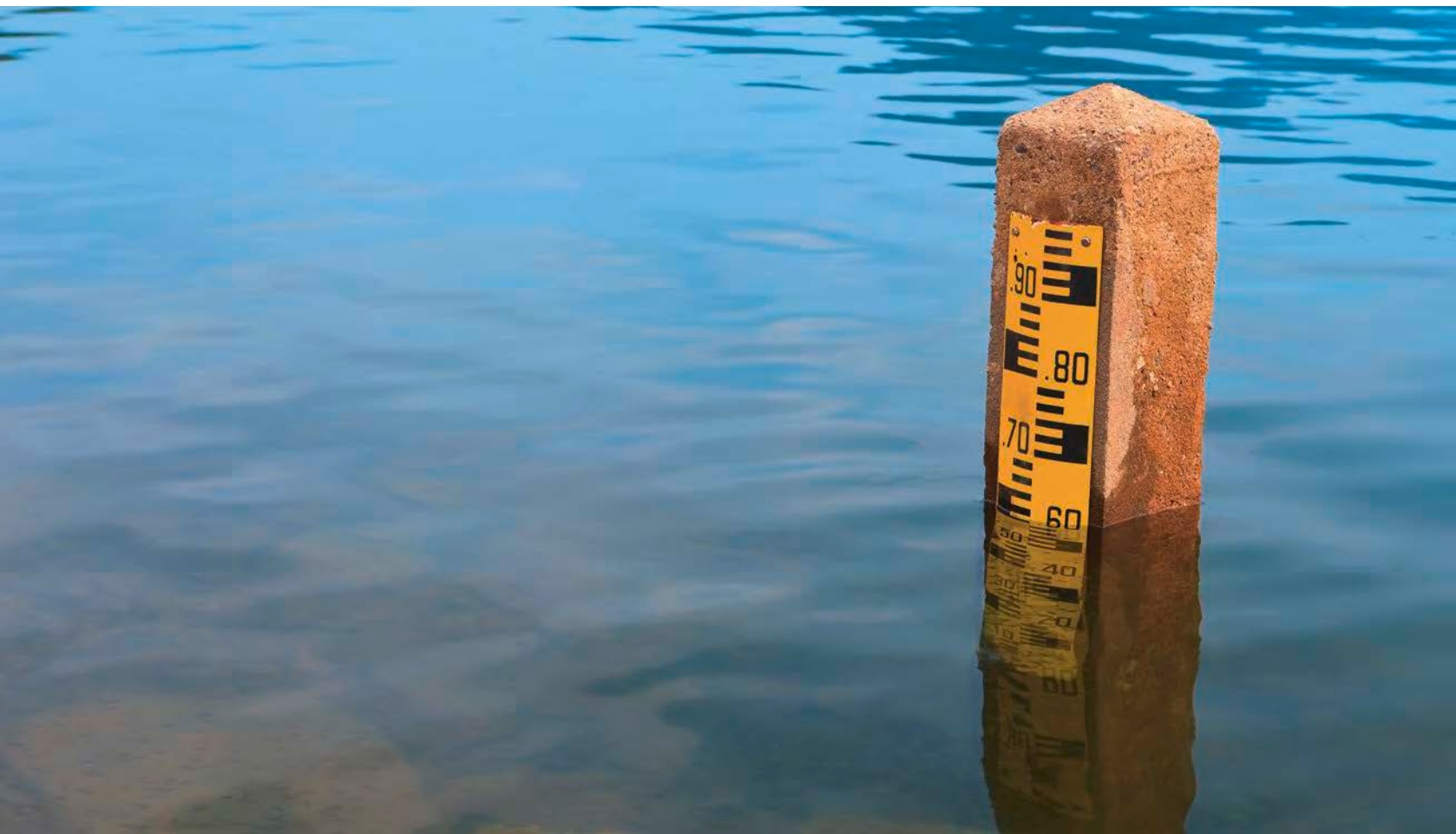




Flood Risk Management

an increasing challenge in international cooperation

GIZ - Tailored Services for Integrated Flood Risk Management

Floods are an increasing challenge for development around the world. They cause loss of human life, collapses in basic public services, substantial economic loss and environmental pollution. The risk of flooding is exacerbated by climate change. More frequent and more extreme flood events are predicted, putting ever more pressure on partner countries of the German Development Cooperation.

The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), on behalf of the German Government* and other co-funding partners, strengthens the capacity of people, institutions and societies to prevent and manage flood risks through and reduce loss and damage caused by flooding:



For more information on our flood risk management programmes visit:
<http://www.giz.de/fachexpertise/html/3722.html>

* German Federal Ministry for Economic Cooperation and Development (BMZ), German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB).

GIZ - An Innovative Partner for the Global Challenges of Tomorrow

Expertise for Sustainable Development:

The wide range of services offered by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH are based on a wealth of regional and technical expertise and on tried and tested management know-how. We are a German federal enterprise and offer workable, sustainable and effective solutions in political, economic and social change processes.

Tailored Services:

We offer demand-driven, tailor-made and effective services for sustainable development. We support our partners at local, regional, national and international level in designing strategies and meeting their policy goals.

Who we work for:

Most of our work is commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ). However, GIZ also operates on behalf of other German ministries and public and private bodies in Germany and abroad. These include governments of other countries, European Union institutions, such as the European Commission, the United Nations and the World Bank. We are equally committed to helping our clients in the private sector to attain their goals.

Global Reach:

GIZ operates throughout Germany and in more than 130 countries worldwide. Our registered offices are in Bonn and Eschborn. We have 16,510 staff members around the globe, almost 70 % of whom are employed locally as national personnel. GIZ's business volume was over EUR 1.9 billion as at 31 December 2013.



GIZ Portfolio of Flood Risk Management Services

Flooding – An Increasing Challenge in International Cooperation

Floods are an increasing challenge for development around the world. They cause loss of human life, displacement of people and collapses in basic public services such as drinking water supply, electricity, health care, communication and transport. In addition, flooding frequently leads to substantial economic loss and environmental pollution, e.g. through chemicals spills or overloading of drainage and sewerage systems.

As a consequence of population growth, the increasing use of flood prone areas for agriculture and human settlement as well as the deforestation and degradation of catchment areas, there is a growing risk of flooding to coastal and inland areas alike. Cities are particularly vulnerable to flooding, owing to the concentration of people, critical infrastructure and economic activities. The number of globally reported flood events has increased three-fold during the past decades. In 2011 alone, according to UN Office for Disaster Risk Reduction, over 106 million people were affected by floods.

Causes of flooding

Natural phenomena: - Extreme rainfall - Tidal effects, storms, tsunamis	➔
Impact of anthropogenic activity on ecosystems: - Catchment degradation / deforestation - Soil compaction due to intense agriculture - Straithening of water courses - Sealing of catchment areas	➔
Human factors: - Settlement in flood prone areas - Deficient operation and maintenance of infrastructure for river regulation (sedimentation e.g.) - Insufficient carrying capacity or blocking of drainage / sewerage systems	➔

Flood Risk



The risk of flooding is further exacerbated by climate change driven precipitation changes and sea level rise. More frequent and more extreme flood events are predicted, putting ever more pressure on the population, the private sector and government institutions in partner countries of the German Development Cooperation. Absolute flood protection is unachievable given the inherent uncertainties relating to future flood events and the extremely high costs involved in implementing flood protection schemes. The recognition of this challenge is reflected in the paradigm change from *flood protection* to *Flood Risk Management (FRM)*. Flood risk is expressed as the probability of negative consequences due to floods that cannot be fully mitigated, and can only be reduced to a tolerable level. Risk results from the interaction of vulnerability, exposure, and hazard. It describes the potential for consequences where something of value is at stake.

Managing flood risk in an integrated manner requires cooperation and coordination during the planning and implementation of FRM measures. This needs to take place:

- ~ Horizontally: between sectors such as land use and urban planning, water management, disaster management, meteorological services and the environment.



- ~ Vertically: between different levels of decision-making and administration such as regional levels (especially in the case of transboundary river systems), followed by the river basin and national to local levels (municipal authorities).



Challenges in the Context of Developing and Emerging Countries

Poverty, vulnerability and disaster risk are closely inter-linked. In many partner countries of German Development Cooperation, flooding poses a particularly severe hazard to the vulnerable parts of the population, as these are at risk of sliding even deeper into absolute poverty. Individual provisions such as insurance are often not available or not affordable to poor people.

The public infrastructure is frequently not designed in a flood resilient manner. Gaps between flood defence infrastructure plans and the implementation of investment projects can be attributed to a lack of capacities in prioritising and financing development plans. Unregulated solid waste disposal leads to drainage blockages and subsequent overflows of sewers and drains. National and local authorities are insufficiently prepared to respond to emergencies, evacuate large numbers of people and to maintain the supply of public services during and after flood events. Cultural and language barriers present obstacles to effective flood warning.

At the regional and river basin levels, the management of flood risk is often hampered by weak human, organisational and financial capacities. This constrains the provision of timely information and data to assist in planning and allocation of resources for disaster preparedness and response across boundaries. Often this is compounded by a lack of harmonisation of regional strategies with national disaster risk reduction policies.

The coordination of FRM measures between the various administrative levels is often limited by lacking or overlapping responsibilities, insufficient cooperation or little involvement of target groups.

The private sector, especially small and medium sized enterprises, are in most countries the backbone of the national economy. Industrial zones, and value chains, too, are increasingly exposed to flood risks. The 2011 floods in Bangkok, for instance, caused losses of more than US\$ 40 billion to the Thai economy. Whereas large companies may consider flood risks into their overall enterprise risk management system for business continuity, small and medium enterprises need special attention and external support as they do not have human or financial means to address the issue. Aside from economic losses, flooding may cause important environment pollution and subsequent damages to health and ecology (cascading disasters).

Framework of GIZ's Work on Flood Risk Management

GIZ enhances the capacity of people, organisations and societies to prevent and manage flood events. Since 1997, GIZ implements disaster risk management and Flood Risk Management measures on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ) as well as the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), the Federal Foreign Office (AA) and international clients. GIZ has established a wide range of strategic and technical partnerships with German and international institutions. GIZ derives its FRM approaches from three concepts and their associated knowledge communities: Integrated Water Resources Management (IWRM), disaster risk management and Climate Change Adaptation.

- ~ According to the Global Water Partnership IWRM is a process which promotes the coordinated management of water, land and related resources in order to maximise economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. IWRM is the guiding principle of German Development Cooperation in the water sector. In relation to the management of flood risks, IWRM presents valuable principles particularly for cross-sectoral coordination.
- ~ Disaster risk management comprises all types of natural disasters, including e.g. earthquakes. GIZ has developed a wide range of tools and generated experience, which are applicable for multiple risks, including weather related extreme events.



~ Long term climate related (slow onset) changes in natural systems need special instruments and approaches for adaptation to climate change. In many regions of the world, climate change is increasing flood risk. National adaptation strategies, vulnerability assessments, approaches for climate proofing of investments and ecosystem-based adaptation aid in managing flood risk in an uncertain future.

GIZ integrates the approaches of these concepts and adapts them to the context specific requirements in the partner countries of German Development Cooperation. Within our portfolio, we support the development of capacities for:

- 1) *risk analysis and assessment*: effective structures, human capacities and processes for hazard, vulnerability and risk determination and evaluation
- 2) *pre-flood risk reduction*: organisational capacity, communication mechanisms and permanent or temporal measures to reduce risk
- 3) *flood event response*: human and organisational capacities and temporal measures to minimise the loss and damage caused by a flood event
- 4) *post-flood appraisal*: capacities and temporal measures to cope with the loss and damage caused by floods.

GIZ's Approaches to Integrated Flood Risk Management

In order to strengthen FRM in our partner countries, GIZ operates through a cross-sectoral approach, and where possible, cooperates with the private sector. Partnerships aim at matching private and public interests in addressing flood risks, e.g. under the water stewardship initiative.

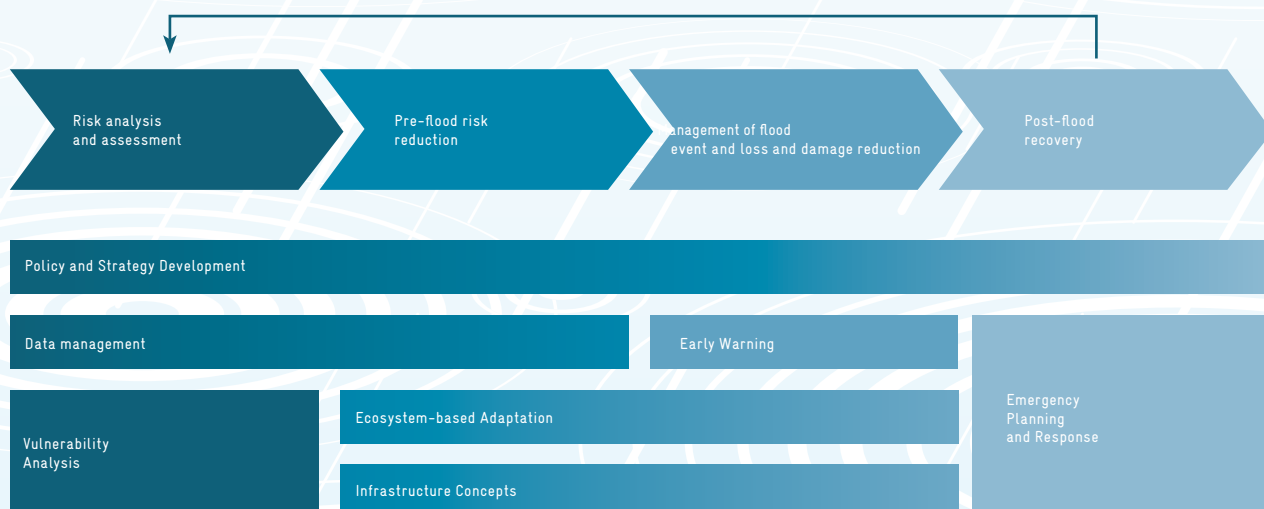
GIZ International Water Stewardship Programme

With private companies increasingly perceiving flooding as risk to both their direct operations and value chains as a whole, new models of cooperation are being sought with other actors, with whom the flood risk is shared. The GIZ International Water Stewardship Programme promotes such multi-stakeholder partnerships between the private sector, civil society and governmental actors to jointly tackle the reduction and management of water risks. The programme supports the full cycle of a water stewardship partnership, from its initiation to the conduct of a joint risk assessment, the development of risk mitigation options and implementation plans right through to a comprehensive evaluation and identification of best practice for replication and scaling-up.

Responding to the needs of our partners, we combine ad-hoc interventions to address acute emergencies with long-term capacity development. Key approaches of FRM, which GIZ advises on, are:

- I. Flood Policy and Strategy Development
- II. Vulnerability Analysis, Risk Modelling and Mapping
- III. Flood Data and Information Management
- IV. Flood Early Warning Systems
- V. Flood Infrastructure Concepts
- VI. Ecosystem-based Approaches for Flood Management
- VII. Emergency Planning and Response.

Overview of GIZ Approaches to FRM





I. Flood Policy and Strategy Development

GIZ advises on the development of sustainable FRM policies, strategies and action plans at the level of the regional, river basin and national authorities. Particularly, the institutional development and support of organisations, which operate at the river basin scale, e.g. the Mekong River Commission, has proven to be a successful approach for harmonising regional strategies with national policies.

By advising on mechanisms for monitoring and evaluation of the effectiveness of policies at the national level, and by supporting capacity development within all FRM authorities, GIZ also strengthens partners in coordinating strategies for the management of floods and water resources, with urban planning and climate adaptation strategies.

Through the implementation of global programmes, which investigate emerging trends within the international climate change debate, GIZ supports the German government in shaping future risk management strategies. To achieve this, GIZ compiles tried-and-tested action guidelines for application by the German Development Cooperation and its international partners, and implements pilot projects to develop case studies and good practises.

GIZ Global Programme on Risk Assessment and Management for Adaptation to Climate Change

The topic of loss and damage has taken on increasing significance in the climate negotiations under the United Nations Framework Convention on Climate Change. Focussing on loss and damage, particularly in relation to slow-onset changes, the BMZ funded Global Programme on Risk Assessment and Management for Adaptation to Climate Change develops innovative concepts and practical instruments in the field of climate risk assessment (including flood risk) and management, which will support at-risk countries in their efforts to adapt to climate change. In addition it will support the German Development Cooperation in the UN climate process with regard to loss and damage issues.

II. Vulnerability Analysis, Risk Modelling and Mapping

The first step in the course of systematic implementation of FRM activities in a region is comprehensive risk analysis. The risk map is at the core of a FRM strategy. This includes hazard zoning and vulnerability assessments, and results in risk maps in order to identify areas at risk and prioritise measures to reduce flood risks.

GIZ establishes mechanisms to involve the local population in risk assessments, in order to incorporate local knowledge, sociocultural values and perceptions, and develop know-how, resources and self-help capacities. Instruments and approaches GIZ employs for the identification of flood risk are:

- ~ historic flood extent and flood risk mapping and community based risk identification
- ~ river and coastal hydrodynamic modelling and climate modelling
- ~ remote sensing e.g. for the development of terrain models and the identification of flood defence assets, both natural and man-made
- ~ integration of flood management into urban planning and land use management.

III. Flood Data and Information Management

Effective cooperation and strategy development for FRM relies on the availability, accessibility and timely distribution of comprehensive information for risk assessment, early warning and disaster response.

GIZ assists partner institutions on the regional level, such as the Niger Basin Authority, and on national and local levels in the collection, analysis, presentation and dissemination of flood risk information by:

- ~ supporting the implementation and maintenance of hydrometric networks and hydrodynamic models, including flood scenario development and forecasting
- ~ assessing the interaction of land use change and hydrology in combination with climatic as well as regional and national studies
- ~ developing human and institutional capacities to improve inter-sectorial communication
- ~ supporting the implementation of shared information platforms
- ~ promoting best practices, and facilitating knowledge exchange/transfer with projects worldwide.

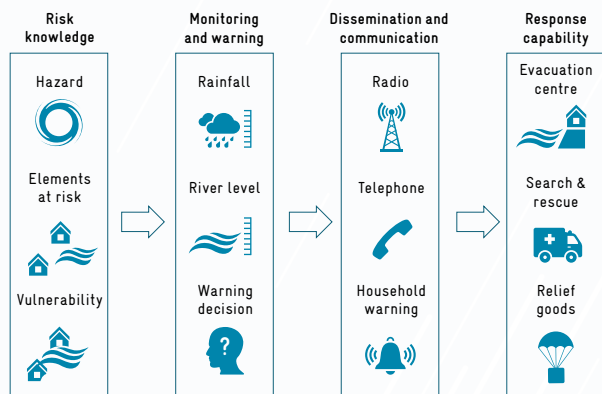
IV Flood Early Warning Systems

Early warning is a core element of effective disaster preparedness and a key approach for German Development Cooperation to prevent and reduce the loss and damage caused by flooding.

GIZ considers the whole chain of elements in an early warning system. It is not enough to convey warnings quickly to the population. The population must also know what to do in the event of a predicted disaster. This is why pol-



Key Elements of LFEWS



icy makers are involved in developing and implementing early warning systems and the population is familiarised with these. Our experience shows that early warning systems work when they are incorporated into regional or local development strategies and linked with management capacity.

Through the successful implementation of Local Flood Early Warning Systems (LFEWS) in the Philippines, Vietnam and Mozambique, GIZ has demonstrated that people-centred early warning systems, which incorporate local knowledge and capacities, and have been planned, tested and are maintained together with the population, work most effectively.

On the regional level for example, GIZ assists in the establishment of a flood early warning system covering the riparian countries in the Drin River Basin Albania, Kosovo, Macedonia, Montenegro, Serbia.

V. Flood Infrastructure Concepts

Flood defence infrastructure such as storm water drains, retention basins and dykes, protects human life and private and commercial assets, particularly in cities.

In extreme environments traditional structural interventions may not be suitable e.g. due to the impacts of desertification, and can significantly reduce flood storage and conveyance capacities. Accordingly, it is critical to fully understand the local conditions for the design and operation of effective flood control measures.

In Vietnam for example, GIZ advises provinces and cities on planning and implementation of structural interventions. In addition, we support the sensitisation of the local population on the important function of flood control

infrastructure as well as on its limitations. In GIZ's approach, constructional measures are combined with sustainable land management and must be integrated into spatial planning. To be effective, they should cater for open flood ways for rivers and integrate settlement areas into natural flow characteristics.

GIZ advisory services for infrastructure concepts and urban drainage comprise:

- ~ implementation of asset surveys and development of asset management strategies
- ~ urban drainage master planning and flood sensitive urban development planning
- ~ development of technical capacity for sustainable operation and maintenance of drainage systems and sensitisation through trainings and seminars
- ~ identification of sector investment options for prioritised flood infrastructure including advising on design of governance and financing structures
- ~ enhancement of functionality of structural measures like reservoirs respecting energy and water supply.

VI. Ecosystem-based Approaches for Flood Management

Through their natural processes such as infiltration, evapotranspiration and the storage of surface and ground water in lakes and aquifers, ecosystems provide valuable flood management services to both urban and rural environments. Vegetated buffer zones, for example, can reduce runoff whilst wetlands can act as temporary storage reservoirs. If managed correctly, these ecosystem services can complement or even substitute hard or 'grey' infrastructure measures. Ecosystem-based approaches are cost efficient, have lower technological requirements and can be implemented by using locally available materials or vegetation.

Ecosystem-based adaptation makes use of these services in order to enhance the adaptation capacities of people and to maintain the integrity of ecosystems at the same time. For example, in Thailand GIZ supports water management institutions in implementing ecosystem-based measures for the protection against extreme events and developing the respective information systems.

GIZ advisory services for ecosystem-based approaches to FRM comprise:

- ~ enhance the cooperation between authorities responsible for environmental protection and FRM
- ~ supporting the planning and implementation of local ecosystem-based measures for flood risk reduction and renaturation of river flows and wetlands

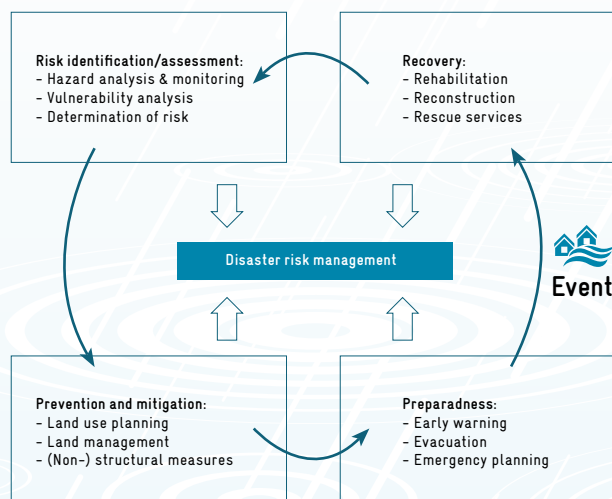


- ~ conducting studies on impact of climate change on ecosystem services and economic valuation of ecosystem services
- ~ training of staff of FRM-institutions in partner countries in the planning, design and implementation of ecosystem-based measures for flood risk reduction
- ~ advising on national adaptation strategies considering ecosystem-based adaptation.

VII. Emergency Planning and Response

As part of comprehensive disaster risk management and in order to enhance capacities of national partner institutions, local communities and the private sector for post-flood situations, GIZ provides the following services to strengthen capacities for emergency planning and response:

- ~ development of communication materials and training in order to build capacity for the public sensitisation and education on behaviour and measures in emergency cases
- ~ contingency planning, including the development and testing of appropriate standard operating and evacuation procedures



Key Elements of Disaster Risk Management

- ~ establishment of communication channels for a quick and efficient flow of information in case of emergency between institutions
- ~ clarification and functional distribution of tasks and competences amongst stakeholders at all levels
- ~ integration of disaster risk management into urban development plans, business continuity management plans for enterprises, as well as national institutions and development strategies
- ~ post disaster needs assessments.

Results

A strong focus on results, monitoring and evaluation is at the core of GIZ's support to FRM in our partner countries. In the following, exemplary results of our capacity development programmes are presented:

- ~ Cost benefit analysis undertaken by GIZ in the Philippines has revealed that savings from avoided damages through Local Flood Early Warning Systems outweigh the costs of system setup very quickly, usually within the first year of operation.
- ~ In the Philippines, German Development Cooperation has assisted in the creation of 52 community disaster preparedness plans in cooperation with the local public.
- ~ In Mauretania, we supported the stabilisation and protection of 3.5 kilometres of natural dunes in the municipal area of Nouakchott to mitigate risks of sea flooding of the capital city.
- ~ GIZ has supported the Regional Flood Management and Mitigation Centre of the Mekong River Commission in improving its flood forecasting system e.g. by incorporating climate change scenarios. As a result the citizens of the Mekong River's riparian countries are better protected, now and in the future.

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Flood Proofing and Drainage of Medium-Sized Coastal Cities for Adaptation to Climate Change in Vietnam

Project Partner:	Ministry of Construction (MoC), Provincial People's Committee (PPC)
Project Region:	Vietnam
Project Term:	Overall: 2012 – 2017
Project Budget:	Total: EUR 5.2 million
Funded by:	BMZ

Context

As one of the world's countries most severely affected by the impacts of climate change, Vietnam is confronted with the challenges of rising sea levels, increasing precipitation and more frequent and extreme natural events. In the case of coastal cities, three main sources of flood risk (rivers, sea and surface water) contribute to urban flooding. Due to a lack of flood defence infrastructure, insufficient carrying capacity of existing drainage networks and a lack of disaster emergency plans and required implementation capacity coastal cities are not adequately prepared for urban flooding in the future.

Further contributing factors, such as insufficient cross-sector coordination at the national and provincial levels, and poor flood preparedness and response measures at the communal level, inhibit effective climate change adaptation planning and a timely and systematic disaster response.

Project

The aim of the project is to improve the capacities of government authorities and the local population for the adaptation to more frequent and more extreme urban flooding events. The project takes a multi-level approach, working at the national, provincial and communal levels, as well as across several sectors relevant to urban flooding.

The project activities focus on the provincial capitals of Nha Trang, Tuy Hoa, Quy Nhon, Quang Ngai and Soc Trang at the Southern and South Central Coasts of Vietnam.

Flood Risk Management Approach

At the national level, GIZ advises the Ministry of Construction on improving the overall policy framework for urban drainage and climate change adaptation, towards the implementation of a National Climate Change Strategy to 2020. All actions are carried out in close coordination with the National Steering Committee on Climate Change, the Ministry of Natural Resources and the Environment, and the Ministry of Agriculture and Rural Development.

At the provincial and city levels, GIZ collaborates with the Provincial People's Committees, the Provincial Steering Committees on Climate Change and line ministries on the development, improvement and implementation of urban drainage plans and climate change action plans.



GIZ supports the institutional capacity development and the formulation of climate change related policy on the national and provincial levels.

For this, GIZ supports the government of Vietnam in:

- ~ analysing climate change impacts and increasing awareness



- ~ integrating climate change adaptation strategies into development planning across different sectors and levels, and into policy institutions and legal documents
- ~ harmonising sectorial efforts in the fields of climate change adaptation and disaster risk management
- ~ developing, improving and implementing urban drainage plans and strategies for upgrading drainage systems and their capacity
- ~ identification and prioritisation of flood management measures
- ~ implementing pilot projects to adapt and respond to climate change, and sharing lessons learnt with other provinces.

For the disaster risk management component of the project, the German Red Cross and the Vietnamese Red Cross implement disaster preparedness and awareness-raising activities. The project also supports the local population in developing and implementing small-scale community and household measures.

In close coordination with the Ministry of Agriculture and Rural Development, and the Provincial Committees for Flood and Storm Control and Search and Rescue and line ministries, GIZ supports the following activities to improve urban Flood Risk Management (FRM):

- ~ improving systematic mapping of flood risk and developing local early warning systems to enable effective preparation
- ~ development of Flood Management Guidelines considering the integration of FRM into land use planning and urban development planning
- ~ developing institutional capacity to implement preventive measures to mitigate the negative effects of flooding
- ~ participatory development of emergency and evacuation plans with the local population as well as awareness-raising towards characteristics and consequences of urban flooding.

A comprehensive flood early warning system is being developed together with the partners. The early warning system considers (1) risk knowledge, (2) monitoring and warning, (3) dissemination and communication, and (4) response capability. Activities include:

- ~ implementing a automated flood forecasting system and developing response capacities in a participatory way, including upstream reservoir managers, government institutions and local communities
- ~ supporting decision-making by involving local governments and communities in participatory disaster risk analysis, and in compiling essential information to improve planning and courses of action.

Outcomes

In the present phase of the project, the cross-sector planning of project activities has been finalised together with the local partners.

Capacity development activities are being implemented, such as trainings for decision makers and technical staff on FRM in cities and on mainstreaming climate change adaptation. During two study tours to Germany and the Philippines, decision makers and practitioners familiarised themselves with different approaches and methods for preparedness planning mechanisms adapted to various flooding scenarios and different institutional structures, and with strategies for awareness-raising in the population.

A cross-sector task force for the implementation and improvement of local flood early warning systems has been established, involving all relevant government institutions. GIZ has also worked with various government institutions to conduct participatory assessments to develop an action plan for the improvement of FRM.

Whilst the project's primary focus is on urban FRM, possibilities for catchment wide activities may be considered at a later stage, such as flood sensitive management of water resources.

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Climate Change Adaptation in the Western Balkans

Approach to Flood Risk Management

Project Partner:	Ministries responsible for Environment
Project Region:	Albania, Kosovo, Macedonia, Montenegro, Serbia
Project Term:	Overall: 2012 – 2018
Project Budget:	Total: EUR 3.5 million FRM: EUR 2.0 million
Funded by:	BMZ

Context

Owing to the diverse geography of the Western Balkans, the region is prone to multiple environmental hazards such as heat and cold waves, droughts and extreme precipitation, resulting in regular flooding. As a consequence of climate change, the frequency and intensity of extreme weather events is predicted to increase, which will ultimately put the region at a higher risk from flooding. Changing land-use patterns and ongoing human settlement in vulnerable areas compound this challenge.

The regularly occurring floods of recent years have resulted in high economic and environmental losses, from which the affected populations struggle to recover. The capacities of the Western Balkan countries to manage and respond to flooding are very limited. Hydro-meteorological data collection and flood forecasting is hampered by the absence of adequate gauging networks and limited resources to operate and maintain them. A comprehensive regional flood early warning system does not exist.

On the national and municipal levels, the responsibility for Flood Risk Management (FRM) such as flood defense infrastructure development, data collection, early warning and disaster management, are spread across multiple

authorities. The lack of clear leadership for FRM and limited understanding on how flood risk can be locally managed, pose significant obstacles for effective FRM.

Project

On behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ), GIZ advises the governments of five Western Balkan countries on the development and implementation of adaptation strategies with regards to climate change. The project focuses on adaptation to the predicted impacts of climate change. Support is provided in the following distinct areas:

- ~ establishment of a regional Flood Early Warning System for the Drin River Basin
- ~ drafting of national climate change adaptation strategies
- ~ formulation and implementation of flood and drought management plans on the communal level
- ~ regional cooperation in water resources management
- ~ integration of climate change adaptation in urban planning and development in the cities of Belgrade, Podgorica and Tirana.

FRM constitutes one of the priorities of project intervention in the Drin River Basin with the riparian countries Albania, Kosovo, Macedonia and Montenegro.

Flood Risk Management Approach

With the countries' overarching objective to become members of the European Union, the requirements of the EU Floods Directive (2007) provide the comprehensive framework for the project's activities.

Taking a multi-level approach to FRM the project engages on regional (basin level), national and local levels. Its focus is on establishing prevention and protection measures that cover the entire FRM cycle, from preparation and disaster management to the recovery phase.

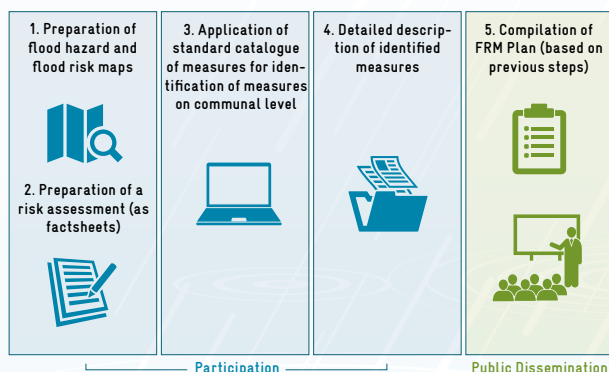


Here, the main objective is to improve flood management particularly through non-infrastructure measures such as early warning, preparedness and spatial planning and awareness creation. Further measures aim at reducing damage to human health, the environment, cultural heritage and the local economy.

Under the project, FRM plans are developed in a participatory process together with the responsible administrations as well as other relevant stakeholders. The following milestones have been identified to lead to a full-fledged FRM Plan:

- ~ hazard and flood risk maps based on flood extent mapping and satellite images
- ~ regional and communal risk assessments
- ~ standard catalogue of measures
- ~ identification of priority measures and responsible actors.

Main steps towards a FRM Plan



On the national level, the key implementation partners are the respective hydro-meteorological services as well as ministries responsible for water resources and disaster management. Moreover, hydropower companies regulating

the river flow are crucial partners for flood protection. A robust automatic hydro-meteorological network providing near to real-time data is a key element for improving FRM, and in particular flood warning. Therefore, the project supports the rehabilitation and upgrading of existing national precipitation and water level gauging stations in all riparian countries in the Drin Basin, as well as national information systems enabling data sharing. Furthermore, assistance is provided to field campaigns for measurements and station maintenance.

On the regional level, the project assists the establishment of the first Flood Early Warning System for the Drin River Basin. A catchment-based approach is applied for this complex, transboundary hydrological system, as countries are highly reliant on one another for effective FRM. For the first time, a hydrological model covering the whole basin, on which the real-time flood forecasting model can be based on, has been developed by the project.

Outcomes

Through its multi-level approach, the project has contributed to a more integrated and transboundary FRM in the Drin River Basin, which involves all stakeholders.

Once operational, the regional early warning system will enable the respective national hydro-meteorological services to issue warnings to their relevant authorities and affected municipalities, based on catchment-wide information.

As a result of assisting municipalities and cities to develop and implement FRM Plans in line with EU requirements, their vulnerability to flooding is significantly reduced. Particularly, the flood risk managers at the local level have reported that they consider themselves better prepared to provide more effective FRM for the protection of the local population.

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Reform of the Urban Water and Sanitation Sector in Uganda Approach to Flood Risk Management

Project Partner:	Ministry of Water and Environment (MWE) through Directorate of Water Resources Management (DWRM)
Project Region:	Uganda
Project Term:	Overall: 2002 – 2017 Current phase: 2014 – 2017
Project Budget:	Current phase: EUR 10 million FRM: EUR 370,000
Funded by:	BMZ

Context

Only about half the population of Uganda's towns and cities has access to clean and safe drinking water, and a mere 6 % are connected to a sewerage system. In particular, the poorer residents of the rapidly expanding urban peripheries have inadequate access to clean and reliable drinking water and sanitation. The expected impacts of climate change such as the increased frequency of extreme weather events and temperature increases of 2 to 4°C, decrease the chance of maintaining the status quo in water supply and sanitation. Limited comprehensive long term hydro-meteorological data significantly hinders the development of nationwide climatic predictions, which are essential for national development planning and disaster risk management.

Furthermore, Uganda's water sector is limited in specific strategies and prevention measures such as Flood Risk Management (FRM) action plans, dam safety and reservoir regulation instruments, as well as equipment for flood prevention and reservoir operation.

Project

The overall programme's objective is to improve the framework for pro-poor, sustainably efficient urban water and sanitation services. To achieve this, GIZ, on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ), strengthens the institutional, regulatory and business competencies, as well as the capacity of the partner institutions, and supports the implementation of the Government of Uganda's reform of the urban water and sanitation sector.

Flood Risk Management

The support started in 2009 with the aim to improve institutional capacity of the Directorate of Water Resources Management to respond to climate change impacts hence increasing resilience and adaptation towards climate change for the water sector. The specific objectives for the FRM project support is focused on:

- ~ improved understanding, knowledge sharing, development and implementation of FRM measures and instruments through joint action planning for relevant stakeholders for three target catchments
- ~ improvement of water monitoring and early warning systems on the rivers of the Kyoga basin
- ~ establishing a framework for, and training in emergency response and relief including provision and use of equipment.

Flood Risk Management Approach

Development and implementation of a FRM action plan:

At the national level, FRM had found only very limited consideration prior to the project. In order to support the provision of a national institutional framework for FRM,



the project sensitises stakeholders on the topic of flood risk through policy advice, strategy development and implementation, awareness raising and trainings.

To support the development of a FRM action plan for three target catchments, the project took the following approach:

- ~ Risk and vulnerability assessments on the basis of which FRM actions could be based – this was achieved by identifying flood risk ‘hot spot’ areas, and collection of information/data on how people are currently coping with floods and on possible gaps.
- ~ Awareness-raising in the ‘hot spot’ areas and supporting the creation of local disaster risk committees – this facilitated the participation of the local population in the FRM process.
- ~ Demonstration on how FRM targets and actions can be integrated with existing strategies and funding streams – this contributed to ensuring the sustainability of the FRM action plan by avoiding added pressure on the national and local governments to introduce new funding streams.

Flood Early Warning System (FEWS): To support the design and implementation of a new FEWS, the project focussed on the provision of new hydrometric equipment as well as assisting in the quantification of flood risk in terms of return periods and the development of flood risk maps.

The project supported the installation of 14 hydrometric stations within three target catchments that report water levels in real time, these cover the majority of rivers. Based on lessons learned from other projects, the stations were specifically designed to prevent vandalism. Furthermore, awareness-raising as to the purpose and importance of the stations was carried out with the local population.

Through cooperation with the local communities and post flood survey information, historic flood maps were created. These maps, in conjunction with statistical analysis of available flood information, were used to define exceedance probabilities of critical design flood events. This data formed the basis for determining the early warning trigger levels and flows.

Emergency response and relief: To strengthen emergency response and relief capacities, the project facilitated the procurement and the training in the use of mobile water purification units. The project also supported the establishment and strengthening of local disaster management committees within 10 districts, which were trained in general aspects of disaster risk management.



Outcomes

Through sensitisation of the stakeholders to flood risks and the integration of FRM strategies within existing political structures, sustainable framework conditions for FRM in Uganda have been created. At the level of the affected population, mechanisms for transferring strategies into actions have been successfully demonstrated, and the lessons learned will guide FRM decision making in other catchments in Uganda.

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Transboundary Water Management within the Southern African Development Community

Approach to Flood Risk Management

Project Partner:	Southern African Development Community (SADC) Secretariat
Project Region:	Angola, Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, Republic of South Africa, Swaziland, Tanzania, Zambia, Zimbabwe
Project Term:	Overall: 2005 – 2015 Current phase: 2011 – 2015
Project Budget:	Current phase: EUR 38.48 million FRM: EUR 4.41 million
Funded by:	DFID, DFAT, BMZ

Context

The SADC region is prone to recurring extreme events as a result of endemic climate variability. This is predicted to worsen with the impacts of climate change. Recurring droughts and floods adversely affect the population of the region, as can be evidenced by recent floods in the Limpopo and Kunene / Cuvelai Basins. In general, the SADC Member States have structures in place which are responsible for disaster risk reduction and Flood Risk Management (FRM). Response to drought and flooding events, however, is often hampered by the lack of timely information and data needed to assist in planning and allocation of limited financial, technical and human resources.

Over recent years, the SADC region has made important progress towards joint management of floods and water resources, as the majority of the region's 15 major trans-boundary river systems have established River Basin

Organisations. The establishment of River Basin Organisations is a key step towards facilitating Integrated Water Resources Management, a key principle behind the Revised SADC Protocol on Shared Watercourses (1998, Revised 2004). However, human, institutional and organisational capacities to coherently facilitate trans-boundary cooperation at the regional, river basin, national and local levels, remain weak.

Project

On behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ), GIZ strengthens the capacities for climate adaptation at all levels: SADC, River Basin Organisations and national/local level. Key outcomes, which were achieved during the first two phases, are the development of regional policies for transboundary water management, as well as the improved regional cooperation as a result of facilitating a strong link-up between the SADC-Water Division and the River Basin Organisations.

The GIZ Transboundary Water Management in SADC Programme's successful institution building and organisational support of the Orange-Senqu River Basin Commission, the Limpopo River Basin Commission as well as of the Kunene Permanent Joint Technical Committee have contributed towards developing a high degree of trust and willingness to cooperate amongst the individual riparian states.

The Programme addresses flood risk reduction through specific water management measures, thereby increasing the resilience of the SADC Member States. Outcomes are measured across the three levels of support.



Flood Risk Management Approach

The Programme employs the Hyogo Framework for Action to improve the level of flood preparedness of the region and of specific disaster “Hot Spots”. To accomplish this, the programme:

- ~ supports the development of a baseline on the status of Disaster Risk Reduction for flood risk reduction in the region
- ~ creates regional flood hazard / risk maps and develops best practices and standards for mapping
- ~ facilitates the assessment, revitalisation and integration of the SADC regional Hydrological Cycle Observing System (HYCOS) Network
- ~ streamlines and develops guidance on a unified approach for FRM in the region, covering structural and non-structural measures, taking a basin-wide perspective
- ~ supports the implementation of Disaster Risk Reduction / FRM in flooding “hot spots” at a national and local level.

At the regional level, the HYCOS network provides the backbone for regional tools for FRM. It generates real-time hydrological data for flow forecasting and early warning systems. Through revitalisation and incorporation of the HYCOS stations into the national systems and the collection of relevant data for FRM, the programme assists in ensuring sustainability of the stations.

At the river basin level, by linking trans-boundary initiatives with the implementation of FRM approaches at national and local levels, the River Basin Organisations increasingly support their riparian states in implementing the SADC Protocol on Shared Watercourses. The programme also supports the basin organisations’ integrated water resources planning and climate change adaptation strategies, and in doing so, contributes to improved flood

management. Furthermore, the programme directly supports the Flood Task Team of the Limpopo River Basin Commission, most notably in a joint arrangement for flood information sharing and training between the Commission and the Murray Darling Basin Authority in Australia.

At the national / local level the programme focuses on two initiatives to showcase how lessons learned on community level flood early warning systems can be transferred between river basins, and how flood hazard and risk mapping can be produced and disseminated for disaster management at the provincial / municipal level.

Case Study - Limpopo Basin

A pilot initiative funded by the programme transfers GIZ’s experiences with a community based early warning system in the Búzi River Basin to the Mozambican part of the Limpopo Basin as Mozambique is the most downstream Limpopo State and is affected by recurrent flooding. The objectives of this pilot are to improve local disaster risk reduction capacities for effective response by providing relevant and timely information about impending flood risk and mechanisms for response measures through a community based early warning system.

Outcomes

The programme reinforces the linkages of the parallel structures of the water management and disaster management units. The programme clearly showcases the value of various products and initiatives, such as the flood risk mapping and the community level flood early warning system, which serve both management units, in terms of damages / losses avoidance as well as improved resilience to flooding.

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Environment and Rural Development Programme Approach to Flood Risk Management

Project Partner:	Department of the Environment and Natural Resources, Department of Agrarian Reform, Department of Agriculture
Project Region:	Philippines
Project Term:	Overall: 2005 – 2015 Current phase: 2009 – 2015
Project Budget:	Current phase: EUR 23.5 million FRM: EUR 1.8 million
Funded by:	BMZ, EU

Context

The Philippines is made up of more than 7,000 islands, and is annually affected by two monsoon seasons, and on average 20 typhoons that enter its area of responsibility. Those events lead to exceptional rainfall resulting in frequent flooding during monsoon times. As a consequence of a changing climate, the frequency of extreme events is predicted to increase, pressure on natural resources will become more intense. Existing disparities in living standards and unequal access to resources already carry a high risk potential for social conflicts.

The responsible authorities, especially on the province, municipality and community (barangays) levels, face the challenge to develop and implement climate change adaptation and natural disaster risk management strategies.

Project

The overall aim of the project is to develop the capacities of government institutions, local authorities and the local population to carry out conflict sensitive and disaster prevention oriented management of natural resources. The anticipated outcome is to contribute to climate change adaptation.

The project also supports the stabilisation of the economic and social welfare following the devastation by Typhoon Haiyan in November 2013.

The multi-stakeholder and multi-level approach adopted in the project involves representatives of national government agencies, local government units and civil society groups, and focusses on the national, provincial, municipal and community levels.

The project comprises of several components including policy dialogue, governance of natural resources such as fisheries and forests, food security, disaster preparedness and reconstruction support for areas affected by the tropical typhoon Haiyan.



Under the disaster risk management component two Flood Risk Management (FRM) objectives are defined:

- ~ successful implementation and testing of local flood early warning systems (LFEWS) in one of the sixteen target catchments
- ~ creation of 52 community disaster preparedness plans in cooperation with the local public.

One important element of the project is the linking of interventions between the different sectors, which also contrib-



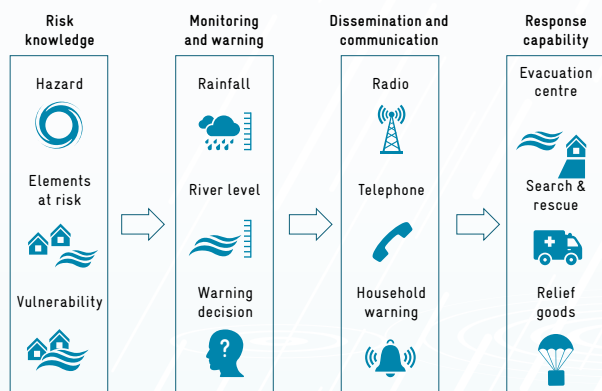
uted towards FRM objectives, for example, as a result of reduced rainfall-runoff through sustainable land use planning.

Flood Risk Management Approach

The project predominantly concentrates on LFEWS, but other aspects such as the improvement of evacuation centres, search and rescue training, and the creation of community disaster preparedness plans are also implemented.

The primary objective of the LFEWS is to reduce the vulnerability of populations during floods, in particular, through the timely dissemination of vital information to concerned stakeholders or villages (barangays). To achieve this, the systems were set up in such a way as to draw on both indigenous knowledge and state-of-the-art flood warning technology.

Key Elements of LFEWS



The LFEWS operates on the basis of hydrometric gauging stations (rainfall/water level), which transmit data via radio to an operations centre run by provincial or municipal offices. This centre is linked, again via radio, to the municipal Disaster Risk Reduction and Management Offices, which in turn warn the barangays. Within the barangays, simpler, more locally appropriate methods are applied to

disseminate the warning further, such as bells and empty Liquid Propane Gas tanks, used as gongs. These are used to send pre-arranged signal patterns, set according to a three step warning protocol - standby, prepare and evacuate! Residents also rely heavily on indigenous knowledge and collective experience to anticipate the likelihood of flood.

Outcomes

Since the initial conceptualisation of the LFEWS, fine tuning of the approaches involved was carried out. As a result, a mature approach for the establishment of LFEWS has been developed by GIZ, which is transferrable to other regions.

The LFEWS has issued many timely and reliable warnings, and had very few false alarms or missed floods. The new systems increased the warning time, and client satisfaction surveys indicated that the majority of residents in flood prone areas felt safer with the systems in place.

A key lesson learned, is that attention has to be paid to the whole chain of elements in a LFEWS. The chain is as weak as its weakest part, and cannot function without it. This means that equal support has to be given for technical and social aspects of the system. Through workshops, meetings and conferences with the different stakeholders, a significant amount of know-ledge exchange and transfer was achieved.

Whilst the early warning systems were found to be effective in saving lives and moveable property, their implementation also led to further awareness about disaster mitigation measures to reduce damages to non-movables such as crops and buildings. Cost-benefit analysis undertaken by GIZ revealed that savings from avoided damages outweigh the costs of system setup very quickly, usually within the first year of operation.

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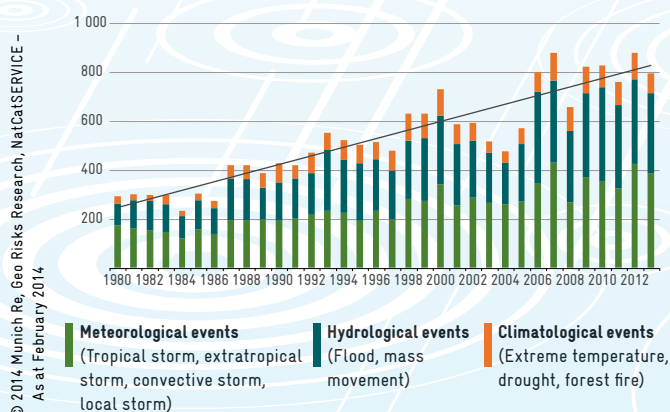
Global Programme on Risk Assessment and Management for Adaptation to Climate Change

Project Partner:	Regional and national institutions charged with long term climate risk management
Project Region:	Global
Project Term:	Overall: 2013 – 2019
Project Budget:	Total: EUR 3.7 million
Funded by:	BMZ

Context

Weather and climate-related loss and damage have increased dramatically over the past few decades. The most recent projections in climate research all anticipate a significant increase in the frequency and/or intensity of extreme weather events as well as slow-onset climate-related changes, which pose a growing risk to the sustainable development of all countries in general, and to least developed countries in particular. Since 41 % of weather related disasters are caused by flooding the resulting losses and damages are highly threatening affected areas in developing countries. In addition, in 2013 more than half the number of fatalities from natural disasters can be ascribed to flooding.

Weather-related loss events worldwide 1980 – 2013
Number of events



As a result of these critical developments and ensuing rising concerns, the topic of loss and damage (L&D) has taken on increasing significance in the climate negotiations under the United Nations Framework Convention on Climate Change (UNFCCC), especially since the last Conference of the Parties (COP 19, in 2013) and the decision on the Warsaw International Mechanism for Loss and Damage.

It is expected that there will be greater emphasis on adaptation and L&D in the new climate agreement that is to be negotiated by 2015. All stakeholders are faced with the challenge of developing and implementing concrete and effective instruments and measures in the area of climate risk assessment and management in order to support partner countries in their efforts to prevent L&D, and to respond appropriately where limits of adaptation are reached. Corresponding policies and recommendations for action by German Development Cooperation are required. While there are a number of approaches and measures currently in use in the field of short-term risk assessment and management for all risks, these are often not sufficiently operational, or not addressed to climate change. Moreover, they do not adequately monitor slow-onset changes, that may in some regions lead to an increase in flood risk, and are often not geared to the information needs of policy-makers, local governments and the private sector.

Project

On behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ), the programme aims to generate tried-and-tested action guidelines on climate risk assessment and management for application by German development cooperation and its international partners in the UNFCCC process in regions that are severely affected by climate change. Aside from the UNFCCC, the programme aims to link closely to the processes of the United Nations International Strategy for Disaster Reduction (UNISDR), thus capitalising on existing tools and experience.



Approach

The global programme will implement pilot activities in four selected regions and countries. The aim is to extend the number of pilot regions and intensify activities within them, if additional funds can be mobilised. The programme's main function is to generate experience that 1) can be used in development cooperation to help partner countries better manage challenges with regard to L&D and 2) simultaneously fuels the international climate policy dialogue with informed recommendations for action. The programme will develop practical instruments in the field of climate risk assessment and management which will support at-risk countries in their efforts to adapt to climate change. The programme targets the poor populations most affected by climate change who will, in the medium and long term, benefit from improved climate risk management.

Regional and national authorities, associations, the private sector and civil society who work in the field of climate change adaptation and disaster risk reduction as well as development planning and who implement the UNFCCC at national level are important programme partners. German Development Cooperation and its partner organisations are beneficiaries of the programme since a better understanding of both L&D and climate risk management is vital. Bilateral and multilateral donor agencies and other international organisations are important partners for dialogue and cooperation in this field.

The programme's areas of action comprise:

(1) (Non-)economic risk classification and assessment of L&D resulting from climate change:

- ~ classification of climate-related risks along the continuum between extreme events and slow-onset processes
- ~ stock-taking and processing of risk assessment approaches in the field of disaster risk management, climate change adaptation and existing private and public sector approaches
- ~ enhancement of methods for economic and non-economic evaluation of climate risk and modelling of main risks

as well as socio-economic assessment of potential L&D

- ~ establishment of climate risk assessment and management in selected partner countries.

(2) Development of innovative concepts for comprehensive climate risk management and its integration into both development cooperation operations and key processes (e.g. National Adaptation Plans) in partner countries:

- ~ stock-taking and processing of disaster and long-term climate risk management approaches (including risk reduction, risk transfer mechanisms and management of inevitable risks)
- ~ private and public sector approaches (with a focus on slow-onset changes), including approaches for ensuring climate risk resilient business continuity of small and medium-sized enterprises (SMEs)
- ~ conceptual design and piloting of instruments in selected regions/countries and sectors
- ~ identification and prioritisation of public and private risk management measures and investments.

(3) Knowledge management, promotion of dialogue and capacity development:

- ~ sharing of knowledge gained from conceptual design and piloting as well as institutional mainstreaming of climate risk management
- ~ contributing to the harmonisation of donors and practitioners in the fields of climate change adaptation, disaster risk management, development planning and (climate) finance
- ~ strengthening the German contribution to UNFCCC processes and the international debate on L&D
- ~ human capacity and institutional development in order to 1) enhance the ability of individuals (e.g. through training and pilot activities), organisations and institutions and societies (e.g. strategy development) to perform climate risk management, and 2) support the integration of risk management into development planning.

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Innovative Risk Reduction and Management for Business Continuity

The Thailand Business Case

Project Partner:	Chambers and associations of small and medium sized enterprises
Project Region:	Asia, Latin America
Project Term:	2011
Project Budget:	Total: EUR 300,000
Funded by:	BMZ

Context

The 2011 floods have been labelled the worst in five decades, killing over 800 people, and affecting 65 provinces across the country (including the recent flood in the Southern provinces). This time the industrial sector was also severely hit. Many of the industrial estates in the central region were affected and many factories were forced to close their operations for several months. In the wake of the 2011 flooding, economic losses to the private sector were estimated to amount to over US\$ 40.82 billion.

Damages occurred mainly in large industrial zones and especially around Bangkok, where hundreds of plants, from automotive industries to high tech electronic devices, were located. Roads and airports were flooded and electricity, water and communication cut for months. As a consequence, prices for commodities such as computer hard disks increased worldwide, since 40 % of their global production is based in Thailand. All in all, a substantial portion of the Thai industry stopped operating for several months. Thai authorities reacted immediately and highly professionally with financial, technical and military support in order to save lives and goods.

The floods have been a wake-up call, and all stakeholders are now aware of the high risks faced by the people and economy of Thailand. The Thai government approved

and initiated several plans, which concentrate on the recovery and reconstruction process as well as on preventive Flood Risk Management (FRM). With regard to the private sector, the efforts mainly focus on industrial estates, where enterprises are concentrated.

Global Programme: Mobilising the private sector for disaster preventive adaptation to climate change

A short term programme funded by the Federal Ministry for Economic Cooperation and Development (BMZ) focused especially on small and medium sized enterprises (SMEs), as these represent the backbone of the private sector in most countries. The project “Mobilising the private sector for disaster preventive adaptation to climate change” examined the specific needs of SMEs in several countries and continents, and developed innovative approaches to make SME and their production chains more climate risk proof.

The Thailand case serves as an example from this project, where a study has been conducted following the dramatic flood event of 2011. The study emphasises that joint consideration of private sector and governmental objectives with disaster risk reduction concepts is crucial to avoid similar damages in the future. The study revealed a wide range of necessary approaches and actions to be taken in all countries at risk.

National Level

- ~ *Capacity development:* To make SMEs more resilient and autonomous with regard to disaster risk management.
- ~ *Corporate risk management:* To improve business continuity management of enterprises at risk in industrial estates. Integration of flood and climate risk into an overall corporate risk management is needed. A substantial number of SMEs are usually dispersed all over the country, outside the estates, and within cities and municipalities. They do, however, need special attention, too, as they contribute



to the supply chains or deliver inputs for industrial estates, export, assure transport or serve the tourism sector.

- ~ *Land-use planning*: Review existing land-use planning for industrial estates considering future flood risks. Establish effective prevention measures for existing estates at risk.
- ~ *Contingency plans and early warning*: To link SMEs to national communication and early warning channels, and include SMEs in contingency plans.
- ~ *Climate finance and risk transfer*: Examine potentials to take full advantage of national and multi-lateral climate funds (e.g. Green Climate Fund, Adaptation fund) and for making small scale industries climate risk proof. Examine specific risk transfer mechanisms (e.g. insurance schemes).
- ~ *Involvement of science and technology*: Facilitate and further scientific exchange between Thai, German and international universities with regard to applied science in disaster risk management on SME level.

Intermediate level

- ~ *Risk analysis*: Increase awareness of risks of established SMEs and avoid further establishment of enterprises in high risk areas. Facilitate measures for risk reduction.
- ~ *Capacity development and promotion of chambers/business and industrial associations*: Introduction of risk reduction and management issues into the services (knowledge broker) of chambers and business associations.

Micro Level

- ~ *Public Private Partnerships*: To make international supply and production chains more disaster sensitive and resilient, and promote risk transfer/micro insurance schemes.
- ~ *Nationwide extension*: Include remote and rural SMEs in disaster risk reduction measures and capacity development. These measures may be implemented as advisory inputs to programmes on sustainable private sector promotion in general (mainstreaming), as tools and methods for mak-

ing industries and industrial estates more resilient to floods (corporate risk management), or as stand-alone national disaster risk reduction and mitigation programmes (e.g. on government level, City of Bangkok).

Benefits

The benefits of investments in risk management are immediate and long-term. Awareness and knowledge of existing risks will be established among the private sector, providing relevant information for business decisions ("living with tolerable risks or investing for reducing critical risks").

Through combined and coordinated measures by the government and the private sector, individual factories/enterprises and industrial estates will be less at risk and more resilient to disasters. Although initial investments will be necessary for appropriate measures to be taken, SMEs will capitalise on those measures and the national economy will greatly benefit from these investments.

Flood risk assessment and management of GIZ

GIZ has developed internationally recognised tools and methodologies for FRM and disaster risk reduction (risk analysis, prevention measures, mitigation and preparedness, early warning, contingency planning). In general, households, local communities, regions or states and industry are being addressed by programmes on disaster risk reduction.

With regard to adaptation to climate change, specific services on climate risk assessment and management address short term (disaster) and especially long term (slow onset changes) challenges. The overall objective is to avoid or reduce losses and damages caused by climate change and to manage residual risks, e.g. through risk transfer mechanisms like insurance schemes. Through many ongoing and implemented programmes worldwide, experiences on the ground have been gained which are constantly updated and expanded.

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Improved Management of Extreme Events through Ecosystem-based Adaptation in Catchments in Thailand

Project Partner:	Ministry of Natural Resources and Environment (MoNRE) – Department of Water Resources (DWR)
Project Region:	Thailand
Project Term:	Overall: 2013 – 2016
Project Budget:	Total: EUR 2.8 million
Funded by:	BMUB

Context

As a result of climate change, floods and droughts in Thailand will increase in frequency as well as intensity in the future.

Thailand has been affected regularly by impacts of flooding and drought. The flood of 2011 was the worst in the country's recent history, inundating more than 9 % of the total land area. The total damages and losses were estimated to be in excess of USD 40 billion. Bangkok with its extensive industrial zones is rated as one of the world's most vulnerable cities to flooding. In future more than 5 million people of Bangkok's population will be exposed to flood risk. Floods are also a major risk factor for the agricultural sector.

Many river basins, such as the Chao Phraya and the Pasak basins in Central Thailand, are sites of intensive agricultural activities while being very prone to flooding, especially during the rainy seasons. While droughts are a challenge in the North-Eastern part of the country, the South is affected by flash floods. Existing flexible water management systems, which consider both retention and storage issues to minimise the impact of floods, are not yet suffi-

cient. There is a lack of data systems for the forecasting and management of extreme events. The cooperation between institutions and a joint adaptation strategy in order to minimise the impact of extreme events is deficient. Responsible water management institutions lack capacities to manage extreme events; as a consequence major economic damages as well as harvest- and production losses affect inhabitants of watersheds.

Project

The objective of the project, which is implemented on behalf of the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Construction (BMUB), is to prevent increasing damages in Thailand's watershed areas caused by floods and droughts as a result of climate change.

GIZ aims at enabling the responsible institutions on national, catchment and local levels to prevent increasing flood and drought related damage in Thailand's catchments through the implementation of Ecosystem-based Adaptation (EbA) measures. EbA "is the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change" (Convention on Biological Diversity, 2009).

The project's approach is to strengthen cooperation among institutions in the water sector and institutions responsible for climate adaptation, and to enhance their technical expertise and planning competence. The project encompasses two major areas of intervention:

- ~ In two pilot catchment areas (Chi in the North-Eastern part of the country and Tha Di in the South East River

On behalf of:



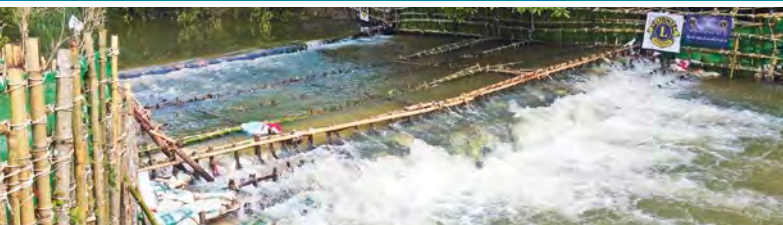
Federal Ministry for the
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Basin) water management institutions are supported in the planning and implementation of EbA measures for the protection against extreme events and developing the respective information systems.

- ~ On the national level, the pilot experiences are integrated into the national adaptation strategy. Staff members of national water authorities are trained to design and evaluate EbA-measures for flood and drought prevention.

Flood Risk Management Approach

The project promotes the use of ecosystem services in order to reduce the vulnerability of the catchments to the effects of flooding in Thailand. The approach comprises measures to conserve, restore or sustainably manage ecosystems and natural resources, such as wetlands and forests. Ecosystem-based measures provide potential for sustainable flood and drought prevention, e.g. through natural wetland areas for flood retention, zoning of land use and restricting certain types of land use or preservation of vegetation to improve permeability. They retain and reduce rainfall run-off and flooding in urban and rural areas. Green buffer zones in urban areas allow for the deposition of sediments in the flow, provide for retention of floods and increase the infiltration hence reducing surface run-off.

In order to implement and mainstream EbA in Thailand, the project

- ~ organises stakeholder platforms in the pilot catchment areas in order to support the decision-making for EbA-based measures
- ~ supports the development of hydrological information systems and trains the local institutions in using and updating the systems
- ~ assists in developing/updating water management plans with a focus on extreme events and EbA

- ~ conducts vulnerability studies in order to identify and prioritise EbA measures for flood water retention and water storage
- ~ advises the national Water Resources Department and Royal Irrigation Department on the integration of ecosystem-based approaches into the national adaptation planning.

Expected Outcomes

Water management institutions in the Chi and Tha Di catchment areas are using an information system for the development of water management measures, which integrates data from the relevant institutions. At least one EbA measure in the field of drought/ flood prevention in the Chi and Tha Di catchment areas is implemented by Thai public water management institutions, respectively. Thailand's national adaptation strategy for the water sector includes ecosystem-based watershed management measures in the field of drought/flood prevention. National Water Resources Department and Royal Irrigation Department officials are trained in the design of EbA measures.



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Adaptation to Climate Change and Disaster Risk Management in Mozambique

Approach to Flood Risk Management

Project Partner:	National Authority for Disaster Management (INGC), Ministry for the Coordination of Environmental Affairs (MICOA), National Institute for Meteorology (INAM), Brazilian Agency for International Cooperation (ABC), Regional Water Agency (ARA Sul)
Project Region:	Provinces of Sofala, Inhambane and Gaza, Mozambique
Project Term:	Overall: 2012 – 2015
Project Budget:	Total: EUR 6.03 million
Funded by:	BMZ, UK Aid, Australian Aid

Context

Mozambique is one of the countries most strongly affected by climate change. Poverty, limited institutional development and frequent extreme weather events make Mozambique especially vulnerable. Climate-related hazards such as droughts, floods and cyclones occur with increasing frequency and have a cumulative and devastating impact on the population. The provinces in Central and Southern Mozambique suffer particularly from recurrent agricultural losses as a result of droughts, floods and uncontrolled bush fires.

To compound these hazards, the densely populated coastal lowlands are repeatedly affected by severe erosion, saltwater intrusion, loss of vital infrastructure and the spread of diseases such as malaria, cholera and influenza. These factors add up to a significant burden for the poor, and the people in these provinces live with the constant threat of losing the basis of their livelihoods.

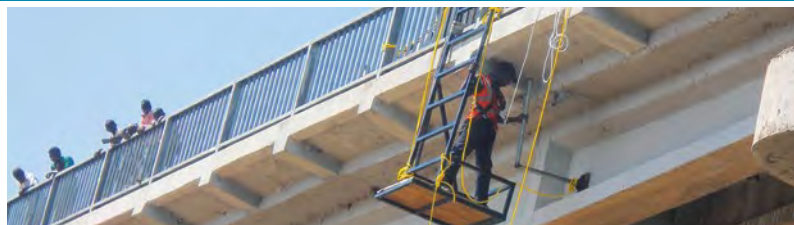
Disaster risk management and adaptation to climate change are therefore closely interlinked policy fields, which contribute to poverty eradication. The societal relevance of these issues has been recognised in Mozambique. A National Climate Change Strategy and a Disaster Management Law have been adopted, which establish flood early warning as a key issue and secure the institutionalization of Flood Risk Management (FRM). A key challenge remains the limited capacity for implementation and maintenance of flood early warning systems.

Project

GIZ is implementing three interlinked projects at the interphase of disaster risk management and climate adaptation. The main project, Adaptation to Climate Change in Mozambique (AMC Moz) focusses on the provinces of Sofala and Inhambane with the goal to strengthen the climate resilience of the population and promote the systematic implementation of adaptation measures. The project aims to

- ~ link climate adaptation with food security and income generation for the poor
- ~ support the coordination of stakeholders involved in climate-focused urban development in the city of Beira
- ~ mainstream adaptation through climate proofing into public sector planning and private investment.

Two side projects aim to modernise people-centred flood early warning, firstly, in the Buzi river basin – involving Brazilian partners through ABC and secondly, in the lower Limpopo river basin – in the context of a regional water resources management program within Southern Africa Development Community.



Flood Risk Management Approach

Both side projects, in Buzi and Limpopo, develop and establish low cost, robust climatic and hydrometric gauging stations that allow automatic data transmission to the key institutions, and strengthen capacities among local disaster risk management committees to get involved in early warning.

In rural areas GIZ strengthens the capacities of district administrations and communities to cope with climatic risks and to integrate climate adaptation into development planning and livelihoods. In order to increase community awareness and mobilisation around flood risks, adaptation and preventive health, local disaster risk management committees are integrating interactive, ludic approaches originated in Brazilian “Teatro do Oprimido” (A. Boal) with an excellent reception among communities. So far 11 community theatre groups have been created.

In Beira GIZ has established a people-centred flood early warning system along the drainage channels of flood-prone informal settlements based on simple snorkel-type water level sensors with alarm dispositive. The initiative was recognised with the 2012 International Risk Award. Now the AMC Moz project is giving advice to the formulation of the adaptation master plan of Beira. At the same time a participatory strategy for the maintenance of tertiary drainage channels and sanitation is been implemented. In collaboration with the German Financial Cooperation and GIZ's Decentralization Program AMC, Moz is initiating an initiative in the Goto informal settlement of Beira to increase waste management capacities within the city administration and the affected communities.

Outcomes

From the experiences gained so far, the community involvement is considered a key asset susceptible of replication. In particular, disaster preparedness in the Lower Limpopo Basin has benefitted from this approach, as information on possible floods will be shared earlier with local communities allowing more lead time for a coordinated response to emergencies.

The main challenges encountered during the implementation of the three flood early warning systems (Beira, Buzi and Limpopo) have been related to the high staff fluctuation among partner institutions impeding organisational capacity development, the difficulties to avoid vandalism and robbery of gauging stations in remote places, and the institutionalisation of the initiatives in order to secure sustainability.

The strengthening of local disaster risk management structures has shown to be effective, and results in the improvement of community organisation and capacity development for preparedness and response to emergencies. 32 new local disaster risk management committees have been created and not less than 80 committees were capacitated in disaster risk management and adaptation to climate change, including preventive health.

The climate proofing of district development planning is contributing to a secure local budget for the operation and maintenance of early warning systems. Training the technical staff of key institutions in the assembly and maintenance of gauging stations and data system management is creating the basis for future autonomous operation of the early warning system.

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Namibian Water Resources Management Project

Approach to Flood Risk Management

Project Partner:	Ministry of Agriculture, Water and Forestry (MAWF)
Project Region:	Namibia
Project Term:	Overall: 2006 – 2013
Project Budget:	Total: EUR 8.46 million FRM: EUR 200,000
Funded by:	BMZ, EU, MAWF, BGR

Context

Namibia is the most arid African country south of the Sahara. It is estimated that only 2 % of rainfall ends up as surface run-off and a mere 1 % is available for groundwater recharge. The remaining 97 % is lost through evaporation (83 %) and evapotranspiration (14 %). It is predicted that, as a consequence of climate change, certain areas of Namibia will be affected by a higher frequency of extreme events such as cyclones, droughts and floods.

The high variability in precipitation and inadequate water infrastructure contribute to water shortages. The limited water resources pose a significant obstacle to the socio-economic development of the country and carry a high conflict potential. The sustainable management of the critical resources, land and water, is of vital importance for ecosystems, and for sustainable economic development.

At the time of the conceptualisation of the Namibian Water Management project, national policies already reflected the strategies of the Integrated Water Resources Management (IWRM) approach. Due to a fragmented water sector, however, in which roles and responsibilities overlapped and were not clearly defined, and target groups were insufficiently involved in water resources management, the IWRM approach was not effectively implemented.

The sub-nationally operating basin management committees had previously assigned roles in the early warning and disaster response processes. However, a lack of human and financial capacity meant that actions to manage risks related to flooding were almost entirely carried out by the national authorities, the ministry's hydrology division in particular.

Project

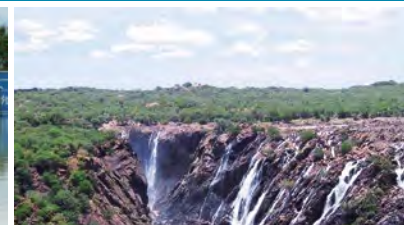
The primary aim of the project was to enhance the management of the Namibian water resources on the basis of the IWRM framework. The key project approaches were to develop the capacities of national decision makers, and to integrate and support decentralised basin management committees in the IWRM process.

Through close collaboration with the Hydrology Division of the Ministry of Agriculture, Water and Forestry the project supported Flood Risk Management (FRM) components on the national level by improving Namibia's existing hydrometric gauging network and developing the capacities for flood preparedness.

Flood Risk Management Approach

The project contributed to national FRM objectives through the following initiatives:

- ~ provision of hydrometric equipment such as flow meters and rain gauges
- ~ trainings and seminars on early warning systems, in cooperation with the United Nations Platform for Space-based Information for Disaster Management and Emergency Response, and the German Aerospace Center.



By supporting the Hydrology Division's technical capacities and through the provision of hydrometric equipment, the project supported the sustained improvement of the national hydrometric network for flood early warning. Basin management committees were supported through workshops on early warning and disaster response measures.

At the closure of the project, Ministry of Agriculture, Water and Forestry possessed adequate capacity for the operation of the national hydrometric gauging network, as well as for data processing and dissemination during flood events. Flood risks were systematically included in the regional IWRM planning process.

However, the challenge remains to strengthen the national and regional disaster management authorities, to interpret the generated flood information for conversion into FRM actions.

Lessons Learned

The Hydrology Division had an ongoing interest in improving the resolution and quality of their hydrological information, for example through the addition of gauging stations and the creation of high resolution digital terrain models for catchment analysis. The weak link within the chain of action of the existing flood early warning system was identified to be the disaster risk management authorities; therefore, there would have been little benefit in producing higher resolution flood information. As a consequence, no further investments to improve the hydrological datasets/predictions were made during the lifespan of the project.



A further important lesson learned was the need for the local population has to be sensitised to the importance of an operational gauging network; this in turn improves effective hydrometric data collection and management. One particular challenge to the improvement and maintenance of the hydrometric network had been the vandalism of gauging stations by removal of the stations' solar panels.

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Adaptation to Climate Change in Coastal Cities

Approach to Flood Risk Management

Project Partner:	Ministry for the Environment and Sustainable Development (Ministère de l'Environnement et du Développement Durable, MEDD)
Project Region:	Mauritania
Project Term:	Overall: 2013 – 2016
Project Budget:	Total: EUR 6.5 million
Funded by:	BMZ

Context

Nouakchott, the capital of Mauritania, is a very young coastal city situated on the edge of the Sahara. Just 5,000 people lived there when the city was founded in 1960; today it has an estimated population of one million inhabitants.

During the past decades, prolonged periods of drought resulted in a rapid rural-urban migration, leading to the development of urban and peri-urban informal settlements. Pro-active urban planning and development were not possible under these circumstances. Today, the city is confronted with two challenges, which are shaped by both manmade and climate induced factors: desertification and flooding.

Large parts of the city are built in a dried-up saltwater lake (sebkha). Even as late as the 1990s, building material for the city was taken from the natural sand dunes running along the ocean. The dunes, which were the only barriers protecting low-lying areas of the city from seawater incursion, started to erode as a result.

Since around 2008, another phenomenon is also creating problems for the city: rainfall contributes to a rising groundwater water table, causing flooding in several parts of the city, lasting up to several months. The rising sea

level and increasingly heavy rains will intensify the city's challenges in the future.

Project

On behalf of the German Federal Ministry for Economic Cooperation and Development, GIZ, through the Adaptation to Climate Change in Coastal Cities project, is supporting the Mauritanian government in developing protective measures for the cities of Nouakchott and Nouadhibou, and its citizens, against the impacts of climate change. The main objective of the project is to develop integrated planning of adaptation measures to climate change in urban areas, to ensure the sustainability of investments.





The Flood Risk Management (FRM) objectives of the project focus on strengthening the institutional capacities of national and municipal authorities, and on securing the coastline and adapting to flood events in the city.

Flood Risk Management Approach

The FRM approach developed by the project consists of different elements:

- ~ Data production and knowledge sharing – The first step was the consolidation of existing knowledge. Since 2004, a number of studies have been developed. A commonly build information system (AdaptNKC) including geographical data gives all participating organisations access to the data they need to make sound decisions.
- ~ Local vulnerability analyses and new climate risk assessments for sea level rise, surface and groundwater related flood risk, for different city districts.
- ~ Development of an integrated climate adaptation action plan addressing flood risks.
- ~ Stabilisation of coastal dunes.
- ~ Development of urban drainage strategies – Irregular rainfall-runoff flow paths (due to the very flat landscape topography), and the extremely low frequency in rainfall events, preclude the implementation of traditional urban drainage techniques.
- ~ Implementation of pilot projects – These will serve as basis for developing replicable flood management approaches.

Outcomes

Three and a half kilometres of natural dunes in the municipal area of Nouakchott have already been sustainably stabilised and protected. The idea that coastal and dune protection is not a one-off event but an ongoing project has also been successfully communicated.

In 2013, a Mauritanian delegation of experts and decision makers travelled to Germany. While in Germany, the experts collaborated with different institutions and learned about current issues relating to coastal protection and modern technical solutions.

The AdaptNKC information system provides access to more than 800 relevant documents. This knowledge base helps decision-makers to plan, manage and evaluate adaptation measures in the future.

An environmental impact assessment investigating ways of closing gaps in the natural dune strip was realised. Now, GIZ and the Mauritanian Ministry of the Environment undertake the first coastal protection measure as a pilot project closing two breches in the dunes belt.

In cooperation with the University of Applied Technologies Hamburg-Harburg, Institute of River and Coastal Engineering, GIZ is developing technical solutions for areas particularly at risk, such as the local fish market with its landing area for more than 500 pirogues (fishing boats).



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Support of the Niger Basin Authority

Approach to Flood Risk Management

Project Partner:	Niger Basin Authority (Autorité du Bassin du Niger, ABN)
Project Region:	Benin, Burkina Faso, Cameroon, Ivory Coast, Guinea, Mali, Niger, Nigeria, Chad
Project Term:	Overall: 2013 – 2016
Project Budget:	Total: EUR 3.3 million FRM: EUR 710,000
Funded by:	BMZ

Context

The Niger Basin Authority, *Autorité du Bassin du Niger* (ABN), is mandated to facilitate coordinated and cooperative management of the Niger River Basin. In 2002, the member states of the ABN agreed on a joint vision (vision partagée) for the sustainable development of the Niger Basin. On the basis of this vision the ABN has formalised a water charter (*Charte de l'eau*) as an institutional framework for the usage of water resources.

As a result of weak financial capacity and a steadily increasing amount of responsibility, the ABN is confronted with the challenge to develop mechanisms to guide the member states in the implementation of the charter's principles. Insufficient capacities, as well as a lack of harmonisation of the charter's principles with national Disaster Risk Reduction policies, significantly affected the disaster response of the national authorities to floods. As a result, the floods of 2012 caused widespread loss of life in Mali, Niger and Burkina Faso, despite the ABN issuing warnings six days in advance of the event.

Project

The primary objective of the project is to strengthen the ABN to sustainably manage and develop the trans-boundary water resources in the Niger River Basin, on the basis of shared principles and strategies.

Flood Risk Management (FRM) objectives focus on providing timely and understandable flood warnings, on the basis of an ABN managed early warning system, to the population of at least four pilot communities within two countries along the River Niger.

Indirect contributions to FRM are also expected through the strengthening of institutional capacities of the ABN, as well as by supporting the harmonisation of national Disaster Risk Reduction policies with the principles of the water charter.

Flood Risk Management Approach

On behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ), GIZ supports the capacity development of the ABN and its member states to manage risks related to climate variability. In this context the project strengthens the high- and low-flow forecasting capacities on the basis of an existing regional hydro-climatic gauging network.

The ABN is already successfully managing the data exchange between member states for the operation of its forecasting system. In order to further improving the quality of regional forecasts, the project focusses on enhancing:



- ~ hydrological modelling – particularly for adequately capturing localised events
- ~ communication channels – developing strategies and mechanisms for warning a maximum number of people of varying literacy and language through multiple communication streams
- ~ analysis and presentation of hydrological data – through technical advice and advanced training.

For an improved link-up between the regional and national levels, the development of suitable communication formats between the ABN and reservoir operators are a priority to:

- ~ improve the utilisation of forecasts for enhanced reservoir management by the reservoir operators
- ~ support the daily operation of reservoirs.

With a steadily increasing utilisation of floodplains as economic areas and for settlement, there is an increased risk of flooding related losses and damages. The project, in cooperation with the national connection offices (Structures Focales Nationales), implements pilot projects for community-based flood early warning systems (FEWS) in a number of communities at risk from flooding in Niger and Benin.

A particular focus is placed on the systematic cooperation of the flood early warning by ABN and the disaster preparedness within communities. The needs of the female and male population are equally considered.

To inform local flood management strategies, remote sensing via satellite was carried out to provide strategic flood risk maps, as well as an inventory of dykes and embankments along the river corridor.

Lessons learned from other development programmes are adopted where feasible, from programmes such as the Southern African Development Community (SADC) Trans-boundary Water Management Programme. Based on the experiences gained through the pilot projects, recommendations for replication and knowledge transfer along the River Niger will be made.

Outcomes

The achieved outcomes of the technical cooperation are the development of a joint vision, action plan and investment plan. The programme has also contributed to the development of the water charter. Through the development of the national connection offices, the agreement on a mechanism for the exchange of relevant data, as well as through the improved communication mechanisms, the cooperation between the ABN and its member states has been strengthened.

As a result of effective flood early warning, which requires the cooperation of the authorities across all levels, the positive impacts of trans-boundary cooperation will become noticeable at the level of the affected local population.

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Transboundary Disaster Risk Management in the Niger River Basin (Gao – Niamey)

Project Partner:	Ministry of Planning, Niger (Ministère du Plan, de l'Aménagement du Territoire et du Développement Communautaire)
Project Region:	Niger, Mali
Project Term:	Overall: 2013 – 2016
Project Budget:	Total: EUR 3.46 million
Funded by:	BMZ

Context

One of the predicted effects of climate change on the Niger Basin's water resources are changing rainfall patterns with increasing precipitation during shorter time periods, partly occurring outside typical rainy seasons. These impacts already become evident in more frequent periods of drought and flooding. Food insecurity and temporary water shortages further add to the region's vulnerability and pose an important challenge to Mali and Niger.

The adjacent regions of Gao (Mali) and Tillabéri (Niger) are particularly affected by periodic flooding and the rural population in faces increasing threats to their livelihoods. Further key contributing factors to the population's vulnerability include the high population growth and poverty rates, expanding urbanisation and inappropriate land use systems.

At present the involved authorities across local and national levels as well as the affected population lack the capacity to adapt to changing risks, and to realise adequate measures of disaster prevention and mitigation.

Project

The aim of the project is to enable the population and the partner authorities along the Niger River to adapt to changing risks and to protect them from flooding out of their own capacities. To achieve this, the project links a multi-level approach with the support of stakeholder cooperation.

The target group of the project is the flood affected population of:

- ~ Niger: *Départements* of Tillabéri, Téra and Gothèye in the Tillabéri region
- ~ Mali: *Cercles* of Ansongo and Gao in the Gao region.

The primary project partner is the Ministry of Planning, Niger. As a result of the project's trans-boundary approach, however, cooperation agreements with the regionally operating Niger River Basin Authority (*Autorité du Bassin du Niger*) will be made.





Flood Risk Management Approach

The organisational and political advice of partner organisations as well as the project's capacity development interventions focus on two main areas:

- ~ improving the capacities of all relevant government institutions for disaster risk management
- ~ assisting local communities and municipalities to improve the planning and implementation of disaster prevention and disaster preparedness measures.

The project implementation follows three main steps:

- ~ **Step 1** – Professional and methodical development of partner and project staff through trainings
- ~ **Step 2** – Project roll-out into the target regions with a primary focus on vulnerability and capacity assessment within communities

- ~ **Step 3** – Conceptualisation and implementation of individual action areas for disaster preparedness and prevention.

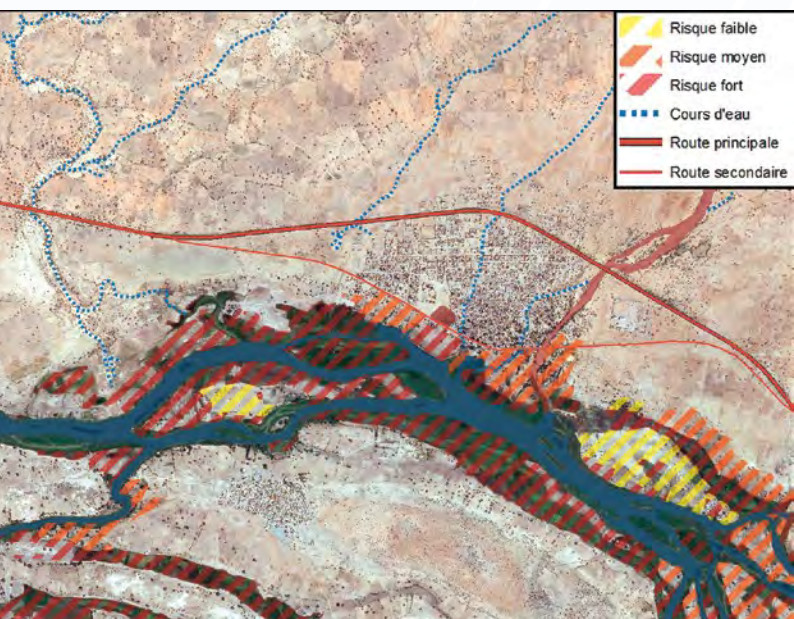
At the heart of the process to identify disaster risks at a local level lies a community-based participatory risk analysis approach. Subsequently, targeted risk management strategies are developed. The project's methodical approach differs from similar community-based approaches by integrating flood risk information based on high resolution satellite imagery verified by local communities.

High resolution satellite imagery is hereby used as a methodical tool:

- ~ to identify flood-prone areas and related infrastructure
- ~ to create easily interpretable maps that can be used as an instrument to develop and prioritise strategies for disaster risk reduction
- ~ to discuss cause and effect relations with the local community
- ~ to analyze the driving forces of vulnerability in the community
- ~ to raise awareness and to assist decisions in community planning.

Trained experts in community development and mobilisation are responsible for identifying and involving stakeholders and interested parties to carry out this highly participatory community-based process.

The findings of the remote-sensing-supported risk analysis approach will be compared and evaluated against common community-based approaches.



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Climate Change Adaptation through Climate Sensitive Flood Management in the Lower Mekong Basin

Project Partner:	Mekong River Commission (MRC)
Project Region:	Cambodia, Laos, Thailand, Vietnam
Project Term:	Overall: 2010 – 2014
Project Budget:	Total: EUR 3.2 million
Funded by:	BMUB

Context

Natural floods are important contributors to the Mekong river system. They improve the livelihoods and productivity of local farmers and riverside dwellers as they provide additional fertile soil for agriculture by depositing sediment. At the same time, extreme flood events threaten people's lives and their income sources as they destroy harvests and infrastructure. In recent decades the Mekong Basin has experienced a significant increase in extreme floods. This is a direct consequence of manmade alterations to the river system and changes in rainfall patterns. International climate change studies have projected a continuation if not an acceleration of this trend.

The increased probability and severity of floods are a danger particularly for the inhabitants of the Mekong floodplain, but also for those living near tributaries prone to flash flooding. Additionally, a projected sea level rise of up to one meter makes the Mekong Delta one of the world's five most vulnerable deltas to the impacts of climate change.

To manage flood events in a coordinated manner is one of the Mekong River Commission's (MRC) key tasks as part of its mandate to coordinate the sustainable management and development of water and related resources in the Mekong River Basin. Significant progress has been made

in recent years but there still remains a pressing challenge because of the limited knowledge and capacities within the MRC as well as the relevant line agencies to adapt to the projected changes in flood patterns.

The impact of future climate change on floods in the Mekong Basin will be a key challenge for the MRC's flood forecasting system. At present, the existing data management and flood forecasting systems are not capable of including climate change scenarios.

Project

The MRC assesses the likely impacts of predicted future climate change on flood generation and propagation as well as the flood risk in the Lower Mekong Basin. It has become clear, that changes to the hydrologic system of the Mekong resulting from the impacts of climate change need to be integrated into flood forecasting systems and Flood Risk Management (FRM).





On behalf of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), GIZ supports the MRC's Flood Management and Mitigation Programme (FMMP) which aims to improve flood forecasting and the management capacities of the relevant line agencies of the MRC's Member Countries.

Flood Risk Management Approach

The Regional Flood Management and Mitigation Centre (RFMMC) receives support in several areas:

- ~ Adjustment of the current flood forecasting system and incorporation of climate change scenarios: The software packages that comprise the RFMMC flood forecasting system and the MRC Decision Support Framework and Toolbox are updated and improved. New data inputs are integrated, report formats are changed as well as sensitivity testing is carried out. In addition to incorporating the climate change scenarios, these efforts aim at improving the forecast quality of the RFMMC system.
- ~ Improvement of access to flood related climate change projections and information: The project provides the national ministries with medium and long term flood simulations under climate change conditions. The line agencies use the adjusted flood forecasting systems as well as a comprehensive and gender-sensitive climate change vulnerability analysis for their planning processes.
- ~ Implementation of pilot measures in cooperation with national institutions in the MRC member countries: Pilot measures such as the construction of safety areas, regeneration of flood plains, or construction of dams for flood control are going to be implemented to reduce the vulnerability of the population to extreme flood events. Lessons are fed back into the FMMP.

The Capacity Development support by GIZ comprises

- ~ building networks of international and regional experts and institutions with a focus on the Mekong region
- ~ developing, testing and introducing IT-based flood forecasting solutions
- ~ organising study trips, trainings and conferences in order to facilitate learning and the exchange with other River Basin Organisations
- ~ supporting the on-the-ground implementation of flood management pilot projects.

Outcomes

Mainstreaming of the climate change adaptation efforts within the MRC was strengthened through a joint appraisal of flood forecasting and climate change modelling capacities in the Member Countries with the MRC's Climate Change Adaptation Initiative. The results of this appraisal were used to define the changes and improvements to the flood forecasting system at the RFMMC, which are currently under implementation. As a result of these improvements the MRC will be in a position to forecast floods within the context of a changing climate.

Additionally, the MRC advises Member Countries on which regions to focus their flood preparedness, mitigation and management efforts. Through the application of the MRC's flood forecasting system national institutions can design, plan and implement climate change adaptation measures related to flooding. In order to gain practical experience in this field, flood protection measures are being implemented in areas that are likely to suffer from increased flooding in the future. In the long run, these efforts will help to protect the poorest and most vulnerable sectors of society within the four countries.

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