Module 8: DRM of hydro-meteorological hazards

Introduction

This module focuseson the hydro-meterological hazards in watersheds, which are closedly linked to the challenges of climate change and human activities in the upper and lower parts of a watershed. The module provides an overview of DRM measures to systematically reduce and manage disaster risks.

Disaster risks, climate change and natural resource management

As Module 1 indicates, it is important to remember that a hazard in itself does not necessary cause a disaster. A **hazard** is a potentially damaging phenomenon. Only in combination with vulnerability and exposure, a hazard may lead to a **disaster**, which lead to significant damage and loss. Therefore, **purely natural hazards** are few**,** such as earthquakes or volcanic eruptions. Most **disasters** are generally not **natural**, since they are linked to a vulnerability that is influenced by human actions.

Figure 1: Illustration of hazard, vulnerability and disaster.

Disasters can be distinguished by scales of size and time. There are **frequent and infrequent** disaster events, also referred to with return period or probability of occurrence. **Slow-onset** disasters, such as droughts or desertification, emerge gradually over time. In contrast, sudden-onset disasters, such as earthquakes or flash floods emerge quickly or unexpectedly. Since different types of hazards might be relevant in a given context, it is important to assess all relevant hazards using a '**multi-hazard' approach.**

A **disaster** occurs when these hazard processes overlap with communities' vulnerabilities and exposure due to lack of awareness, limited weather data, absence of preventive infrastructure, low preparedness, etc. As a consequence, disaster events may cause significant loss of human lives, infrastructure, houses, harvest and other livelihood assets, which may affect single households and families or whole communities and regions.

Disaster risk management (DRM) is the application of policies, processes and actions to prevent new risks, reduce existing disaster risks and manage residual risks contributing to the strengthening of resilience. Worldwide 90% of major disasters have been caused by **weather-related events** such as floods, heatwaves, storms and droughts (UNISDR, data 1995 - 2015)[1]. With the effects of climate change, these water-related events tend to increase in frequency and intensity. Therefore, DRM is closely related to concepts of climate change adaptation (CCA). The measures frequently include adaptation, improved management of disaster and climate risks as well as natural resources (cf. Modules 1 and 4).

Disaster risks in watersheds

Life is dependent on water but water is also a potential threat to life. Rural communities frequently face the challenges of either too much or too little water. Human settlements are located within watersheds and are dependent on its resources. However, watershed and administrative borders may vary substantially.

The major **hazards in a watershed** are typically droughts and floods. Both might be relevant for one and the same community but at different seasons of the year. Floods usually occur suddenly; over a couple of hours to days. Droughts, on the other hand, tend to occur only gradually and are therefore often perceived only at a late stage. Further, there is a range of other complex hazard processes that might be relevant in watersheds such as landslides (mobilisation of soil), mudflows (soil - water - soil - wood mixture), avalanche (snow, stone or rock) and erosion (riverbed - bank/shore – land surface).

[1] UNISDR & CRED, 2015: The human cost of weather related disasters 1995 – 2015

Complex interaction of upper and lower watershed activities

Multiple natural and human factors of the upper and lower watershed interact with each other leading to specific hazard risks. These are described in box 1 and figure 2 with the example of Yelga village.

Box 1: interaction of upper and lower watershed area of Yelga village

Yelga is a small village in Kakhmar district in the watershed of Yelga. The village has only limited access to basic services. Electricity and irrigation infrastructure is available to only a few inhabitants and poverty is wide-spread.

The local population has grown substantially over the past years, which results in intensified agriculture and livestock rearing. An increasing number of sheep graze in the sensitive upper watershed areas, where some farmers nowadays grow wheat. To complement family income –instead of going to school –boys and girls collect shrubs in the upper watersheds to use or sell as fuel wood. As a result, the protective vegetation of the upper watershed has become scarce. The soil retains and stocks less water. This has led to increased water runoff, erosion of fertile lands and reduced ground water reserves.

Additionally, as an effect of climate change, both the intensity of rainfall and the length of dry seasons have increased. As a consequence, Yelga is affected by flash floods every year. Damaged houses, lost harvest, dead chicken and cows and sometimes drowning of children on their way to school are some of the most direct impacts. There are also some "hidden" consequences that are related to the loss of livelihoods bases, when seeds for the next season are lost, irrigation infrastructure is damaged, important access bridges or roads to neighbouring villages and markets are closed, etc. Further, the extended dry periods reduce the amount and quality of wheat and potato produced. As women use water for domestic tasks, they are particularly affected by water scarcity. During droughts and floods, young children suffer from diarrhoea and skin diseases due to the low water quality.

The sum of these consequences exacerbates poverty to such a level that some villagers have migrated to nearby towns and the capital.

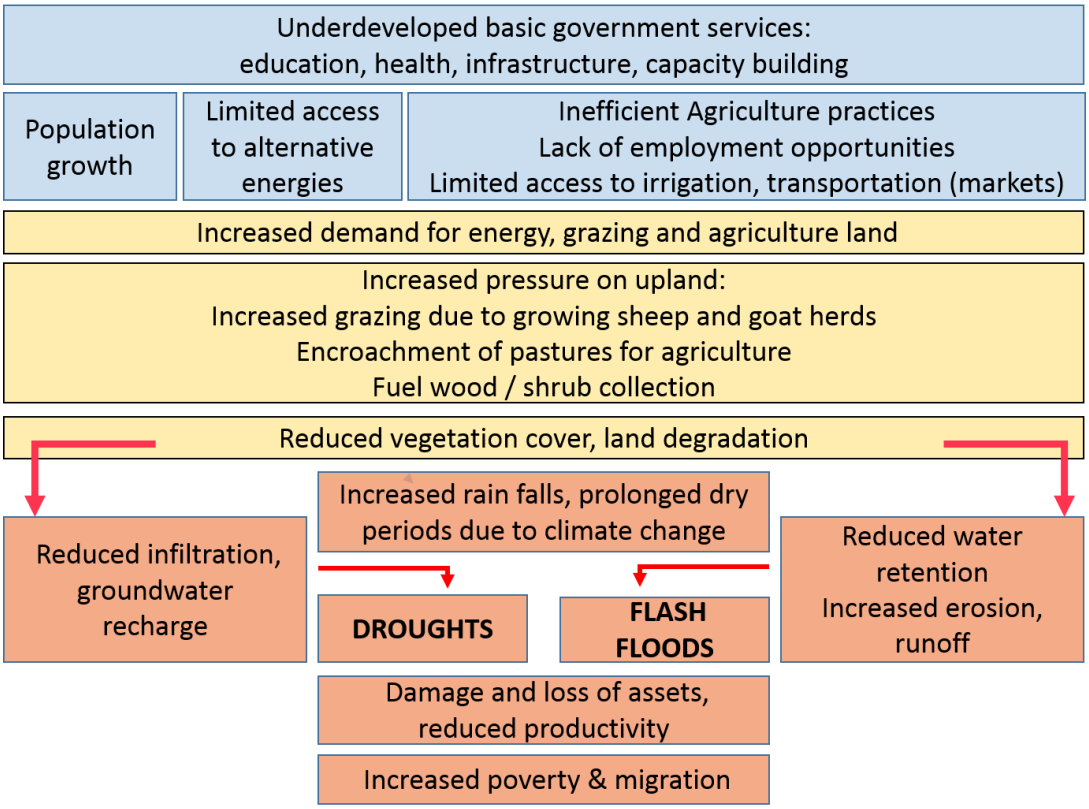

Figure 2: Problem tree in upper and lower watersheds

It is important to analyse and understand the complex interaction of natural hazard factors and human practices and influences. The impacts of disasters tend to be most relevant in the lowlands, where valuable assets are located. However, its cause is often related to the uplands of the watershed.

In order to support rural communities depending on watersheds and its natural resources, it is key to understand the **interdependence between lower and upper watersheds**. Participatory community based problem analysis and solution finding is therefore an essential starting point to define appropriate measures but also to raise awareness, strengthen collaboration, ensure participation, increase linkages, etc. (cf. Working with Groups, Good Governance, Working with Women and Men, Participatory planning for watershed management).

Box 2: Disasters as an opportunity

Analysis and statistics of disaster events tend to focus on the negative impacts. However, under certain circumstances, disasters might also offer certain opportunities:

- **Build back better** (BBB): Reconstruction of basic infrastructure (houses, health and education facilities, roads, etc.) might include improved and more robust design, more modern services, access to more service users, etc.
- Increased awareness and **will for prevention measures**: after a disaster event, the population tends to be more aware about risks associated with their livelihoods. According to the impact, this might remain valid for various years or even generations, limiting a risky behaviour. Due to this increased awareness, people tend to be more willing to invest into prevention measures. Therefore, disaster events are an important momentum to promote DRM to reduce current and future risks.
- **Improved collaboration**: In emergency situations people cooperate more easily together to cover most urgent needs, since there is a mutual understanding of the commonly faced situation. A successful (informal) emergency collaboration amongst neighbours, governmental representatives, local institutions, private sector and other actors might become the start of improved linkages or might even systematically set collaboration mechanisms for an improved preparedness.
- **Co-benefits of DRM measures**: DRM measures promoted after a disaster event might have important benefits as indirect or spin off effect, e.g. increased value of land or a housed property that is protected from future floods, additional income through flood resistant crop varieties.

DRM framework in the context of a local community managed watershed

In order to systematically reduce and manage disaster risks the international framework (SFDRR) focus on four main priorities of actions (box 3). In the local context of community-managed watersheds, these DRM interventions can be translated through the following actions:

Understanding: Participatory risk assessment. Combine statistics, scientific data with observations and perceptions of local population, include elderly and marginalized people's risk perception.

Institutionalizing: Define roles and responsibilities of local institutions: local governments, community based, civil society organisation (CSO, CBO). Define intervention strategies for action plans based on local resources. Strengthen their knowledge and link them with government, science and private sector institutions at various levels, from various sectors.

Risk reduction: Become pro-active instead of reactive. Plan and implement specific preventive measures to reduce risks. Such investments payoff: prevention measures are cheaper than the costs related to reconstruction and recovery. Low cost measures with local material (e.g. stones, wood and soil) and implemented by local labour force can effectively reduce losses of frequent small-scale floods or droughts (cf. Module 9).

Preparedness: Prepare early enough for flood or drought events. Define who does what and where already in normal time and test it! Invest into simple local early warning systems; observe and communicate rainfall and water flow in the uplands to alter downstream population timely (cf. Module 9).

Box 3: International Sendai Framework for Disaster Risk Reduction (SFDRR, extract)

Goal: Prevent new and reduce existing disaster risk through the implementation of integrated and inclusive measures that prevent and reduce hazard exposure and vulnerability to disaster and increase preparedness thus strengthen resilience.

Priorities for action:

1) **Understanding** disaster risk;
2) Strengthening disaster risk **governance to manage** disaster risk;
3) Investing in disaster **risk reduction** for resilience;
4) Enhancing disaster **preparedness** for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction.

DRM measures to systematically reduce risks

Integrated DRM requires a combination of measures before, during and after an event, which refer to measures related to prevention, preparedness and response. In the past, the focus was first on recovery and rehabilitation reacting to disaster events. Thereafter preparedness measures were implemented and only later measures related to prevention and the overall risk management came into practice (cf. Module 1).

There is no perfect DRM measure as such. Interventions need to be prioritized and smartly combined. The so-called '**hard' measures** such as infrastructure / engineering measures have to be combined with non-structural 'soft' measures, such as capacity building and awareness raising.

The implementation of different risk reduction measures requires management capacities for prioritisation and coordination of the overall risk management cycle. In particular, complex measures, such as an early warning system and implementation of DRM policies, require intervention at various stages with different actors, continuous policy dialogue, concrete actions with policy makers, population, etc.

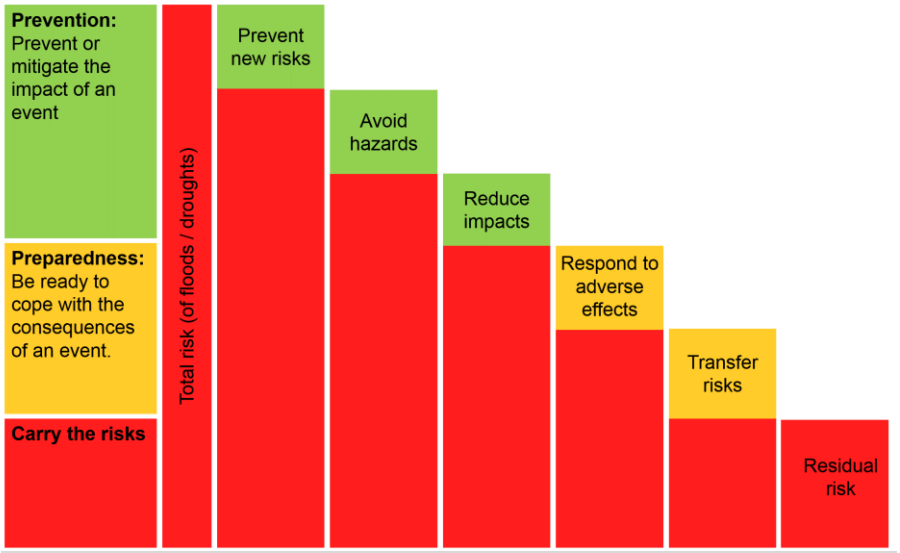

Figure 3: Risk Stair case (SDC, adapted)

The **risk stair case** (Figure 3) describes how different measures (illustrated in green/ orange) can reduce the total disaster risks (illustrated in red).

Generally, risks are most effectively reduced by **prevention measures**, which need to be implemented long before an event. This refers first to prevent that new risks are created and that current hazards are avoided. For instance, a territorial planning that prohibits housing and investments in a flood plain. Other measures, also referred to as mitigation measures[2], might not prevent disasters but may limit its impacts. For example, a dam does not prevent a flood but reduces the extent of damage.

Preparedness measures aim at an effective response once a disaster event happens, e.g. a rescue system based on a contingency plan. Further risks might be **transferred or shared** though a formal insurance system, community-based emergency fund or informal family savings.

Despite all risk reduction measures, risk can never be fully eliminated. The remaining or **residual risk should** be at an acceptable level, which is specific for each country, community or even individual. In other words, any given country or community has to know and to live with a certain amount of risk. (cf. Modules 9 and 10).

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Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Federal Department of Foreign Affairs FDFA
Swiss Agency for Development and Cooperation SDC

[2] In DRM 'mitigation' refers to limit the impacts, whereas related to climate change policy 'mitigation' refers to reduction of greenhouse gas emissions.

Further reading

- UNISDR, 2015: Proposed updated terminology on disaster risk reduction: a technical review. Available at: http://www.preventionweb.net/documents/framework/Working%20background%20text%20on%20DRR%20Terminology%202%20October%20reissued%20on%2023%20October.pdf
- Humanitarian Policy Group, 2015: 10 things you should know about disaster risk reduction (movie). Available at: https://vimeo.com/142153857
- Swiss NGO DRR Platform, 2016: Disaster risk reduction, climate change adaptation and resilience. Briefing Note (March 2016). Available at: http://www.drrplatform.org/images/Swiss_NGO_DRR_Platform_DRR-CCA_Briefing_Note_March_2016.pdf
- UNISDR, 2015: Chart of the Sendai framework for disaster risk reduction 20015-30 (chart). Available at: http://www.preventionweb.net/files/44983_sendaiframeworksimplifiedchart.pdf
- Abarquez I. & Murshed Z., 2004: Community-based disaster risk management: field practitioners' handbook. Asian Disaster Preparedness Center, Bangkok. Available at: http://www.adpc.net/igo/category/ID428/doc/2014-xCSf7I-ADPC-12handbk.pdf