Module 10: DRM measures in the lowlands

Introduction

This module focus on interventions in the lowlands. It provides an overview of DRM options and explores the elements of early warning systems (EWS), aspects of community based DRM committees, introduces a cost-benefit-analysis (CBA) and complementary resilience building options.

Hazard risks for lowlands from degradation of upper catchments

Overuse of natural resources and inappropriate agriculture practices (overgrazing, shrub collection, etc.) in the uplands directly compromise the lowlands, since these activities contribute to more frequent and severe floods and droughts. Communities' productive and most valuable assets (e.g. houses, fields, livestock, roads, irrigation and other infrastructure) are usually concentrated in the valleys of the lowlands and are potentially at risk from floods, droughts and other natural hazards. However, there is a wide set **of DRM measures and sustainable agriculture practices for the lowlands** to reduce specific disaster risks, to adapt and to increase resilience. (cf. Modules 4, 5 and 9).

Risk reduction measures in the lowlands

Disaster risk management (DRM) capacities are a key for successful risk reduction. The planning, implementation and maintenance of any DRM measure requires that local institutions, structures such as committees or task forces are in place and they have clear strategies and action plans. Figure 1 illustrates DRM measures for the whole watershed (grey boxes) and those specific to the lowlands (blue boxes).

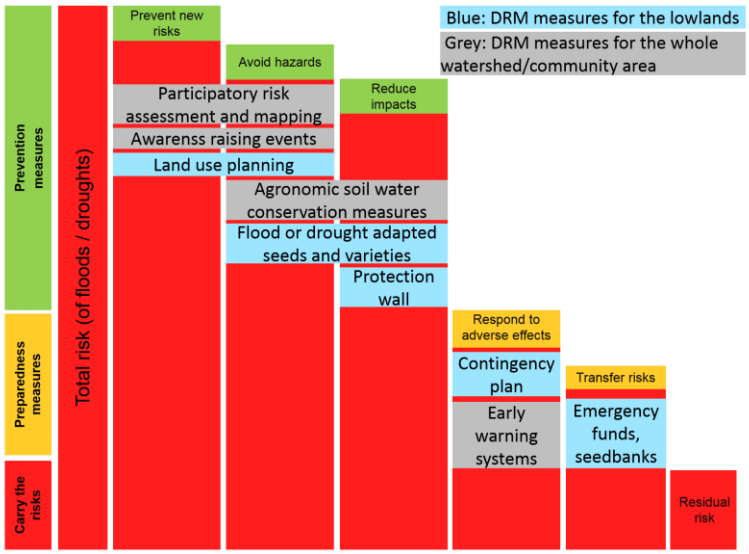

Figure 1: Stair case model for DRM measures (SDC adapted)

A **participatory risk assessment** is an important entry point for understanding the problems and for finding solutions. Its results can be shared through **awareness raising events** with the whole community or specific groups e.g. inhabitants located near riverbanks. **Land use planning** defines different zones with contrasting regulations and restrictions in order to avoid housing or other investments in disaster prone areas, such as flood plains. **Soil and water conservation (SWC)** measures can be implemented in the upper watersheds to reduce floods (cf. Module 9) or - in lower areas - in combination with agriculture production or other climate change adaptation measures (cf. Module 4). Since all SWC measures can substantially reduce flood and drought risks, they are particularly interesting to protect valuable livelihood assets of the lowlands. **Adapted agriculture practices,** using **adapted seeds and varieties** (e.g. drought resistance crops) and crop diversification offer alternatives in case of a major flood or drought, increasing farmers' resilience. Where alternative land plots are scarce, particularly exposed fields or houses can be **protected** from erosion or extensive floods **by tree plantations or stone walls**.

To support the community during disaster events coordinated local responses are required, based on a contingency plan that defines who does what and where. An **early warning system** is an essential asset to improve such local preparedness mechanisms. **Emergency funds** may cover most urgent needs after emergencies. These risk-sharing options might be formally set up by an insurance with financial compensation or refer to informal **community funds** with predefined conditions and rules for the provision of funds or emergency kits for food, seeds, tents, etc.

Community based DRM committee for preparedness and prevention

In remote rural areas, when a disaster strikes, communities can hardly count on timely external support. Therefore, they have to rely on their local resources by mobilising community members. If they are trained and have a clear protocol for action, it enables a faster and more effective response.

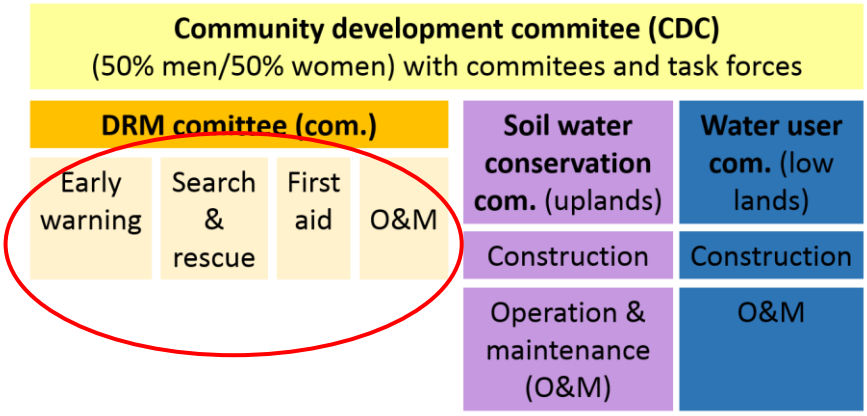

Figure 2: Key elements of community based DRM committee with specific task forces (TF) based on the experience of ILRC/GS-projects.

Figure 2 presents the structure of typical community based **DRM committee**, which is directly connected to the community development committee (CDC) in charge of the overall planning and coordination of the local development. The **DRM committee** has to be able to respond quickly during disaster events (preparedness). Furthermore, it is also in charge to address disaster risks in a long-term perspective, e.g. by conducting participatory risk assessments, organising awareness raising events, and ensuring the operation and monitoring (O&M) of structural DRM measures. Specific **task forces** of DRM committee are typically first aid, search and rescue, early warning, and O&M. All of them have specific predefined tasks and responsibilities, which requires according resources, instructions and trainings. The DRM committee coordinates also with other local committees, such as the SWC committee in charge of the DRM measures in the upper watershed, or the water user committee in charge of irrigation infrastructure, to identify most critical community assets and to support these other committees for the implementation, operation and maintenance of according infrastructure.

In order to fulfil its **preparedness functions** the DRM committee elaborates a **contingency plan**, which defines who does what and where during and after an emergency situation. This plan relies on a most probable disaster scenario, and it defines available resources (e.g. rescue equipment, emergency kits, and funds) and contacts of key actors (e.g. neighbour villages, District development committee/DDC, local government representatives such as ANDMA). Such a plan needs to be practically tested and rehearsed during normal times with trainings and mock drills.

Early warning system (EWS)

A EWS is an interrelated set of hazard warning, risk assessment, communication and preparedness activities that enable individuals, communities, businesses and others to take timely action to reduce their risks (UNISDR, 2015). A EWS refers actually to a complex set of measures, which requires an important coordination amongst actors of various levels and sectors. Nevertheless, experience, particularly from Asian countries (e.g. Bangladesh, India), shows that with simple local community based EWS, disaster losses can be significantly reduced at large scale, especially in case of flooding and cyclones. Table 1 summarizes the key components of a mature well developed EWS at large scale and a possible simplification for a community based EWS at smaller scale with limited resources.

Box 1: EWS example from Saighan district

In Bayanquly, Saighan district a community based EWS was set up through a community based preparedness team. Instructed members of the early warning task force monitored the river flow in the upper watershed area during the heavy rains in 2014. When they observed the rapidly increasing river flow, they called their colleagues in the inhabited lower areas, who warned the inhabitants with loudspeakers. As a result, 300 habitants could timely save their most valuable assets and were evacuated to save areas when the flood soon after hit the village.

Table 1: Key elements of an EWS for flooding (Helvetas, based on four components WMO)

Component	Mature EWS at national level	Simplified community based EWS
Hazard data & forecast	Analysis of historic hydro-meteorological data. Computer based simulation and modelling of short-term weather, seasonal forecasts and long-term trends.	Assessment of damages and water flow of historic floods. Field marking of historic maximum and reference water levels. Measurement of water flow and precipitation in lower and upper watershed area.
Risk information	Modelling of vulnerable areas and assets for risk mapping. Identification of most risk prone areas.	Participatory risk mapping with community based organisations, including most vulnerable groups, elderly people to identify vulnerable zones and groups, to recall historic events and define most risk prone areas and assets.
Communication & dissemination	Alert per phone chain, email, web sites, siren etc. across govtl. departments, public alerts, interaction with private sector, (I)NGO, CSO organizations etc.	Dissemination of warnings to the community members by a preparedness team through SMS and loud speakers moving around predefined village sectors.
Preparedness & response	Mobilisation of civil protection, police, ambulance, further resource institutions based on formal cooperation agreements, laws and standing procedures.	Mobilisation of preparedness task forces: dispatch of first aid, search & rescue teams, based on a predefined and practically rehearsed checklist or contingency plan: who does what and where. Information of the government contact person, the local ANDMA representative and neighbouring villages to check for further support.

Cost-benefit-analysis of SWC-measures

Besides coordination and management efforts for local DRM, the implementation of preventive infrastructure such as SWC measures is costly, since these measures are generally highly labour intensive. Nevertheless, in the end **prevention pays off.** International studies show that preventive DRM measures are 7 to 10 times cheaper than recovery and reconstructions costs. Consequently, preventive DRM measures should be promoted as a **cost effective investment**. The cost-benefit-analysis (CBA) is an interesting tool to analyse and proof that prevention is cheaper that reconstruction. Beyond its numeric results, CBA can also be used in dialogues with different actors, e.g. communities, farmers, house owners, government, and private sector actors, to convince them to invest and contribute to preventive DRM measures.

The CBA example of table 2 refers to a livelihoods project where SWC measures where implemented in over ten watersheds. Data refer to the average of three analysed watersheds (each 810 ha) with structural and agronomic SWC measures (510 ha per watershed).

The costs are generally rather simple to assess. They include construction costs with expenses for labour and material as well as maintenance costs over the whole lifespan of the measures. **The benefits** tend to be more difficult to quantify since there are various indirect positive effects. **Quantitative benefits** may refer to reduced or avoided damages on harvests, houses, infrastructure, etc. thanks to a DRM measure. Other benefits may refer to additional incomes (e.g. production associated with DRM measures) or increased value of protected assets, such as land or houses that become safer after DRM measures.

The **final results** are presented as cost-benefit ratio. It is important to consider therefore the same time spans for costs and benefits; yearly, over the live span of a DRM measure or over the return period of a flood event. For cost effective DRM measures benefits are higher than the costs (C: B < 1). Due to various assumptions, the exact ratio may be discussed. However, C: B < 1:10 and lower can be assumed as highly cost-effective.

Usually, there is a set of **additional benefits** from DRM measures, which might be difficult to quantify, but interesting to describe and document qualitatively. These benefits comprise increased awareness and technical capacities, improved coordination and linkage amongst local actors (due to a participatory risk assessment or a joint implementation of a DRM measure), among others.

Table 2: Simplified Cost-benefit-Analysis of SWC measures (average costs per watershed i.e. community)

Quantitative costs	Quantitative benefits	Qualitative benefits
Construction costs: - Labour costs : 209‘000 USD - Material : 9’300 USD Annual costs over 30 years lifespan: 7‘300 USD (assumption: zero maintenance costs)	Reduced damage: - 225 houses : 810‘000 USD / flood event - Potato, wheat, fodder harvest : 578‘000 USD / flood event - Irrigation, transport infrastructure: 0 (assumption) - land (avoided rehabilitation cost): 7’880’000 USD / flood event.	- reduced temporary migration - increased technical capacities of involved workers - reduced drought problems due to increased water retention, soil moisture. - rehabilitation of up lands due to reduced erosion of fertility land - increased security for population; no abandoned houses during floods, reduced fear from floods.

Cost (C) : Benefit (B) ratio of different scenario:

C : B = 1: 42 Assuming one devastating flood over the 30 years lifespan of SWC measures

C : B = 1: 1270 Assuming yearly devastating floods during the whole lifespan of the SWC measures

C : B = 1: 2.6 Assuming one devastating flood over the whole lifespan of SWC measures, considering exclusively the value of saved harvest.

- **All scenario clearly indicate a high cost efficiency for SWC measures**

Further measures in lowlands to increase communities’ resilience

Committees and task forces are crucial to promote local DRM by planning and implementing risk reduction measures. Risk reduction and resilience building are complementary approaches. The diversification of livelihoods can provide crucial alternatives in case one income resource is seriously hit by the consequences of a disaster event. Bellow some examples of measures to increase local communities’ resilience to disasters with interesting co-benefits:

Box 2: What is Resilience

The ability of a **socio-ecological system, community or society** exposed to various shocks (e.g. flood, earthquake) and trends (e.g. drought, climate change) to **anticipate, manage change** and **recover** from the effect of a disturbance. This requires the capacity of a system for absorption, adaptation, and transformation in the long term.

- Tree plantations of willow or poplar tree stabilize the riverbank, reduce the erosion process, and can reduce the damage of extensive flooding. The leaves can be used as fodder for sheep and cows (reducing grazing pressure in the uplands); smaller amounts of wood of these fast-growing trees can be used as firewood (reducing shrub consumption), for carpeting or handicrafts (generating additional income), and for life fencing (cf. Module 6, Alternative Energy Resources, Feed and Fodder).
- **Women Economic empowerment (WEE):** Women are typically in charge of vegetable gardens, poultry and handicrafts. These activities can be important to complement household incomes, to contribute to a healthy and diversified nutrition, and to ensure food security in case the main harvest is damaged by a flood or drought event. Women’s participation and empowerment is crucial for a balanced and sustainable local development for the whole community (cf. Working with Women and Men).
- **Water and land use management plans (WLUMP):** These plans are usually elaborated in a participatory process involving all relevant actors, mainly landowners and farmers of the community, in order to identify water and land related resources, current and future demands and potential conflicts. It includes an assessment of flood and drought related impacts on particularly vulnerable assets such as productive fields or irrigation infrastructure. Thereafter, necessary options to ensure current and future water demands are identified, prioritized and described. Ideally, a WLUMP refers to the whole watershed area – up land and low land, including all relevant actors, considering water as a hazard (floods) as well as a resource. Typical upland measures are SWC-measures (cf. Module 9), whereas measures in the productive lowlands rather refer to irrigation infrastructure and management of water and land resources. Due to the complexity of certain technical measures and the involvement of many actors - after an assessment of water and land related risks at a watershed level - options might be elaborated separately for the uplands (e.g. SWC measures) and the lowlands (related to productive infrastructure). (cf. Working with Groups, Participatory Rural Appraisal, Good governance, and Module 6).

Author(s): Eveline Studer, April 2016

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Federal Department of Foreign Affairs FDFA
Swiss Agency for Development and Cooperation SDC

Further reading

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