Background and Components of

Disaster Risk Reduction

Fisherman planting Mangroves in Aceh, Indonesia

By Peter Rottach

Diakonie Katastrophenhilfe

actalliance

Content

Introduction

This paper addresses humanitarian aid staff working with DKH in the headquarter as well as in regional and project offices. It is meant to provide background information on disaster risk reduction (in the following abbreviated DRR) for those staff members who are not or only to a minimum extent familiar with disaster prevention, mitigation and preparedness, but who have to deal with this precautionary approach in their day-to- day work.

DRR is considered to be a cross-cutting issue between development work and emergency assistance. In over 50 years of DKH and BftW´s active engagement in developing countries with different types of support and interventions, one of the lessons learnt is that situations and conditions may differ quite substantially from community to community or even from household to household. The conclusions are that there is no single universal solution to the many problems poor people are forced to struggle with. This also applies to DRR. There is no universal approach that can be applied everywhere in the same way. For that reason, this paper just intends to provide some general background information, ideas and considerations that hopefully stimulate the readers to start with their own reflections and creative thinking on this subject.

The paper also does not intend to replace expert knowledge. It rather tries to create a level of expertise among the staff that allows them to decide, at what stage such expert knowledge is necessary and what type of expert advice needs to be looked for.

There are many similar papers and publications on this topic (and on climate change adaptation, which to a large extent overlaps with DRR and similar topics included in this paper). Here, an attempt is being made to touch down on a practical and technical level which often is not adequately addressed to.

This reflects DKH´s position that disaster risk reduction has to be a practical, concrete, grass-root-oriented and bottom-up approach. It also takes into account that DKH is not only a funding agency, but in some cases an implementing aid organisation at the same time that needs practice-oriented advice and support.

Many of the topics raised in this paper do not only matter in humanitarian work, but in many development projects, too. This is almost inevitable due to the fact that DRR is a cross-cutting issue. Although in institutional terms, DRR often is divided into sections and themes which fall under either humanitarian or development mandates, on a household and community level in affected regions such divisions are of no use and do not matter at all. Therefore, this paper does not differentiate between different mandates and responsibilities but looks at needs and opportunities at a household and community level.

Acknowledgement:

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Abbreviations:

ACT	Action by Churches Together
BMZ	Federal Ministry for Economic Cooperation and Development, Germany
CARI	Centre for Agricultural Research in India
DRR	Disaster Risk Reduction
DKH	Diakonie Katastrophenhilfe
ECLAC	Economic Commission for Latin America and the Caribbean
FAO	UN Food and Agriculture Organisation
GHG	Greenhouse Gases
HFA	Hyogo Framework of Action
IASC	Interagency standing committee
ICRAF	International Centre on Research in Agro-Forestry
IOM	International Organisation on Migration
IPCC	Intergovernmental Panel on Climate Change
ISDR	International strategy on disaster reduction
IUCN	International Union for the Conservation of Nature (World Conservation Union)
NAPA	National Adaptation Program of Action
REDD	Reduced Emissions from Deforestation and Degradation
PDNA	Post disaster need assessment
UNFCCC	United Nation Framework Convention on Climate Change
WHO	World Health Organisation
WB	World Bank

Notice:

All pictures have been taken by the author unless it is indicated otherwise

Chapter 1: What is DRR and why is it important (for a humanitarian organisation and others)?

What very few people seem to know is that the 1990ies had been declared by the UN as the “international decade of disaster risk reduction”. But it took quite some time to put DRR high on the priority list of humanitarian and development aid organisations. And yet, when looking at EU member states, very few have an explicit policy on DRR or are just in a process of working on it.

There are several reasons which might have contributed to the improved reputation of DRR and to the growing numbers of DRR projects implemented around the World. Among them are:

- The UN World conference on Disaster Reduction in Japan, 2005. At this conference, not only the need for DRR was highlighted, but also a conceptual framework for strategies and procedures in implementation of DRR projects was defined through the so-called Hyogo Framework of Action (HFA, see page 8)
- Increasing “third party” funding opportunities for DRR projects through national governments, international aid organisations and other back donors
- Larger natural disasters in recent years (e.g. Tsunami in parts of Asia, earthquake in Pakistan, Cyclone in Bangladesh and Myanmar, floods in the Sahel) which provided both necessities and financial resources for rehabilitation programs that included DRR components
- Climate Change as a threat to present and future generations that requires adaptation to this change. DRR is considered to be an essential element of adaptation approaches.

DRR being recognised as an important tool of humanitarian and development aid perhaps also reflects a spreading paradigm shift within such organisations: **that disasters do not need to happen**, because any adverse natural event only becomes a disaster, when and where people are vulnerable to such events. And vulnerability depends on social, economic, cultural and political conditions which are up to internal changes and outside influences.

On top of that, DRR complies with a sort of general human attitude towards risks or dangers: **that prevention is better than cure**. Kofi Annan, the former UN general secretary, once stressed this point by saying:

“We must, above all, shift from a culture of reaction to a culture of prevention. Prevention is not only more humane than cure; it is also much cheaper…”

Kofi Annan

"More human" in a humanitarian aid context can be interpreted as more efficient, since more lives can be saved and human sufferings can be spared by prevention rather than by just waiting until a disaster occurs. Saying that prevention is much cheaper than cure, Kofi Annan refers to various economic calculations stipulating that every USD invested in DRR could save up to 4-10 USD (figures differ quite substantially, depending on the type of DRR projects and the living standard in a given country) which would be needed to repair damages caused by a disaster and to rebuild the (local/national) economy.

However, in spite of such undisputed and convincing advantages of DRR, one should not overlook or do away with some **critical remarks or concerns** raised. In order to prepare oneself for critique, some of the challenging comments are listed here:

- DRR again looks like a "Northern" invention which always runs the risk of creating some paternalistic feelings among Southern beneficiaries and partners.
- One could say that it is just another buzz word in the area of humanitarian and development work like many previous ones with only temporary importance.
- Since, by its nature, DRR should be implemented prior to a disaster, the disaster which ought to be prevented or mitigated might not happen at all or not within a reasonable period of time, giving the impression of wasting resources and perhaps causing a bad image among recipients of aid and among (private) donors.

Queuing up for food after Cyclone SIDR in Bangladesh

- It goes without saying that in DRR, the perception of "risk" plays a pivotal role. But this perception is subjective and can vary quite substantially between people. To give one example: In a pastoralist society under arid and semi-arid conditions, drought often is not considered a risk (often sharply contrasting the perception of visitors from outside), because pastoralists are accustomed to and know how to cope with droughts. On the other hand, governmental interference in traditional grazing areas

(e.g. by setting up irrigation schemes) or disequilibria in terms of power relationship with conflicting tribes due to distribution of arms can pose a huge risk to such communities (because it can affect their traditional coping strategies consisting in free movements of herds in search of pastures).

By simply supplying food or animals as a means of preparedness and risk reduction in times of drought, what is the usual strategy of many donor organisations under such conditions; one does not really address the beneficiaries´ perception of risk.[1]

Similar stories can be found for other types of risks and other vulnerable societies. They show that risk assessment can be a very difficult and complex undertaking in which outsiders hardly get a full picture of local people´s reality. That does not imply to refrain from doing it but to realistically recognize its limitations and to apply true participatory approaches in all steps of DRR programs.

- DRR on a local project level might give the impression of neglecting the overall (international) social, economic and political background. For example, an unfair international trade regime causes poverty and increases vulnerabilities to disasters. A holistic approach should tackle such root causes of vulnerabilities what rarely seems to happen in and what is not easy to combine with local actions as part of DRR projects.

The concept of DRR is much broader defined than just looking at confined local conditions.

The **Hyogo Framework of Action (HFA)** for example is shaped in a way that a broad social, economic and environmental context, from a national down to a local level, is taken into account.

The framework was agreed upon at the UN World Conference on Disaster Reduction in Japan in 2005. It suggests the following steps for implementing a DRR strategy[2]

1. **Ensure that DRR is a national and local priority with strong institutional basis for implementation;**
2. **Identify, assess, and monitor disaster risks – and enhance early warning;**
3. **Use knowledge, innovation, and education to build a culture of safety and resilience at all levels;**
4. **Reduce the underlying risk factors;**
5. **Strengthen disaster preparedness for effective response at all levels**

Box: Definition of important terms

A **disaster** is defined as a combination of a hazardous event and a family or community that is vulnerable to such an event. Hazards without vulnerable people or vulnerable people without hazardous events do not qualify for a disaster.

Disaster Prevention here is defined as methods to prevent a natural event from happening which in most cases is certainly difficult or not feasible at all.

Disaster Mitigation is defined as means to reduce the velocity/severity of a hazardous event, e.g. storm floods or droughts and to mitigate their negative impact on people.

Measures of disaster prevention and mitigation take place prior to disasters. Measures of **disaster preparedness** also take place prior to a disaster, but they intend to help people reacting to a disaster once this has happened in a way that subsequent negative effects can be avoided and relief and rehabilitation activities can be put in place more efficiently.

Disaster Risk Reduction is: 'Actions taken to reduce the risk of disasters and the adverse impacts of natural hazards, through systematic efforts to analyse and manage the causes of disasters, including through avoidance of hazards, reduced social and economic vulnerability to hazards, and improved preparedness for adverse events' (UN International Strategy for Disaster Reduction (ISDR), taken from: Accompanying document to the EU strategy for supporting disaster risk reduction in developing countries , Brussels 2009[3]).

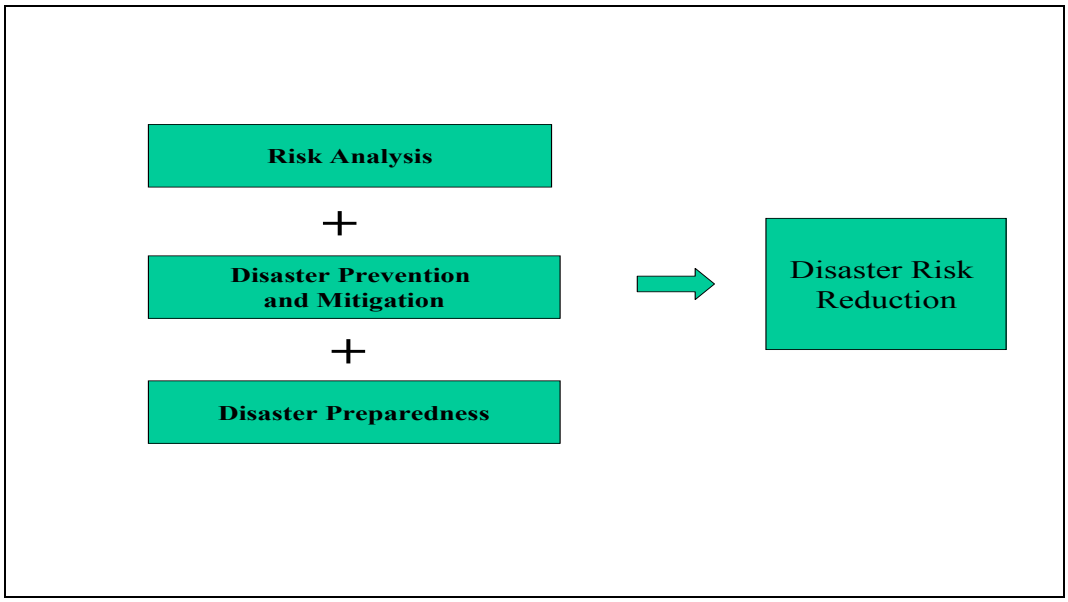
Whereas this definition of disaster risk reduction seems to be well accepted, some people rather prefer the term Disaster Risk Management, sometimes synonymously with DRR, sometimes with broader connotations.

Currently, the HFA initiative is under a mid-term review. More on the terms or reference and the results of this review can be found on the website of the prevention consortium (www.proventionconsortium.org) which is also a very useful and important resource of information on many other aspects of DRR.

More related to the implementation side of DRR, one can think of several options and strategies. Key components of DRR are efforts to….

- prevent adverse natural events from happening or to reduce their velocity
- reduce the vulnerability of human beings.

The German government has prepared a graph that shows how such measures are interrelated: (taken from BMZ: Disaster Risk Reduction)[4]:



Depending on local conditions, emphasis put on either pillar or component mentioned in this graph, can vary. Often, prevention of adverse natural events or reducing their velocities is not feasible or too costly. Financial resources for DRR projects usually are limited so that project decision makers need to identify measures that are likely to achieve the biggest positive impact. And the most costly projects often are not the most efficient ones. Building upon and making use of local communities and enhancing people´s self-help capacities in most cases is more successful and cost efficient than turnkey solutions coming from abroad.

In the light of this, the following strategic recommendations can guide (local) decision makers when strategizing DRR projects:

1. Assessing **vulnerabilities should be an integral and ongoing part of all humanitarian work**.

   It should include the identification of those people who have been most affected by a disaster; of factors that make them vulnerable (including, but not limited to, discrimination, poverty, environmental degradation, conflict and insecurity, lack of access to natural resources and basic services, poor governance, etc.); and of steps that can be taken to reduce this vulnerability.

2. It is important to **identify peoples´ resilience, resources and capacities**. Access to social protection mechanisms, such as a general welfare system, legal protection, or community-based protection mechanisms helps to decrease vulnerability and enable self-protection. Similarly, access to social, cultural and emotional support through extended family, religious networks and rituals, friends and community activities can reduce vulnerability and enhance resilience and capacity for coping.

Drought-prone site in N-Cameroon

3. Relief and response efforts often target current vulnerability, but it is also important to consider **future and new patterns of risk and vulnerability** in order to build back safer and promote resiliency. In many parts of the world, climate change is already beginning to change risk patterns; worsening current hazards and introducing new ones, so local knowledge of hazards, vulnerabilities and capacities need to be combined with assessments of future climate risks.

4. Reducing vulnerability and building resilience need to engage a **wide range of actors involved** with activities that influence levels of direct and indirect risk, including national and local authorities, investment and market activity, individual livelihoods and consumption patterns. Only by recognising how these systems operate locally, relief, rehabilitation and DRR can assure continued resilience while minimising unintended adverse outcomes. Approaches such as market and value chain mapping, livelihoods analysis, gender analysis, environmental assessment and sustainable resource management are critical tools to effective integrated emergency, development and DRR aid programs.

But one should also be aware that human beings never will eliminate every risk. Life always was and will be at risk from its very beginning. Denying this would be nothing else but human hubris. But many risks can be reduced considerably to the benefit of present and future generations, as stated by the "Global Platform on Disaster Risk Reduction", organized by UNISDR in 2009, carrying on "…. a clear and simple message – that disaster risk can be readily reduced through practical action. Solutions exist and are being put into action in many countries. We can invest today for a safer tomorrow." (provention 2010, chair´s summary).

How, where and when putting DRR into practice?

DRR is part of a wider approach of disaster management which includes pre-disaster and post-disaster activities. Undoubtedly, many components, strategies and actions of disaster risk reduction interact with and refer to the wide range of development

work and cooperation. Therefore, humanitarian aid should be closely linked to and coordinated with development work. DRR in particular is a cross-cutting issue between humanitarian and development work and can be implemented……

a) as part of a relief and rehabilitation programme after a disaster has happened in a given area

b) detached from actual disasters but in areas which are projected to be disaster prone in the future, either because the area is known to be disaster-prone as a result of past events or because (scientific) projections (e.g. assessing and forecasting climate change) indicate an area to become a disaster hot spot zone

c) as part of and coordinating with development projects taking place in disaster-prone areas in a way that such development programs take elements of DRR on board

Ad a, DRR as part of a relief and rehabilitation program

Many relief and rehabilitation programs potentially negatively influence the extent to which people are susceptible to future disasters, for example by:

- Changing consumption and dietary patterns as a result of food aid in favour of plants or diets which are difficult to be grown/produced in the region concerned or which increase susceptibility to the vagaries of climatic conditions
- Creating a “recipient mentality” and loss of self-confidence/self-reliance which might end up in seriously undermining peoples own initiatives to prepare themselves for future hazardous events
- Splitting communities by unfair and non-transparent patterns of selecting beneficiaries, creating a mood in a community which makes families working against each other rather than enhancing a spirit of collaboration.

Therefore, whenever a relief and rehabilitation program is in place, one should think of long-term consequences and side effects.

If DRR is implemented specifically as a **component of/parallel to a relief and rehabilitation program**, one should pay attention to the following points:

- Those people who were affected by past disasters and who benefit from relief and rehabilitation programs might not necessarily be the ones most vulnerable to future disasters
- People suffering from a recent disaster, who perhaps lost relatives and friends, might be neither mentally nor physically in a position to think of and prepare for future disasters
- A region or community that was hit by a disaster might not provide the infrastructural nor the institutional conditions necessary to implement DRR systematically
- Offering assistance to people who suffered from a recent disaster in a way that these people are better equipped for future calamities (the slogan used for this is "building back better" ; see Annex I), can cause envy among those who were not or to a lesser extend recipients of relief and rehabilitation support and this can jeopardize the success of a DRR approach
- The type of a disaster for which relief and rehabilitation is in place might not coincide with the most common disasters in the area concerned. Under such conditions the financial resources might disproportionally favour less urgent DRR measures.
- Part of a DRR strategy is preparedness. This, for example, includes risk maps which allow a quick overview on risk-prone zones as well as on vulnerable households. There are numerous examples that such preparedness schemes enable aid organisations to quickly and efficiently deliver support to affected people immediately after a disaster
- In chapter 6, there is a checklist for points to pay attention to when implementing DRR as part of relief and rehabilitation programs.

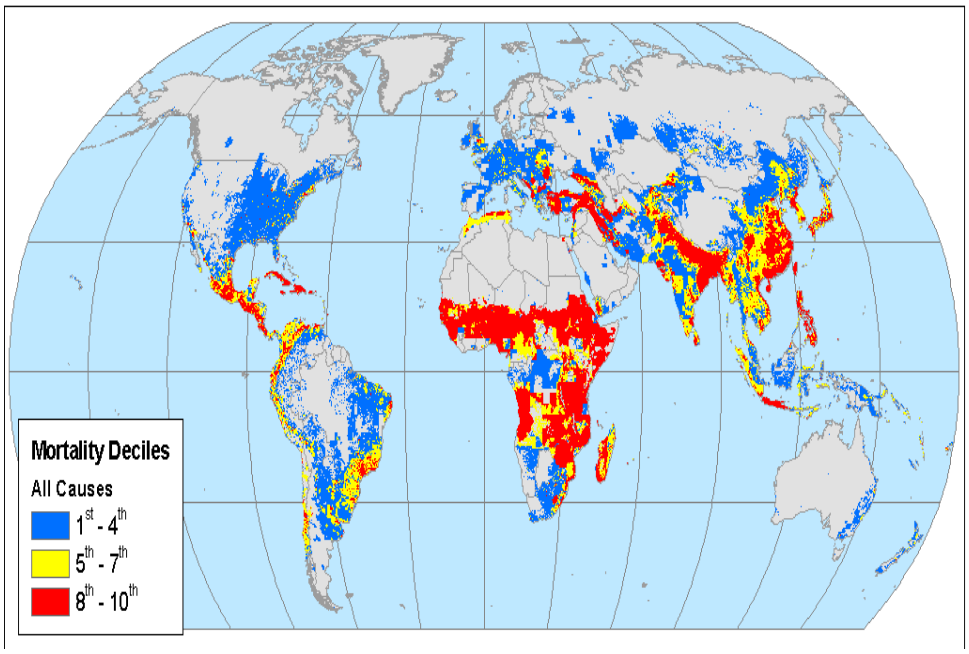
Looking into a bleak future? San woman in Namibia

Ad b, DRR in disaster hot spot zones

Disaster hot spot zones are regions which are particularly prone to disasters. Such regions can be identified by looking at economic damages caused or lives lost during past resp. historic disasters. (e.g. using the database of CRED,

Belgium)[5] or by taking projections of competent experts on future events and calamities into account (like climate change impact).

The World Bank (see reference) uses, among others, mortality as an indicator for its natural disaster hot spots map:[6]



(deciles means clustering countries according to high, medium and low numbers of people killed by disasters)

It should be reiterated that such hot spot regions not only represent regions most frequently affected by hazardous events, but also those which are inhabited by most vulnerable people.

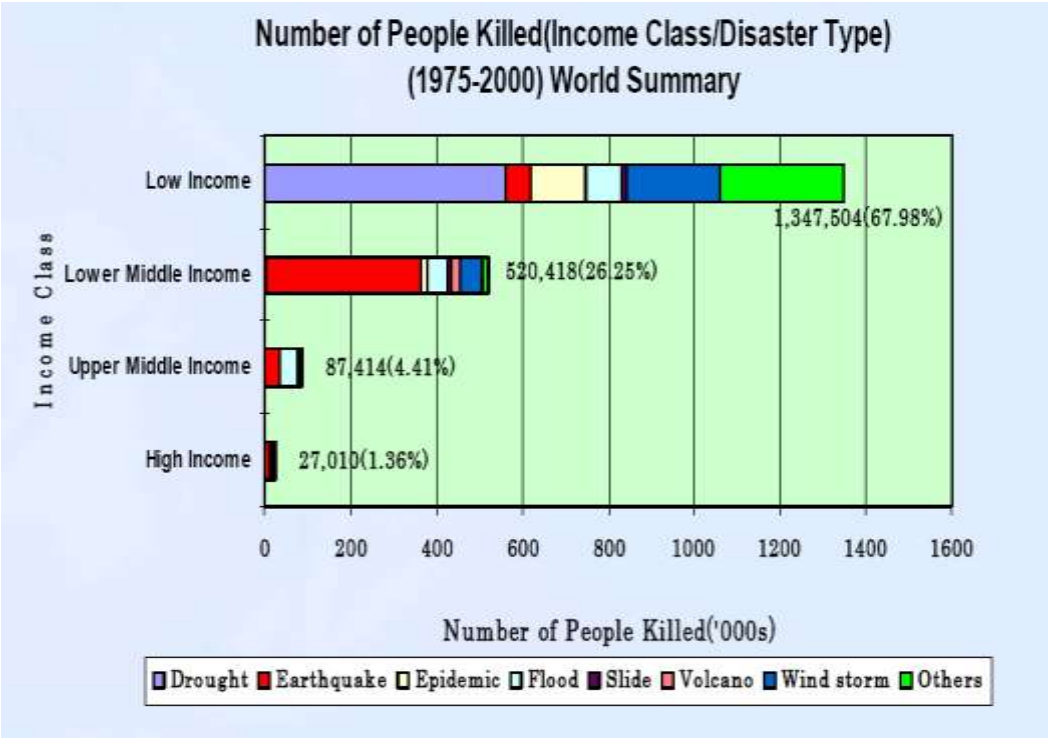
In the light of this it would make sense to put emphasis on such areas when implementing DRR. But often this is difficult to do for various reasons like:

- Lack of financial resources. The fact that these regions have been facing frequent disasters does not mean that such events received international public attention and accordingly financial support. There might be neither governmental funds nor private donations to be used for DRR.
- Perhaps there are no local partners capable of implementing DRR. For sound DRR projects, it is almost a prerequisite to cooperate with local civil society organisations. Such organisations might be missing due to difficult working conditions or due to other reasons.
- Often there are overlapping disasters like natural ones and civil war. The two are definitely in many instances influencing each other. For security reasons it might be difficult for aid organisations to work in such areas.
- Due to severe poverty, the daily life of people often is a mess and resembles the life of those people who are affected by disasters. People under such conditions have to make sure to meet their basic need requirements and therefore are not willing to deal with DRR and future calamities.

Ad c, DRR as part of Development programmes

There is a link between disaster vulnerability and poverty. The poor often are the most vulnerable people to disasters because they are forced to live in disaster-prone areas (usually the cheapest settlement sites) and they don't have the means to protect themselves.

The graph below shows the number of people killed by different types of natural disasters in relationship to income groups.

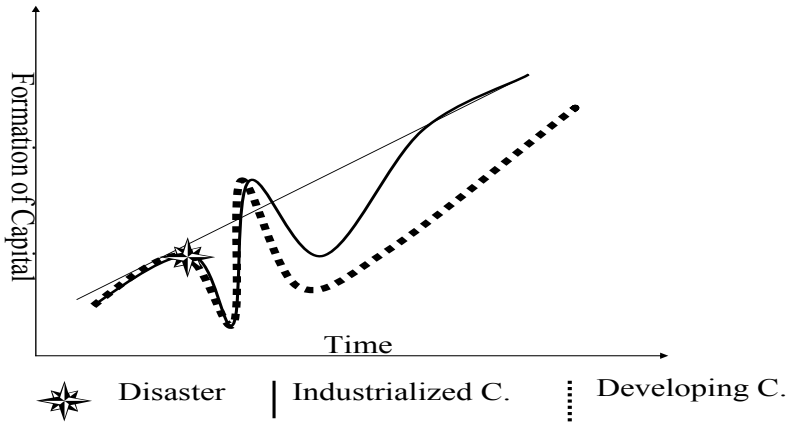


According to this graph, low income groups are more seriously affected by all natural disasters than middle, upper and high income groups except for earthquakes which is probably due to the fact that earthquakes cause the most devastating effects in urban areas where the level of income usually is higher than among rural poor (CRED[7])

Poverty as a reason for vulnerability to disaster applies both to individual households and to entire nations. There are countries lagging behind economic growth because they repeatedly are hit by natural disasters forcing them to use scarce financial resources for reconstruction of damaged infrastructure or for handouts given to people in need rather than using such funds for remunerative economic and technological programs.

The graph below compares the impact of a disaster on a national economy of industrialized and developing countries showing that developing countries need much more time to recover if they manage to do so at all[8]:

Impact of disasters on capital formation in smaller national economies (ECLAC/IDB, March 2000):



Based on this, there is good reason to assume that development projects trying to reduce poverty are an efficient approach to reducing vulnerabilities to natural disasters at the same time. Many people are saying that development projects per se are a means of DRR.

On the other hand, development projects themselves can get seriously hampered by disasters jeopardizing the success of such programs to a large extent if they don't specifically pay attention to disasters.

One can also question whether development projects usually target the most disaster-prone areas in the World. For many years, development projects by and large favoured growth-oriented objectives (growth of income, of food production, of assets) which were difficult to achieve in regions that suffered from frequent natural calamities. On top of that, such growth-oriented approaches often introduced market-driven development models based on highly specialized modes of production or trade. In agriculture, these models often led to reduced diversity of crops, input-demanding farming patterns or modernized animal husbandry systems. While these models under favourable conditions have been quite beneficial, they tend to increase producer risks related to, among others, extreme weather events.

Vulnerable households in Serbia

Taking these points into consideration and for the following additional reasons, DRR requires close cooperation between humanitarian aid and development work:

- Time frame: DRR is likely to consist of short-, mid- and long-term activities and therefore requires

long-term involvement in a given region what often can only be guaranteed by development institutions

- Lobbying: A comprehensive DRR approach will address all relevant stakeholders including local and national governments for which sometimes lobbying is needed
- Soft and hardware support: Many NGO development projects tend to refrain from distribution of material goods and to focus on awareness-building and organising people and communities instead. However, as part of successful DRR programs, supply of hardware (like seed, construction material, food for work) could be required which humanitarian aid organisations usually are equipped to do
- Combining different financial resources
- Combination of skills and know how

DRR in a poverty context:

Poor people often cannot afford to embark on measures that show their beneficial effects only in the long run. Because they have to concentrate on fulfilling their basic requirements of today and tomorrow. If active participation of vulnerable people, who usually adhere to such poverty contexts, in a DRR approach is regarded to be of crucial importance (what most people would subscribe to), any prevention, mitigation or preparedness measure needs to fulfil a dual purpose:

- To protect from and better master future disasters
- To improve the livelihood conditions of poverty-stricken beneficiaries within a short period of time

The DKH approach of Risk Assessments (see annex II) is designed in a way that people's participation is guaranteed right from the start of a DRR project.

Construction of dikes in India (pic. Th. Hirsch)

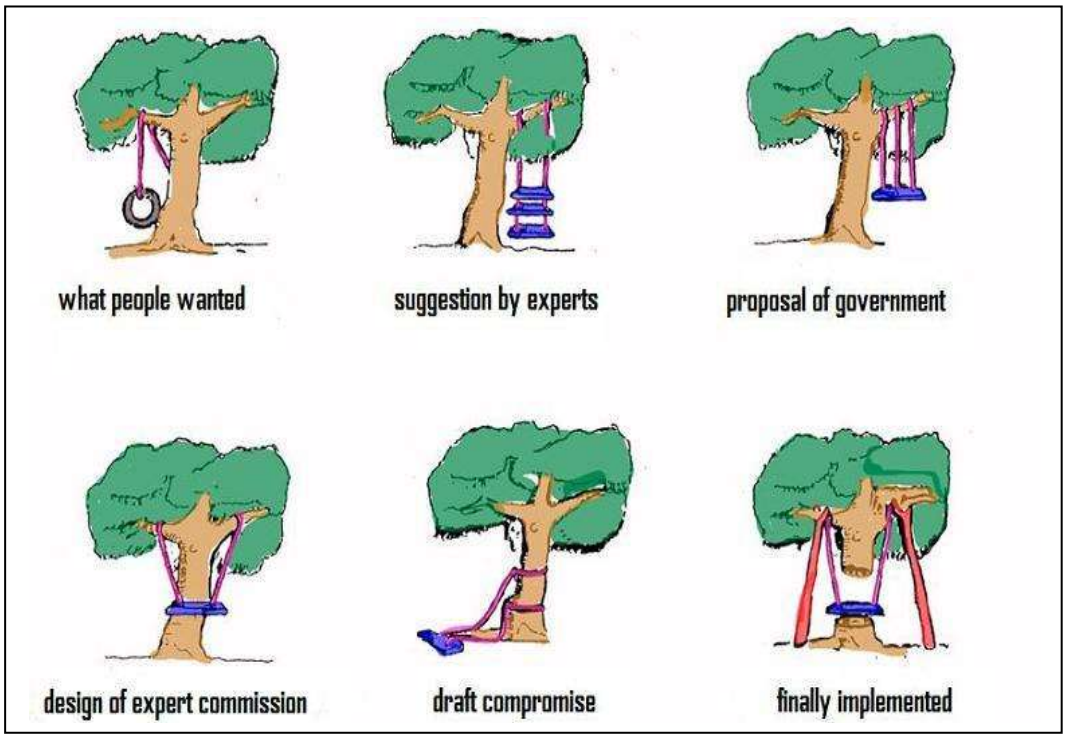
The dual purpose can be met by either implementing DRR measures together with additional livelihood improvement activities or by measures that are capable of combining the two purposes. An example for the latter is reforestation of Mangrove forests. These trees provide efficient protection from cyclones, storms and tidal waves and at the same time contribute significantly to

poor fishermen's income because they are a breeding place for many fish and shrimp species. Another example could be a combination of DRR methods with renewable energy like the DRR project of DKH in Sri Lanka, where tree planting helped stabilizing farming conditions against drought and flood and at the same time provided the raw material (wood chips) for electricity production to be supplied to and improve the quality of remote rural villages. (see page 99: renewable energy)

Before starting a DRR project ….

The following basic deliberations might be applied when starting a DRR project:

- First, a risk analysis should identify the most hazard-prone areas and most vulnerable communities and households.
- Based on the result achieved during a risk assessment, appropriate measures need to be identified. Such measures should address the most dangerous hazards and provide tailor-made solutions to the most vulnerable groups.
- Support schemes can either address disaster prevention and mitigation and /or disaster preparedness. One should avoid to do too many things at the same time but prioritize different steps together with the beneficiaries.
- **Technological solutions are by no means the only and the best approach to achieve lasting effects. Social relationship, people's informal and formal organisations and self-help approaches should be prioritized in order to eventually apply technologies in a way that they truly benefit vulnerable people and communities.**



"Stakeholder involvement....."

- **Participation of beneficiaries has become a buzz word** in development work and humanitarian aid. Still, in reality it is often not more than hollow jargon or rhetoric. For that reason, it is crucial to keep in mind the following key questions:
    - Are local people considered to be the masters of their future?
    - Is a project deciding on behalf of people or enhancing people's ability to decide?
    - Who are the representatives of local people? Was the selection done by outsiders, by a few powerful (and perhaps convenient) members of the communities or by a representative group where everybody principally had a chance to take part and speak up?
    - At what stage of the decision making process have local people become involved? Often projects are being submitted to a donor with objectives and measures clearly determined before a serious interaction with the intended beneficiaries took place. Real participation under such circumstances in many cases is highly questionable.
    - Monitoring and evaluation during project implementation and final assessments need to be done with and by local people in a way that they are not only recipients of questionnaires and interlocutors for external evaluators but are in a way in charge of the process. This step which strengthens local capacities often is ignored as it requires additional resources.
- Conducting risk assessments without subsequently implementing means and actions of prevention, mitigation and preparedness just causes expectation among local people and can easily lead to frustration and anger if nothing follows after. Before starting such assessments, a project holder has to make sure that the necessary resources are available to implement a project based on the results of such assessments.
- **Any intervention from outside should only take place upon careful**

Community work in Rwanda (pic. Dr. K. Egger)

reflection on potential dangers and negative effects, like distorting existing local structures and initiatives, self-help mechanisms and traditional culture. If DRR is donor-driven, it won't achieve long-term sustainability. Lasting sustainability will only be secured if people themselves consider disasters as a serious threat to their survival and livelihood and if they are in need of and looking for outside support to address this threat.

- Protection, mitigation and preparedness can be pursued both by community-based support systems and by help given to individual families. There are conflicting views on this and one can find implementing and donor organisations favouring an either-or approach. Also in this respect, there is no universally applicable solution but in many cases a combination of both seems to be most appropriate to local conditions and to the needs of population. (see chapter 4 on community-based disaster risk management)

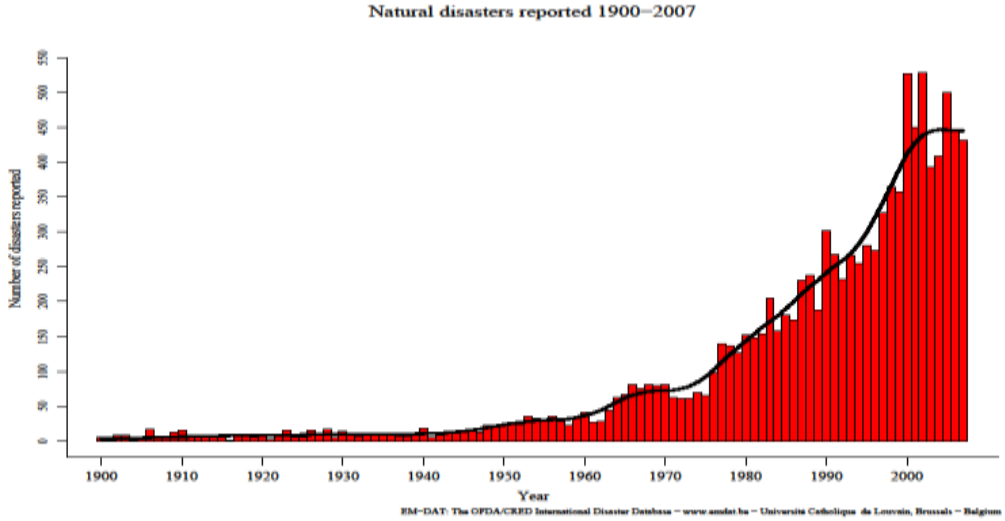
Chapter 2: Climate change and DRR

Not every extreme weather event like a flood or a drought is the result of climate change which is defined as long-term change of prevailing weather patterns.

On the other hand, not every season or winter which is colder than usual should be regarded as a sign that climate change is not happening and that related fears are exaggerated.

An indicator of climate change can be increasing numbers of abnormal weather events over many years or decades.

The graph below shows an increase of natural disasters over the last 50 years what gives reason to assume that global weather patterns at least in some regions are changing and that these changes go along with devastating effects on humankind[9]:



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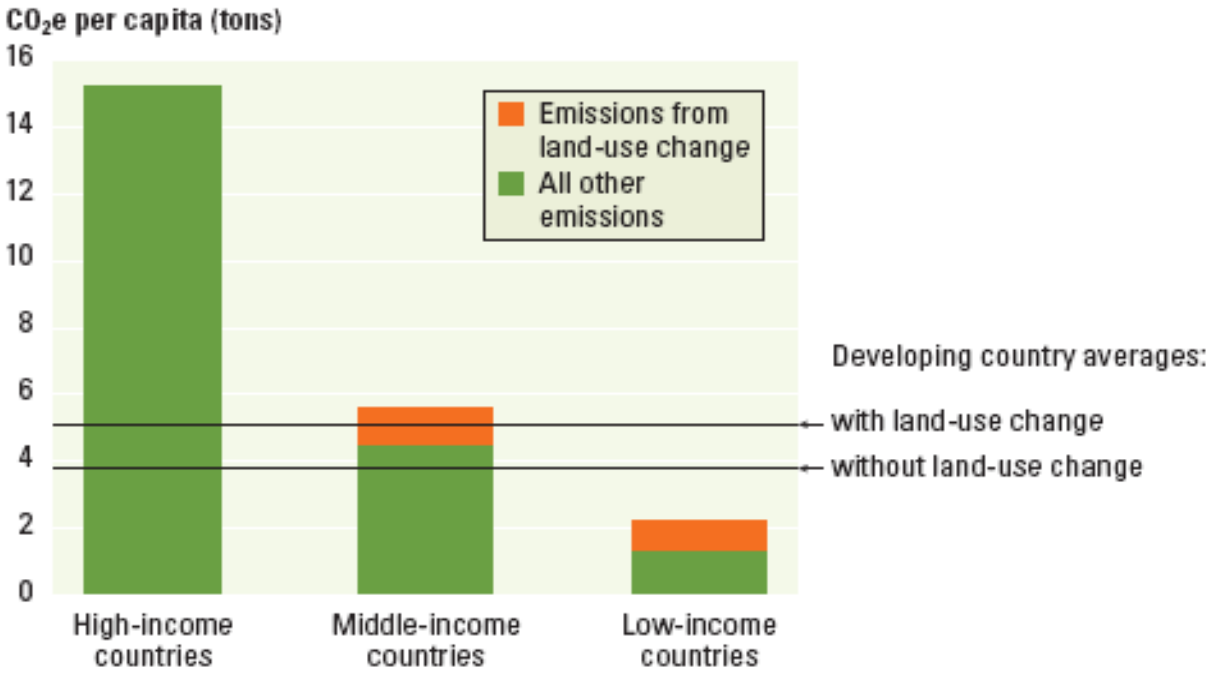
Looking at such trends underlines the urgency to protect people living in areas affected by natural disasters. One way of how people can protect themselves better from disasters is DRR which has proven to be an effective tool for this.

Since disasters mainly hit poor people who cannot protect themselves properly, assistance from outside often is indispensable in order to mitigate negative effects of such disasters. Outside assistance to the victims of climate change is not a matter of voluntary action, because climate change goes along with human right obligations. Those who suffer from it the most are those who contributed the least.

The following graph shows clustered per capita emissions of greenhouse gases which are the main cause of climate change differentiated between high, middle and low income countries[10]:



Even if land use changes (like deforestation of rainforests) are taken into account, the emissions in high income countries are more than double the respective amount in middle income and seven to eight times higher than those in low income countries.

To be more precise, an average German citizen emits the same amount of greenhouse gases as around 500 citizens of Burundi.

Therefore, one can say that DRR related to climate change should first and foremost start in the rich countries aiming at a drastic reduction of GHG emissions. On top of that, rich countries and their citizens who have to be regarded as the perpetrators of climate change are morally obliged to help implementing DRR in poor countries.

This obligation principally is accepted in international negotiations on funding of climate change adaptation. Most people agree on the so-called “polluter pays

principle", which in the end would force industrialized countries to pay for adaptation as sort of compensation for past and future damages caused by climate change. Although there seems to be consensus that money has to flow from North to South, commitments to contribute to adaptation funds are still lagging behind. There are also attempts among industrialized countries to pledge funds for adaptation which are earmarked to development cooperation. In the end, the entire financial transfers to developing countries might not significantly increase.

In order to protect our climate, every person on earth has to think about his/her personal GHG emissions and how to reduce it. The "Guiding Principles on Climate Change for ACT Alliance Programmes" contain useful suggestions on how this can be done[11].

Climate Change adaptation and DRR

Climate change adaptation often is regarded as an attempt to forecast and prepare for future disasters, whereas DRR normally looks into past disasters when assessing disaster risks. Scientists predict that climate-related extreme weather events like downpours or heavy rains, cyclones and extreme drought as well as shifting rainy seasons (starting earlier or later with drought spells interspersed) will be rising both in frequency and in velocity, mainly in regions that already experience such extreme weather events. On top of that, the rise of sea level is threatening the future of millions of people living in low-lying coastal areas.

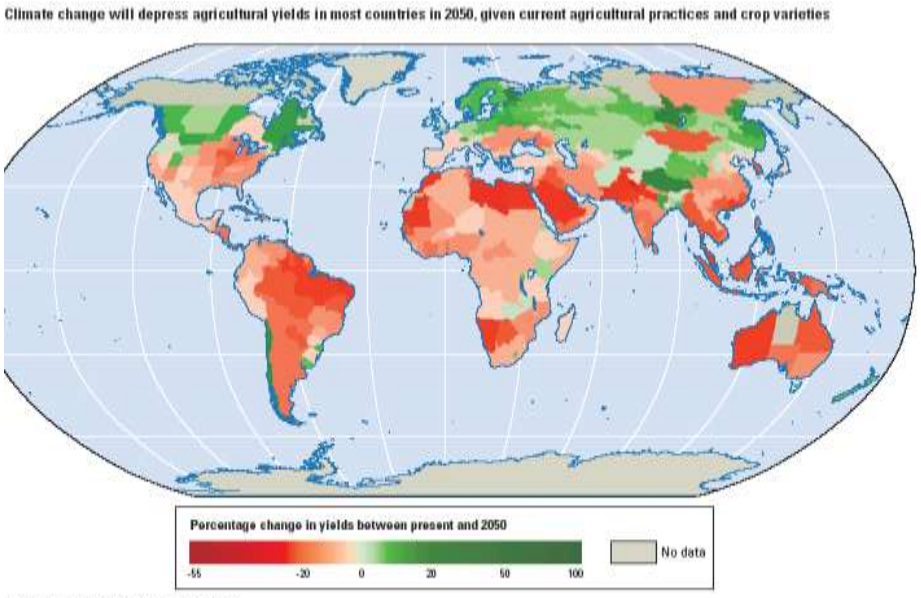
The effects of climate change can be categorized into sudden-onset and slow-onset effects or changes:

Sudden-onset effects of climate change	
• floods	• storm
• Flash floods	• surges
• cyclones (typhoons, hurricanes)	• Tidal waves
• Land slides	• hail

Slow-onset effects of climate change	
• increased overall temperature and reduced yield of staple foods	• Shifting of climate zones and shortened or prolonged monsoon/rainy seasons
• Spreading of vector-borne diseases into areas that were not affected in the (cooler) past	• Sea level rise
• droughts	• Glacier melt
• Unstable rainy seasons in semi-arid and sub-humid areas	

In the past, DRR was applied mainly in the context of sudden-onset disasters plus drought. Other slow-onset events like sea level rise or glacier melt just recently received broad public attention as a result of climate change. Although such slow-onset changes are perhaps less spectacular than the sudden-onset disasters, their harmful effects on human beings could even be worse due to.... (see following bullet points):

- Increase of temperature and reduced yields: Some staple food crops are said to have already reached the limits regarding average day and night temperatures. If the temperatures rise, such crops are likely to respond with decreasing yields. Especially the night temperatures are of crucial importance to some plants and they are said to rise more than daytime temperatures. For example, paddy/rice reacts very sensitively to an increase



Müller and others 2009; World Bank 2009c.

figure shows the projected percentage change in yields of 11 major crops (wheat, rice, maize, millet, field pea, sugar beet, sweet potato, soybean, groundnut, sunflower, eed) from 2046 to 2055, compared with 1996–2005. The values are the mean of three emission scenarios across five global climate models, assuming no CO_2 fertilization

Yield decline as a result of Climate Change

of night temperatures. Plant researcher say that with every degree of temperature rise a decline of yield of up to 10% will follow (see map above, page 23)[12].

In the light of population growth this would certainly mean tremendous negative effects on food security in regions affected and far beyond, especially if the projections come true that temperatures will rise by four to five degrees given the failure to effectively cut global greenhouse gas emissions.

- Spreading of vector-borne diseases: Many tropical diseases affecting both human beings and livestock are transmitted by vectors. Malaria is a very famous example for this. It is transmitted by Anopheles, which needs water for breeding above a temperature of 15 degrees. Another example is the Tse-Tse Fly which is transmitting Trypanosimiasis. In South-West Ethiopia the fly did not appear at altitudes above 1,600 m. However, in the past twenty years it reached altitudes of about 2,000 m killing up to 80 % of the cattle population. The farmers lost their draft animals and could not cultivate their fields in time resulting in a serious food shortage.

- Sea level rise: Almost every year the predictions of sea level rise by scientist have to be up-dated, because the melting of arctic and Antarctic glaciers including Greenland goes on at a much faster rate than previously expected. Until the end of this century, the projection of one meter sea level rise does no longer sound too pessimistic. Many island states and low-lying coastal areas around the globe would become submerged as a result with millions of people forced to move away.

- Glacier melt: In many regions of the World, people depend on melt water from glaciers for drinking purposes, for irrigation, fishing and other sources of living. Glaciers work like buffers absorbing excess precipitation during rainy seasons and releasing water in dry seasons. When glaciers shrink due to higher temperatures, the river flow down to the lowlands will drastically change causing floods and drying out in turns.

Good practice: DKH project in Ladakh, India:

The capital Leh is situated at an altitude of 3.500m whereas some valleys can reach much higher elevations. Traditionally, people almost entirely depend on melt water of glaciers and snow. There is a dramatic change being observed as glaciers are retreating and less amount of snow is being observed during the winter season. Contrary to this, there are nowadays downpours in summer as results of thunderstorms which cause considerable damage

Traditional water pond in Ladakh

through flash floods and because the traditional houses do not have proper roofs. In the past there was no rain in summer but just a little snow in winter (the bulk of the snow was found on the mountain tops).

Measures to counteract such processes are, among others, to remove all barriers to water flow in the rivers and brooks in order to avoid flash floods. One traditional coping mechanism in the villages is ponds to store water for animals and irrigation. These ponds can be enlarged and multiplied. Another water saving technique would be the sealing of irrigation channels in order to reduce leakages. Finally, there is a way of establishing artificial glaciers in winter by forcing small rivers and brooks to spread over a large area down the slopes where due to low temperatures the water gets frozen.

Apart from droughts, such slow-onset changes often are not regarded as core business of humanitarian aid organisations nor as DRR subjects. Addressing these changes commonly is perceived as part of climate change adaptation programs under the responsibility of development cooperation. On the other hand, in many cases people suffering from slow- onset changes are at the same time affected by sudden-onset disasters and vice versa and the two climate-related processes often are influencing each other. Therefore, when implementing DRR it makes little sense for humanitarian aid organisations to entirely ignore slow-onset climatic events..

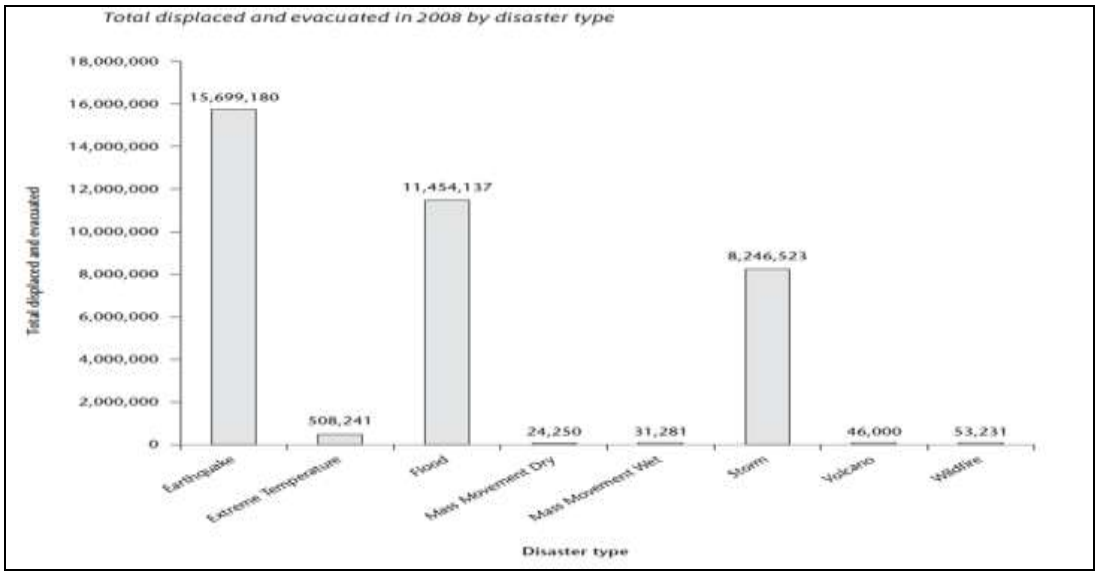
To counteract such slow-onset changes and sudden-onset disasters certainly requires a comprehensive and holistic approach. The least developed countries have prepared or are preparing so-called NAPAs (national adaptation plans of action), which usually focus on both slow- onset and sudden-onset disasters. More on NAPAs (which often are a good source of information for NGOs and a target for lobbying) can be found on the website of UNFCCC.[13]

Climate change and forced migration/resettlement

The frequency and intensity of floods, storms and droughts is increasing and the average number of people affected by climate-related natural disasters is estimated at 243 million annually. Scientific evidence indicates that this trend will continue at an accelerated pace and the forecast is that by 2015, the number of people affected per year will have increased to 375 million. It is estimated that the world's combined disaster management mechanisms can assist at most 100 million people at any one time and that the current national and international humanitarian system is already stretched to its full capacity.

Any future increase in the overall humanitarian case load therefore seriously threatens to widen the gap between the increasing humanitarian needs and the system's capacity to respond. As a consequence, business as usual is not possible. (FROM IASC sources)[14]

The following graph is taken from IOM (International Organisation for Migration) and shows total displaced and evacuated people in 2008 by disaster type and the total displaced and evacuated in 2008 (by region and by different types of disasters)[15]:



Migration often is the last resort for many people responding to worsening environmental or security conditions. If resettlement is properly planned and well ahead of time, a lot of hardship for migrating people can be prevented including conflicts with residents in new settlement areas. But this is certainly no easy matter and perhaps often goes beyond the capacity of non-governmental organisations. Still, one could think of the following measures to be within the capacity of (humanitarian) NGOs as part of their DRR approaches:

- Inform people in affected areas on climate change, its future impact and international negotiations
- Provide information on pros and cons related to migration to affected people before they decide to move
- Building up and fostering local people's organisation
- Lobby the government in both emigration and immigration countries
- Mediation in case of conflicts between newcomers and residents

Climate Change and Land use

This is an aspect of climate change which is of particular importance to least developed countries. In such countries industrial production still is more or less negligible as a source of greenhouse gas emissions, but emissions from land use like deforestation have considerable effect on the global climate (see graph page 21). Therefore, reductions of emissions from destructive land use play an important role in the UN negotiations on climate change (UNFCCC). This falls under the headline "Reducing Emissions from Deforestation and Degradation" (REDD) which basically means that countries that refrain from deforestation and destructive land use would get financial compensation through the UN climate system. However, critiques say that this could allow the Northern industrialized countries to continue their way of fossil fuel-based consumption and production patterns and just pay compensation to

Rainforest destruction in Brazil

poor countries in order to curb global emissions. The same applies to so-called “carbon markets” in which industrialized countries can off-set their emissions by investing money into clean (carbon-free) projects in the South (Clean development mechanism).

Deforestation and degradation of land not only have an impact on global climate, but also increase susceptibility to disasters. They speed up climate change and at the same time weaken or undermine the ability of people living in such regions to cope with changing climatic conditions. Counteracting deforestation and degradation therefore can be considered both as mitigation of climate change, climate change adaptation, and DRR.

Any support that can help preventing such environmentally, socially and economically harmful practices like deforestation of rainforests is badly needed.

But it should certainly not be abused by industrialized countries to bypass or defer serious and sweeping emission reduction.

This is an area where organisations working in the field and on a grass root level need to closely cooperate with political lobby initiatives addressing the international political arena.

From a DRR point of view, large-scale palm oil plantations or land grabbing for sugar cane or Jatropha, to mention but a few fossil fuel substitutes, are as critical as from a development perspective. People who are expelled from such places often have to newly settle in areas where conflicts arise or where nobody else is living so far, which often are highly disaster-prone locations.

Why climate change leads to more natural disasters (some rather general principles)

Floods:

Higher water and air temperatures not only increase water evaporation, they also allow the air to absorb and keep more moisture. Many flood prone areas can be found on the slopes of mountains where winds carrying humid air are forced to move upwards. When air is moving upwards, it cools down and can no longer keep the

humidity. Vapour turns into clouds and finally falls down as rain. The most humid areas in the world are regions where moist air is transported by monsoon from the ocean to such mountainous lands. The higher the temperatures are, the more water will evaporate in the ocean, the more humidity can be stored in the air and will be moved towards the land and the more rainfall and subsequently floods will happen there.

Droughts

The opposite process takes place in semi- and arid areas, which one can find usually behind such mountain ranges (inland), because when the wind reaches such places after having passed the mountain slopes where the moisture of the wind got drastically reduced, it becomes dry and dries out the land. Due to higher temperature, in those arid and semi-arid lands the increased evaporation will further diminish the available humidity in the soil and change hydrological conditions. The fact that warmer air can keep more moisture, rainfall under higher temperatures becomes even more unlikely. In effect, such dry land zones will become even drier as a result of climate change.

Cyclones (Hurricanes, Typhoons)

Scientists say that cyclones depend to a considerable amount on the water temperature in the ocean. That is one reason why they occur only in tropical and subtropical zones. With higher temperatures of ocean waters, such cyclones not only become more frequent, they might also increase in velocity. With sea level rise, they will become more devastating to larger areas far behind the sea shore.

Glacier Melt

The size of a glacier besides other parameters depends on ice losses during summer time and ice increases during the winter season. When temperatures rise, more ice melts away in comparison with ice increases. In the end, glaciers shrink.

Although there is some dispute about the speed of glacier melt in the Himalayans, the fact that glaciers around the globe are declining in an alarming rate seems to be undisputed. This fact is also confirmed by many local people who live close to and depend on melt water (like the inhabitants of Ladakh, see page 24). Glaciers function like buffers, absorbing water in winter and releasing it in summer, which usually is a dry period. When glaciers are gone or shrunk considerably, this buffer function gets disrupted, what can cause more frequent and more violent floods during rainy seasons and drought problems during summer periods.

Sea level rise

Water has its highest density at a temperature of four degrees. With any additional degree, it increases in volume. On top of that, glacier melt in the Arctic and Antarctic will additionally add to water level increases, what is also enhanced by the fact that temperature rise as an effect of global warming is higher in polar zones than in lower latitudes. This sea level rise is a slow process. It affects low lying coastal areas, which often belong to very densely populated and fertile areas and often affect people in the first place through increased salinity problems in drinking water and arable lands.

Chapter 3: prevention, mitigation and preparedness related to main types of disasters

In this chapter, a few ideas and proposals for prevention, mitigation and preparedness related to major disaster types are presented. These examples are by no means comprehensive and should be supplemented by the readers according to their own experiences.

A, Cyclones (Typhoons, Hurricanes)

Cyclones are likely to increase in the future in terms of velocity as a result of climate change. In other words: Scientists predict that the frequency of severe and very severe will increase because of higher temperatures of tropical and subtropical oceanic region.

Picture: CAP Malaysia

Prevention:

There is no way to prevent this type of disasters. But there is scope for mitigating or minimizing their negative effects and for preparedness.

Mitigation (examples):

a) **Mangroves** are efficient means of breaking the force of storms and waves coming from the sea. They grow in brackish water (mixture of sweet and salt water along the sea shores in tropical conditions). There are scientific reports that even the destructive force of the Tsunami wave in 2004 was mitigated where Mangroves still were intact. This certainly stimulated many people and projects in this region to grow Mangroves as a means of rehabilitation and prevention.

However, one should keep in mind that one cannot just plant Mangroves where ever cyclones are common. Mangroves need very peculiar temperature and hydrological conditions. In regions, where still some natural Mangroves are left, it is the best approach to just restore the hydrological conditions that have been there before (e.g. depth of sea water level in times of low and high tide, balance between sweet and salt water) and wait until natural re-growth of Mangroves takes place. Where due to sweeping destruction of Mangroves (e.g. due to intensive

aquaculture) there is no natural re-growth possible, one can bring in seedlings or seed from other areas but not prior to having restored the hydrological conditions such plants need to grow.

It should also be highlighted that the success of Mangrove plantation or rehabilitation depends on the hinterland (the entire catchment area of a river up to the source). If along the river too much erosion takes place and the river carries too much sediment into the sea, the Mangroves might easily suffocate in the sediment. Therefore, in such cases it would be necessary to combine Mangrove rehabilitation with erosion control measures along rivers and their tributaries on their way to the coast (what DKH is practicing in Myanmar along the Irrawaddy river, see page 34)

b) Beach forest

Where Mangroves don't grow because the hydrological conditions are not conducive, one can plant so-called beach forests which also grow on sandy beaches and also mitigate storms and waves. Such forest, for examples, can be made of casuarina e., scaveola, pandanus or betelnut tree species. But also coconut trees often serve such purposes.

Beach forest in Sri Lanka

c) Embankments and dikes

Another means of mitigation are dikes along the sea shore. Sometimes it is also necessary to construct dikes along the rivers flowing into the sea in order to prevent sea water from intruding far into arable land and from contaminating the ground water. Dikes are certainly efficient means for this, but not without bottlenecks. Firstly, they are costly and therefore often beyond the financial means of NGOs. Secondly, in regions with plenty of rainfall, the water has to be drained into the sea. Otherwise there will be water logging in areas without proper drainage. In order to allow water to flow into the sea, one needs sluice gates and/ or water pumps to drain the water during low tide. Experiences tell us that sluice gates have a tendency to get dysfunctional in the course of time and the same can happen to engine-driven pumps. In fact, that obviously happened in many parts of Bangladesh, where large scale embankment projects tried to prevent the major rivers from flooding the land but drainage became dysfunctional with the effect that large areas have become water logged and are almost entirely lost for human use. Another lesson learnt from Bangladesh is the problem with river sediments. Without

embankments, such sediments regularly were deposited on farming areas, contributing significantly to the natural soil fertility. If this is prevented due to such embankments, the sediment gets deposited in the river bed itself, constantly rising the floor of the river. The higher the river floor, the more difficult it gets to drain the land behind the embankment what makes water logging even more likely to happen.

d) **Wind break forests and plantations** (mainly in coastal areas)

They are specifically located in the vicinity of settlement areas and can consist of deep rooting trees that do not pose a hazard themselves to the houses. For ecologically stable forests, it is advisable to avoid monocultures like the many casuarina monocultures in tropical coastal areas (mainly on sandy soils) which are very poor in terms of biological diversity and sustainability.

e) Artificial Reefs

Consisting of large concrete blocks put into the sea and close to the coastline, they can break the velocity of waves. If built properly, they can function to a certain extent like natural reefs and provide breeding space for fish and other maritime fauna. There are critical comments from "Ocean Conservancy" saying that e.g. artificial reefs can displace local fish species and concentrate fish in small areas making it susceptible for overfishing.[16]

Preparedness:

a) A combination of **early warning systems and shelters** where people are protected from storms and surges has achieved very good results. In Bangladesh, the presence of cyclone shelters in coastal areas of Bangladesh has saved many lives when cyclone SIDR in 2008 hit the country.

Cyclone shelter in Bangladesh

b) **Early warnings** can reach people via radio, TV and mobile phones. In villages which are not connected to the national electricity grid, recharging of batteries becomes an essential tool of a preparedness approach. This can easily be done by solar panels which are expensive as initial investment but usually pay off fast.

c) **Cyclone shelters** in low-lying coastal areas often are the only safe place for people to resort to. However, construction of such a shelter

is costly, depending on the number of people it needs to accommodate. In addition, acceptance of such buildings in times of emergencies depends on different factors and cannot be taken for granted. Among others are the following points to consider:

- Due to religious and cultural reasons, women may not be permitted to enter such shelters without their husbands
- If such shelters are of no other use to the people (like as cinema, workplace, cultural centre, seed drying place etc.), people might not accept such facilities and ignore the option to take shelter there. They might also fail to maintain them properly
- People might be afraid of leaving their homes because of thieves. Sometimes, at least one family member has to stay at home in order to prevent theft.

Bearing in mind such points it is essential to not only build such shelters but to train and get people used to such facilities.

d) **Seed stores**: In many remote or traditional rural areas, people still use their own seeds for the next planting season. This seed usually is stored at home in all sorts of containers and pots. If a cyclone hits such houses, often the roof gets damaged or even washed away, the homes get flooded and the seed becomes soaked in water. Such seed is of no use anymore. Community seed bank where people can store the seed before a disaster strikes or even in normal times (perhaps because of less pest problems due to proper storage conditions) can help farmers to save their seed and use it once the disaster has gone.

e) **Protection of drinking water supply**: This is important against surges flooding the land with salt water and making drinking water sources unusable. One can raise the upper walls of an open well at least to an extent that normal floods don't spill over. More difficult is the protection of open surface ponds. It can be done by raising the banks of such ponds scooping out soil from the interior part of the ponds and depositing it around the pond.

In Bangladesh, this is a traditional pattern called "killas". The excavated soil is also being used to build raised corals where livestock can be kept safely when the flood approaches.

Woman fetching water from open pond

f) **Roof water harvesting**: This can be an alternative/a supplementary approach to open ponds. When using concrete or plastic tanks, such reservoir usually can be

sealed against water infiltration from outside allowing the water to be used even in times of floods.

g) **Fortifying plinths**: poor peoples´ homes often are made of mud. Especially the plinths of such mud houses easily get eroded and destabilized, even when the slightest floods occur. Fortifying such plinths by bricks and concrete can avoid considerable damage and relief people from frequently repairing their homes.

h) **Community –based preparedness schemes**: This is a prerequisite in any preparedness program. Major components can be summarized like follows:

- Risk Assessment (see annex II) and village maps (risk maps, resource maps, rescue maps) as planning tools leading towards participatory instruments of preparedness and mitigation
- Training of communities in various aspects like house construction, improvements of local capacities and coping strategies etc.
- Assignment of responsibilities inside a community in times of a disaster (e.g. taking care of elderly or sick people, passing on early warnings)
- Mock drills to train people what to do and how to behave in times of a disaster, how to rescue injured people, first aid.
- Lobbying of local governments and exchange with other communities

i) **Salt tolerant seed**: Sea water intrusion onto the arable land always poses a problem related to cyclones. Salt-tolerant seed is essential in order to allow farmers to cultivate the land once the disaster has gone.

Salt-tolerant rice plants in Java, Indonesia

Take the example of rice: There is upland rice and lowland rice (paddy). Upland rice is grown under rain fed conditions just like other grain, lowland rice normally grows in stagnant water, most often demanding additional irrigation on top of the rain. Some paddy varieties can adjust to varying water levels, like

the so-called floating rice that can increase its height when water tables are rising. Rice normally reacts negatively to salt in water and soil, but there are more salt-tolerant varieties than others. When British colonialists did an investigation in India, they found several tens of thousands of traditional rice varieties which farmers used for different plots according to water availability, fertility of the soil, salt and other mineral content, growing durations, resistance to pest and diseases, taste and ability to store etc…Nowadays, due to the spreading of so-called improved varieties, the traditional diversity on farmers´ fields has almost disappeared

Good practice DKH on cyclone prevention in Myanmar

Through its partner organisation FREDA (Forest Resource Environment Development and Conservation Association) DKH has conducted a project on Mangrove rehabilitation in the Irrawaddy delta of Myanmar. Instead of just planting Mangrove seedling at the coastline, the project consisted of soil erosion control measures in different locations along the river from the source to the mouth. For example, there was one component of protecting the natural rain forest in Kachin state at the Northern part of the country and several others on fruit tree planting, agro-forestry, reforestation and organic farming in other provinces. By doing that, not only the planting of Mangroves was embedded in a more holistic approach, people living under harsh environmental conditions in the hinterland of the Irrawaddy delta benefitted from this project in addressing their immediate needs.

B, Drought:

Drought is considered a slow-onset disaster, but certainly matters a lot in disaster relief, rehabilitation and risk reduction approaches because drought was the biggest killer of human beings in past natural disasters as compared to any other types of disasters.

Drinking water in N-W Kenya

Droughts are likely to increase both in frequency and intensity, mainly in areas which already are suffering from such weather extremes, due to climate change. Among the reasons for this one can say that higher air temperatures enhance evaporation leading to more intense water losses. At the same time, higher temperatures allow the air to hold more moisture what can reduce the likelihood of rainfall.

Droughts are divided into:

- meteorological drought (e.g less rainfall than average)
- hydrological drought (e.g. drying up of rivers, lakes and other water stores)
- agricultural drought (e.g. stunted growth/loss of cultivated plants due to water stress)

Prevention:

A meteorological drought hardly can be prevented although meteorologists are trying to find technical ways of artificially causing rain fall (e.g. by releasing crystallisation particles into the atmosphere). Even if this works, it would have only very localised effects.

Hydrological droughts can occur as a result of meteorological drought, but also as a result of human intervention (exploiting ground water or lakes and rivers). The same applies to agricultural droughts which to some extent depend on farming methods and crops used. In this sense, prevention and mitigation are feasible to some extent and can be regarded synonymously.

Mitigation:

The following basic principles are essential tools for mitigating droughts:

- **reduce water losses (e.g. through evaporation, penetration into deep soil layers, run-off into faraway places)**
- **maximize efficiency of water use (no wasting of water)**
- **enhance local water storage capacity**

Water catchment in Tigray, Ethiopia

Bearing these principles in mind, one can consider the following means of mitigation:

a) **Combating water run-off**: This can be done by small ditches, stone walls, soil furrows etc. which will lead to increased water availability in the soil to plants. All of them have to follow the contour lines otherwise the effects can be very detrimental when water concentrates on one particular point potentially causing erosion. Stone rows are

common in W-Africa and called “diguettes”.

b) **Water storage**: Storing water in topographic depression or between undulating hills with the help of dams, in W-Africa called “barrages”. In other regions this is called water catchment, water reservoirs or dams. It is essential to avoid overgrazing in areas surrounding such dams. The problem is that water flowing into such dams often carries huge amounts of silt and sediment, which gets deposited in front of the dam steadily reducing the water holding capacity of it. The less water is kept in place, the less people clear the dams from sediments. Such water stores can be regarded as means of mitigation and preparedness at the same time. The same applies to sand dams and other water stores.

c) **Protection of natural vegetation**: The root system of trees works like a sponge holding water in the soil. Anything that speeds up the destruction of trees almost inevitably enhances susceptibility to drought. Trees also tap water in deep layers of soil and rock and pump it up to the surface where it increases the humidity of the air finally resulting in higher probability of rainfall. Women in Burkina Faso reported that in areas with many trees left, drought is less severe than in deforested regions.

Mulching in N-Burkina Faso

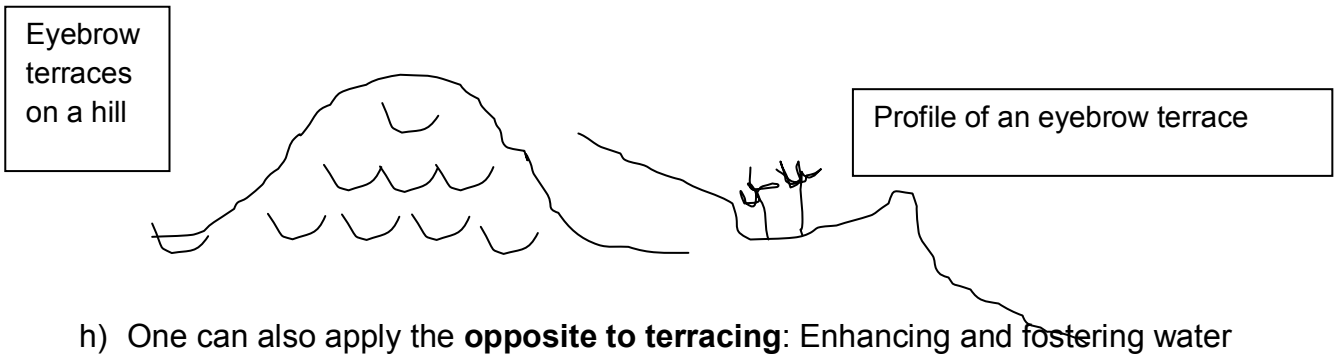
d) **Soil Improvement:** Increasing organic content of soil improves the soil structure. This allows the rain water to enter into the soil where it gets stored. Poorly textured soils cannot store a lot of water. Under such conditions every dry spell can have immediate negative impact on plants and crops growing on such soils.

e) **Mulching**: Covering the soil with organic matter (grass, leaves) can significantly reduce evaporation. There are examples showing that water demand for vegetable production in an arid-to semi-arid zone was 16 times less when mulching was applied.

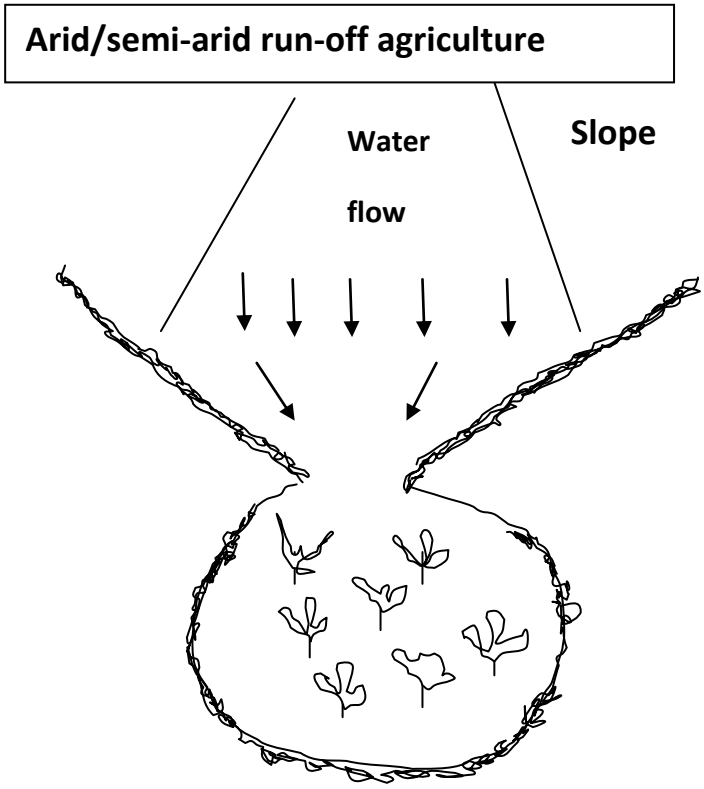
f) **Wind break plantation and forests**: Wind is an important factor contributing to the severity of a drought by drying out the soil and the plants. Fields protected by wind break forests or plantations (like hedgerows) suffer much less from lacking rainfall than without such trees and hedges.

g) **Rain water harvesting soil preparation**: even on slight slopes, rain water will run off during heavy downpours which are quite common even under semi-arid conditions. This water normally is lost to cultivated crops. One can both prevent this run off and concentrate the water to areas where the plants grow.

For example, **eyebrow terraces** on steep slopes and on very gentle inclinations allow farmers to much better use rainfall and increase the water availability for their crops. See the graph below explaining shape and profile of eyebrow terraces (also see chapter/page 98):



h) One can also apply the **opposite to terracing**: Enhancing and fostering water run-off. This is called “run-off agriculture” (similar topic: water catchment described in page 94). It allows growing of crops even under desert-like arid conditions. M. Evenari did research and project implementation together with trainings in Africa already in the 50ies and 60ies of the last century. (M. Evenari, 1968, Negev Desert Run-off Agriculture). The following graph explains the principles of this approach.



Just a simple calculation: If the upper field (water catchment area) has the size of 1 hectare and if annual precipitation is 100 mm (assuming that 20-30 % of this water can be channelled to the cultivated field), the cropping area below would receive an amount of 250.000 litres of water. This would mean sufficient humidity on app. 700 square meters for a crop like sorgho or millet which require around 350 litres per square meter can yield around 200 kg of food.

This would not be sufficient for making a living of an entire family, but could bridge most crucial food deficit periods (and perhaps substitute equivalent amounts of food aid).

Preparedness:

a) **Irrigation**: Access to irrigation water in times of a drought would certainly be a very efficient means of preparedness. But in most cases it is too costly to set up an irrigation scheme just for the sake of disaster preparedness. Irrigation schemes which are constantly operating reduce susceptibility of a farmer or farming community to droughts if properly managed (but see page 76 on dangers linked to irrigation).

b) In the Thar desert of India, there are **traditional systems of storing run-off water** in small brooks and creeks by a chain of small dams. During the usually short and irregular precipitations, the water was stored in such dams just long enough to get moisture in the soil sufficient for immediate planting. The water then was released into the next dam below the slope.

c) **Use of drought-resistant seed/plants**: For example, in many drought-prone African countries, maize is the staple food crop. Maize is rather water demanding as compared to sorghum or millet. Modern millet varieties can grow and give good yields of up to 2.5 to 3 to /hectare with 250-300 mm of precipitation. Appropriate seed is of crucial importance for farming communities in drought-prone regions. In the light of climate change it seems to be questionable whether maize production can go on in the same way as it did in the past.

The cultivation of Maize is a major reason for hunger and famine in East-African countries. E.g. in East-Zambia, maize displaced the traditional drought tolerant crops like sorghum, cassava, cow peas and others. In years with a minor reduced rainfall, maize fails on the sandy soils, while for the traditional drought tolerant crops there would have been no problem for a sufficient yield. It is similar in semi-arid areas of Ethiopia where maize replaces the drought-tolerant crops like sorghum, finger-millet and teff (from: H. Spohn)

i) In addition to seed, farmers can resort to practices that **reduce evaporation** when drought is looming. Verbal reports say that hoeing after every rainfall event breaks the capillarity of the soil by loosening the top soil layer. As a result

Pastoralists in N-Senegal burning dried cow manure for cooking

there will be more moisture in the soil and the cultivated plants grow better.

j) **Storing drinking water** in tanks or cisterns; where roofing is not conducive to this (because of thatch roof or round roofs for example) one can build a hard (compressed) floor around the house and channel the water to a underground container.

k) **Planting of short-cycle crops** (maturing in less than 90 days) like sorghum, different kind of cow peas, mung beans, chick-pea, teff a.o. Seed stocks of these species and varieties should be kept, in case the main crop fails in the middle of the growing season. These crops can be planted late and will bring at least some yield (from: H:Spohn).

l) **Seed stores on a community basis**; in W-Africa, such stores are also called "banques des cereals". They are not only used for emergencies, but also as a means of commercializing the harvest (without such stores farmers are forced to sell their crop/grain right after the harvest when prices are low).

m) **Combining annual crops with perennial crops** like pigeon pea, cassava and fruit trees in order to bridge pockets of drought mainly affecting annual crops. There are many examples (also from scientific research like ICRAF and CARI) showing that mixed cropping consisting of annual crops like maize, millet, sorghum, tubers and leguminous shrubs and bushes (like crotalaria j., cajanus c, tephrosia v. etc.) can increase the yield of the cultivated crop and increase their resilience to drought.

Wild Aloe Vera in NW Kenya

n) **Conservation of uncultivated land**: For many people, the wild vegetation is an important resource in times when farming does not give any yield. They can collect wild tubers, roots, leaves and fruit which can help them to survive even the severest droughts. Environmental protection efforts that help restoring and conserving such uncultivated lands (that, from a modern economic point of view, often are considered useless terrain) therefore is an important way of disaster preparedness.

o) **Diversifying income and resources:** e.g. by combining farming with livestock, vegetable production (e.g. kitchen gardens), forest production and perhaps off-farm income.

p) Community-based preparedness schemes

- Risk Assessment (see annex II) and village maps (risk maps, resource maps, rescue maps)

- Setting up or fostering community organisations like disaster cooperatives.
- Assignment of responsibilities inside a community in times of a disaster (e.g. taking care of elderly or sick people, passing on early warnings)
- What are traditional coping mechanisms and how can they be enhanced?
- Mock drills to train people what to do and how to behave in times of a disaster, how to rescue people, first aid.

Fetching water from river sand bank

- Lobbying of local governments and exchange with other communities

Good practice example for drought preparedness:

This DKH project with its partner ACK/ELRECO is included in the ACT publication "tackling the change". It takes place in Turkana and Pokot areas of North-West Kenya and consists of various water devices like wells, sand dams, irrigation accompanied by reforestation, drought –tolerant seed and community-based awareness-raising on environmentally safe pasture management and conservation farming. The aim is to create "green islands in the desert" as opposed to wide-spreads projects in the 1970ies and 80ies in various Sahelian countries when many wells have been dug in order to provide drinking water to cattle, sheep and goats and which ended up in overgrazing problems surrounding such wells.

C, Floods:

In this section we define floods as temporary inundation caused by a river. Flash floods are short term events as a result of one or several downpours or of continuous heavy rainfall over a couple of days. Flash floods are causing damages due to the destructive force and speed of the water.

Floods mainly occur in areas which are exposed to monsoon winds carrying humidity from the ocean to land. Over land, the air is forced to move upwards which has a cooling effect on the air what leads to the formation of clouds and subsequently rain (often heavy downpours).

These phenomena are likely to increase as a result of climate change when more water will evaporate over the oceans, the air can absorb more water due to its higher

temperature and ultimately more water will come down when the air is forced to raise over land.

Prevention

Floods to a certain extent can be prevented by reducing surface run-off upstream (in mountains and hills where the rivers come from or where they pass through). Although it might not be possible to entirely prevent floods, at least one can mitigate their negative impact. Especially along major rivers with many tributaries, prevention is difficult. However, it is short-sighted to invest money into embankment systems in lower parts of a river without tackling water run-off and erosion in upper parts of the water catchment area.

Mitigation

a) **Protection of forest** cover at the source of the rivers and of their tributaries; this certainly also includes the protection of tropical rain forest.

b) **Reforestation** in watershed areas from the source of a river down to the valley bottom, erosion control and contour planting and terracing (see chapter 4).

c) **Embankment** but bearing in mind negative effects like water logging due to improper drainage (see page 30).

d) **Clearing of rivers** and brooks in order to allow a smooth flow of water avoiding flash floods: Rock, trunks, branches and twigs and other organic and inorganic debris can block the flow of water and facilitate inundation and damage to areas adjacent to such rivers. This is especially important to combat flash floods.

e) **Overflow surface** to sidetrack the water from the main course. The intention is to channel the water onto areas where no or considerably less damage is caused by inundation. In case of larger river, this requires proper planning and huge investment and normally goes beyond the capacity of a local NGO. It should also be considered that areas close to rivers which can be used for this overflow method normally are in use by certain people because such areas often do have a potential for farming, as pastures or for vegetable production. These people might be negatively affected by this method and request compensation.

Traditional Agro-Forestry, (Usambara Mountains, Tanzania)

f) **Avoidance of (arable) farming** on steep slopes (above 18

Dam for flood control and irrigation in China

degrees inclination)

Preparedness:

a) **Early warning** down a river: What sounds logic and perhaps looks quite simple can become very difficult to put into practice: that people upstream inform people downstream in case a river is likely to cause inundation. Somebody has to feel responsible in the upstream community for alerting someone in the downstream community.

   In case of just a few villages included, early warning is rather easy to organize. But if it is a chain of tens or even hundreds of villages, it can become very fragile and susceptible to failures.

b) **Flood Shelters**: Similar to cyclone shelters they can provide effective protection in case of floods. However, different from cyclones, floods may last much longer forcing perhaps people to stay in such shelters for quite some time which might cause problems of sanitation, food and water supply and people not getting along with each other when living together under such confined conditions. Rather than constructing special buildings, it is more efficient to fortify public buildings like schools in a way that they can be used as shelters in times of floods.

c) **Raised settlement** sites: Flood-prone areas normally are flat planes with no or insignificant elevations. Artificially raising the sites on which houses and barns are built can substantially reduce the risk of floods. Often, when scooping out soil for such raised homesteads, the excavated ponds are being used for collecting rain water, paddy fields or fish ponds.

d) **Fortifying the plinths** of the houses: similar to cyclone-prone areas, inundations can damage the plinths of houses if they are just made of mud often causing the houses to collapse entirely. Fortifying the plinths with bricks, stones and concrete is a means of at least preventing such things to happen. In most cases a project just needs to provide the construction material and perhaps some expert advice for local people doing the work.

e) In the absence of shelters or any artificial or natural elevation, people often are forced to resort to **trees** in their neighbourhood to escape the floods. Although this is no long-term solution, trees at least can save people from drowning until they get rescued by somebody. In Mozambique many people mentioned that trees had saved their lives during past floods.

f) **Mock drill** in communities to rescue people in homes and on trees or other places where they took shelter. This should include courses for ordinary people to learn how to swim.

g) **Availability of boats and other means of transport** that can be used in times of inundation.

h) Crop production normally suffers a lot from inundation because the roots need oxygen and plants need to breathe (uptake of CO2 and breathing out O2). This can be hampered or become impossible in flooded fields. Even paddy does not tolerate being entirely submerged unless it is floating rice which can adjust its height to rising water tables (even several metres). In areas where rice is grown and where inundations are frequent, such **varieties of rice** should be preserved and spread to farmers who need them.

i) **Seed banks**: Similar to cyclone areas, seed stored by farmers at home can get spoiled due to humidity and water entering the storage. Water-safe seed banks can help people avoiding losses of their precious seed. Although seed banks mean rather high investment in the beginning, this would be a much better approach than providing seed from outside the community in order to replace lost seeds due to a flood (see chapter 4 on seed, page 67).

Dwelling mounds in Bangladesh

j) **Electricity supply**: In times of floods, often electricity supply through a national grid gets interrupted. If that happens, people can no longer recharge their batteries or watch radio and TV. Grid-independent electricity supply through e.g. solar panels (established on the roof of public buildings) can avoid such a situation and make early warning

and communication with the outside world feasible.

k) **Community based preparedness**: See above drought and cyclones

***Good practice example of floods preparedness**: DKH in Bangladesh*

Implemented by Prodipan, the project distributes construction material like cement and bricks to households living in flood-prone areas along big rivers in the Southern part of the country.
With this support, families can construct fortified plinths which withstand at least recurrent floods.
These floods usually cause the collapse of the entire houses if the foundation gets undermined or washed out by water.
Prodipan is now considering a follow-up project in which dwelling mounds are built by scooping out soil from areas adjacent to settlement sites. In such scooped out plots rain water will be stored and can be used for drinking or other purposes (like aquaculture).

D, Landslides

Landslides normally affect very few houses or families only, but also entire villages have been destroyed and many lives were lost in past events. To a certain extent, landslides are linked to rainfall. Heavy rainfall during a short period of time can cause landslides. If such weather events increase as a result of climate change, it is likely that also landslides will become more frequent.

Apart from the rains, landslides depend on inclination of slopes and the kind of rock or soil a slope is made of. In many cases, a water impermeable layer of rock or soil is superseded by a rather loose and water absorbing body consisting of gravel, soil and rock or a mixture of those which becomes heavy when filled with water and consequently slides down the hill.

Prevention:

Landslides can happen naturally without human intervention. However, many landslides are triggered by inappropriate land use like deforestation of hills or by construction work (e.g. roads).

Proper land use planning preventing deforestation in areas susceptible to landslides can minimize the risk of landslides.

Mitigation:

Once a land slide occurs, there is little scope for mitigating its effect. Again, a dense vegetation cover with forests might limit the amount of soil moving down the hill and the speed of the movement. Trees surrounding settlements might also partly reduce the destructive power of landslides.

Preparedness:

a) **Landslide-save construction** type of buildings: very difficult and costly what realistically can only be done in case of public buildings like schools, churches etc; but investment costs are probably very high and it is often much cheaper and safer to switch to other sites rather than fortifying buildings to an extent that they withstand landslides. For private houses such options for economic reasons most often will be obsolete.

b) **Early warning**: There are scientific systems measuring soil movements but these are costly and sophisticated. However, there are simple solutions which have proofed to be efficient (see good practice below)

c) **Measuring of rainfall** and preventive evacuation: Since landslides often are caused by heavy rainfall, measuring of precipitation can also help evacuating people in hazard – prone zones as a precautionary method.

d) **Hazard mapping** and relocation of people: In many cases relocation of people away from hazard zones could be the only safe option to choose. But often it will be the last choice of people concerned. Hazard mapping cannot be done simply by looking at past land slide events. It needs to be done with the help of experts who can draw a realistic picture of hazards in different localities.

Landslide in Latin America (picture GTZ)

e) **Rescue teams:** If a land slide has occurred and affected people, trained rescue teams need to be in place to search for people covered with soil and rubble and to offer first aid. Training of such rescue teams can be an essential element of a community preparedness programs.

Good practice example on landslides preparedness, El Salvador (*taken from ACT "tackling the change")*[17]

Project components comprise consolidating the capacity of local communities and municipal governments to prevent, monitor and effectively respond to landslides and flash floods. This combines direct, community level actions, such as the household monitoring of rainfall with simple pluviometers, community risk mapping, and the planting of grass and trees for soil retention, with promoting a

direct link between community members and their municipal governments and other institutions in the area. Monitoring and early warning systems also find their place in the project. Modern day technology and traditional systems are both used. On a hillside above the city of Berlin, geological shifts are monitored and recorded by an extensometer (an instrument for measuring changes in dimensions) and a warning station with a solar and battery powered digital recording device. This modern technology exists alongside a traditional, low cost technology system that consists of simple metal bars connected by nylon string. The data is analyzed to gauge the likelihood of landslides, floods and mudflows.

E, Earthquakes

The following map shows the earthquake zones of the World (IUCN 2008)[11]

Prevention: Not possible

Mitigation and Preparedness:

One can mitigate the effects of an earthquake mainly by means of construction (buildings and infrastructure).

There are numerous studies and articles on earthquake-proof house construction. In this paper, we refer to two GTZ publications on this subject which are derived from expert consultations and intensive field studies in developing countries ("Guidelines for building measures after disasters and conflicts"[18] and "Construction manual for earthquake-resistant houses built of earth"). Some general rules and principles in these documents are cited in the following bullet points:

1. Structures are mainly affected by the horizontal forces created by the earthquake. The vertical forces are usually less than 50% of the horizontal ones.

2. The main danger due to horizontal movements of the earth is that the walls of buildings might fall outwards and consequently the roofs collapse.

The main aim of building earthquake-resistant houses, therefore, is to avoid walls being able to fall outwards and to ensure that the roofs are fixed well to the walls, or even better that they stand on a system of posts separated from the wall, so that the roof system and the walls can swing independently due to their differing frequency.

3. Placement of houses on a slope according to the criteria in the graph on the right side:

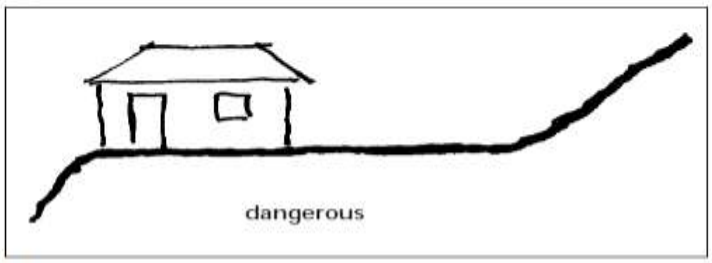
4. Typical failures in house construction:

   - Diagonal cracks leading from the edge of windows to the bottom of the wall The lintels can destabilize the walls if they are not long enough and do not have sufficient bond with the walls.

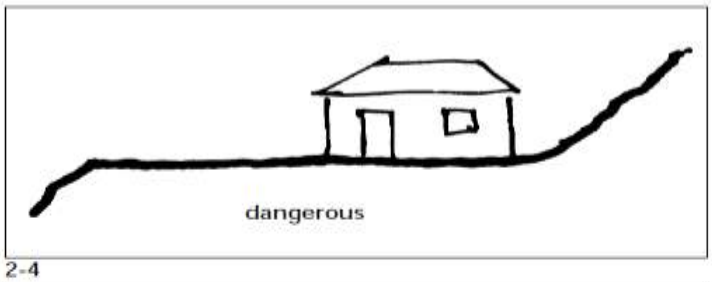
   - The wall between window and door or between opening and corner is not long enough and might break

   - The wall has no ring beam and can break easily when suffering from perpendicular loads

2-2



2-3



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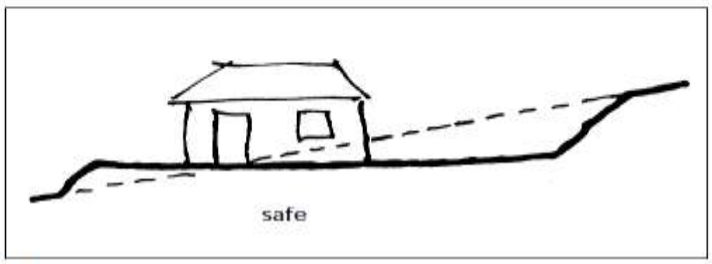
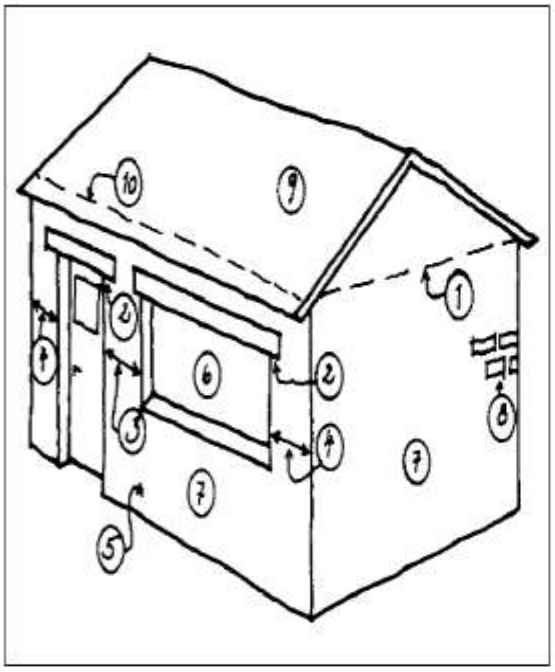


5. The graph below shows typical mistakes and failures in house construction(page 48):

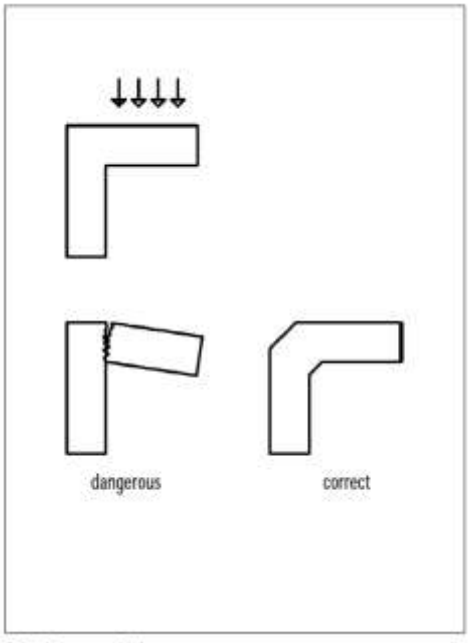


4-7 Typical design mistakes which might lead to the collapse of the house

1. Ring beam is lacking.
2. Lintels do not reach deeply enough into masonry.
3. The distance between door and window is too small.
4. The distance between openings and wall corner is too small.
5. Plinth is lacking.
6. The window is too wide in proportion to its height.
7. The wall is too thin in relation to its height.
8. The quality of the mortar is too poor, the vertical joints are not totally filled, the horizontal joints are too thick (more than 15 mm).
9. The roof is too heavy.
10. The roof is not sufficiently fixed to the wall.

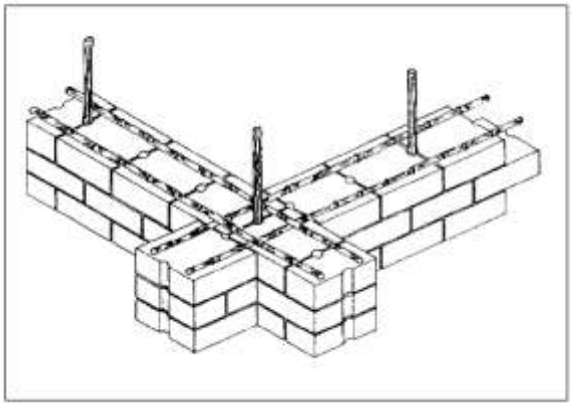
6. Recommendation for safe construction:

- Walls and roof are well interconnected and so rigid that no deformation occurs
- Walls are flexible enough to absorb the kinetic energy of an earthquake. A ring beam which is able to take bending forces is necessary and joints between wall and ring beam and between ring beam and roof must be strong
- The roof is fixed to columns separated from the walls so that structural systems can move independently as they have different frequencies



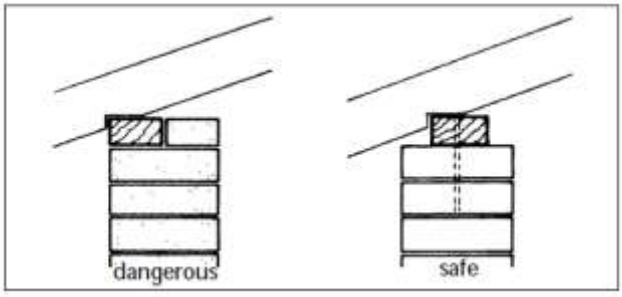
6-8 Corner solution

7. The **walls should be fixed by vertical bars** which can be bamboo rods under low cost housing conditions as explained in the graph below (page 49):

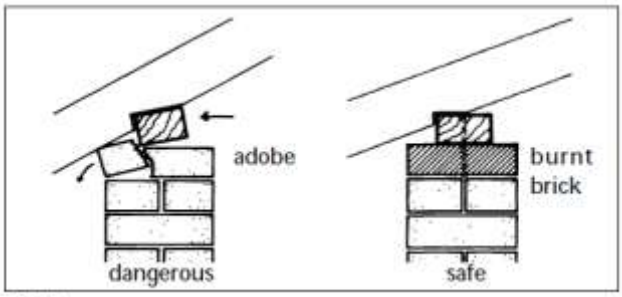


The "Instituto nacional de investigación y normalización de la vivienda (ININVI), Peru, developed a system of adobe walls which are stabilized by vertical bamboo rods that fit into holes of 5 cm diameter, formed by grooves at the side of square adobes and halved ones, see Fig. 7-5. Corner buttresses and intermediate buttresses stabilize the wall, see Fig. 7-6. In Fig. 7-8 it can be seen that the horizontal elements of the roof trusses rest on and are fixed to the buttresses. It is important to mention that if the length of a wall is 12 times larger than its thickness, it should have an intermediate buttress,

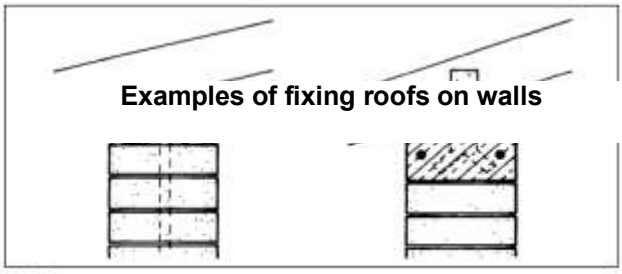
8. The **corners should be stabilized** by diametrical structures (see again graph above page 48)
9. The **walls need to be well anchored in the foundations**.
10. **The roof should be built as light as possible**. Roofs with tiles or stone plates are not recommended. For earthquake-resistant houses a pyramidal roof with four inclined planes resting on a horizontal ring beam, is the best solution. Preferably, the roof should be on columns inside or outside the walls and separate from them.
11. It is also essential to involve an experienced structural engineer in the case of larger buildings (two-storey and higher).
12. Water tanks on the roof have to be especially well constructed, in order to avoid collapse during an earthquake. Better: free-standing water tanks with especially strong supporting structure.
13. Regular control of the strength of structurally important building components and connections (because of the danger of weakening of material due to corrosion, termite attack, decay, etc.).



10-13



10-14


Examples of fixing roofs on walls

10-15

Preparedness:

When it comes to infrastructure, decentralized (“island”) schemes are less susceptible than large-scale and

highly interconnected structures. For example, if people rely on a national grid for their electricity supply or a drinking water supply scheme where water is transported over long distances, an earthquake can harm a much larger number of population than in case of decentralized facilities.

The same applies to food supply and basic health services. In this context, migration into cities which are located in earthquake-prone areas from rural areas increases the numbers of vulnerable people and can be considered counterproductive in a DRR sense.

It is certainly one of the most feasible and realistic means of preparedness to do a proper emergency planning in which not only a few governmental or highly specialized institutions are involved but entire communities which includes the vulnerable citizens themselves.

It is absolutely necessary to adopt and use expert advice in all stages of house construction projects!

Chapter 4: DRR and basic needs: food, water, shelter, health and (protected) environment

In any disaster, access to essential and life supporting means is at stake. Such essential and basic needs are food, drinking water, shelter, health care and a healthy and life-supporting environment. When implementing a DRR approach, emphasis will be put on people getting access to such basic commodities and supplies even when a disaster strikes. In order to do this successfully and sustainably, one needs to understand underlying principles and the natural and technical context in which such DRR projects take place. This chapter presents some of these principles and technical background information.

A, Access to food

Under poverty conditions in rural areas of developing countries, food security to a considerable extent still depends on a family's own food production. At the same time, it is small holder's agriculture in those countries that often is bearing the brunt of natural disasters.

Making small holders´ agriculture more resilient to drought, floods and other vagaries of weather conditions should therefore be regarded as one of the first and foremost components of DRR.

Some general principles of farming in tropical and subtropical regions:

- A fertile and healthy soil is a precondition for healthy plants, good yields and resilience of farmers to extreme weather events.

- A healthy soil consists of inorganic matter like minerals, sand and clay, of organic matter (e.g. humus and roots) and of living organisms like worms, insects and bacteria. The natural fertility of a soil and its texture to a large extent depend on the rock, from which it derived, on the amount and type of organic matter and on composition and activities of living organisms.

- The structure of a soil determines its ability to store water, nutrients and air. As a result of humid and hot weather conditions over thousands of years, tropical soils are poorly structured as compared to soils of moderate climates. This disadvantage can only be alleviated by organic matter (and so-called mineral-humus-complexes).

Organic farming in Cameroon

  Providing chemical fertilizer to a poorly structured soil will hardly produce the desired result because the nutrients will be washed away before plant roots can tap them.

- Mixed farming (crop-livestock integration) can balance out production shortfalls of either type of agricultural activity and increase and stabilize the total farm output (e.g. by growing fodder crops in combination with food crops or by providing manure to fertilize the soil).

Based on such general principles and depending on the local conditions, a DRR strategy should encompass the following actions:

- Increase the humus content by incorporating organic matter into the soil. This can be done by using compost, animal manure or a mixture of both. It can also be done by incorporating residual plant material into the soil (rather than burning it or use it as firewood or for other purposes). In order to avoid a rapid

decomposition of such organic matter in humid tropics, a mixture of wooden material (rich in lignin; e.g. twigs and branches of bushes and trees) and leafy material would suit best the building-up of lasting organic soil content.

- Integrate perennial crops and plants (with a life span of more than one season; e.g. bushes, shrubs, trees, hedges) into the farming system of a given area. Such perennial plants can compensate for poor soil structures, add on organic matter, increase water infiltration, combat soil erosion and provide shade to annual crops and the soil.

- Integration of trees, especially legume trees like Faidherbia or Acacia albida have proven to not only increase crop yields under their treetop, but also to improve the soil (structure, humus, nutrient pump). Many other trees are purposefully retained by African farmers, as they produce so called famine foods as the trees usually continue to bear fruits during drought period (their fruits are edible, but usually only eaten when annual crops get scarce. Some examples are *Imbula (Parinari curatellifolia) or Masuku (Uapaka kirkiana)in Zambia,*

Mixed cropping in Rwanda
(Soja, sweet potato and maize)

or ummfomfo (Marula sp.) in Swaziland which is used to supplement and thus economise peoples diets especially during drought periods). The root system of trees is normally reaching deeper underground layers and thus less affected by water shortages and it is also very beneficial with regard to nutrient pumping from deeper layers. (from Berthold Schrimpf)

- Mixed cropping has advantages over monocropping because different plants use different nutrients, develop different root systems and make more efficient use of the sunlight. On top of that, they can prevent serious pest attacks. In a nutshell, mixed cropping systems by and large are more resilient to adverse weather and environmental conditions.

- “Naked soils” (not covered by organic matter or vegetation) should be avoided. Otherwise the sun will heat up top soil layers to an extent that living organisms get killed or retreat into deeper soil layers. A lot of water gets lost due to evaporation and at the end the soil becomes hard like a stone.

- When applying chemical fertilizers, the risk of losses and low efficiency can be reduced by combining them with organic residues or compost. Before spending money on fertilizer purchases, it is recommended to get the soil tested by a chemical laboratory in order to know which minerals resp. nutrients are missing and need to be added.

Chemical fertilizers - Pros and cons

They are neither evil nor a panacea. Many tropical soils naturally are so poor in nutrients that plant growth is highly insufficient and falls far behind the needs of present and future generations. On top of that, urbanisation leads to a steady loss of nutrients due to food being transported to urban areas. This loss of nutrients needs to be compensated by adding fertilizers to the soils where the food comes from, otherwise soils will become more and more depleted of nutrients and impoverish.

Sometimes, people are confused between fertilizer and chemical fertilizer. While fertilizers are naturally occurring minerals and substances (e.g. like rock phosphate or manure), chemical fertilisers are produced with the assistance of chemicals (e.g. fuel to capture nitrogen from the air, or chemical acids made from oil to break down phosphate rocks.

Tephrosia v. as an intercrop and green manurig plant

Any organic matter or minerals derived from rock like rock phosphate or chalk contain nutrients which can be regarded as fertilizer when added to a soil. But these nutrients are not easily accessible to plants because they are not water soluble. It requires natural chemical and biological processes in the soil to make such nutrients gradually available to the roots.

Chemical fertilizer has been chemically processed to an extent that it has become water soluble. When added to the soil it immediately dissolves in water and nutrients can be tapped by the roots. This on one hand is an advantage because it

stimulates at once plant growth. On the other hand there is a permanent risk that nutrients get lost, usually being washed away by water (either by adding too much fertilizer or when the storage capacity of the soil is insufficient) which means that farmers are wasting money. When chemical fertilizers are added over a longer period of time, a soil may lose its own natural fertility and become addicted to such chemicals.

Producing chemical fertilizers needs fossil fuel. This resource is running out which presumably will make chemical fertilizer scarcer and always more expensive in the future. On top of that, the use of fossil fuel causes climate change. To produce 1 kg of nitrogen fertilizer is equivalent to releasing 10 kg of C02 emission into the atmosphere. Therefore, there is no real long-term alternative to organic fertilizers and to sustainable farming practices which does not exclude chemical fertilizer use in limited amounts and in a very deliberate manner.

Under drought conditions, chemical fertilizers can increase the problem of water stress to the plants. Such chemicals react like salt in liquid, binding or fixing water to an extent that it becomes even less accessible to roots.

Chemical fertilizers can make plants more susceptible to pest attacks and disease infestation and help weeds growing much faster and vigorously. This can force the farmers to apply pesticides and herbicides which not only raises environmental and health concerns but also the cost of production (see below).

On the other hand, chemical fertilizer can be used to rehabilitate degraded soils, if it is mixed with organic material and applied with soil conservation techniques. Under such circumstances, chemical fertilizer applications can be gradually reduced or abandoned.

- One important group of plants are leguminous crops (like beans and peas). They have the ability to fix nitrogen from the air and enrich the soil with this indispensable nutrient which is utterly scarce in many tropical soils. (e.g. Tephrosia vogelii, see picture above)
- They are also referred to as green manuring plants when farmers are growing them just in order to increase soil fertility. They can be used either as intercrops combined with cultivated plants or in a pattern of crop rotation on a fallow piece of land.
- In DKH supported projects, chemical fertilizers should be handled with care. Their supply must not drive the applying farmers into dependence on unpredictable market conditions nor cause negative ecological side effects. Supplying such inputs is justified if they are used to stimulate growth of biomass on degraded soils and improve soil fertility in combination with organic and sustainable means of production.

- **Chemical Pesticides:**

Pesticide application has been critically commented by many NGOs, mainly from an environmental and health point of view. Other people and especially companies producing such chemicals argue in favour of them saying that they guarantee high yields and therefore food security for a large part of the World's citizens and that the negative effects of pesticides on environment and health are being grossly exaggerated by the critiques.

Pest infestation in Vietnam

However, one should bear in mind the following aspects when resorting to chemical pesticides:

- Any pesticide application heavily interferes in the natural balances between pests and predators. In case of a pest infestation, this balance already might have been damaged. However, sometimes predators develop more slowly than pests but are catching up fast because they need pests to feed on. In such a situation, pesticide application can easily affect the predator as well as the pest and thus increasing the risks of pest infestation later on.
- Pesticide application, even if only applied for a limit period of time, can have long-lasting negative effects by creating resistance of the pest to the pesticide:
    - This often happens because pest populations normally consist of large numbers of individual organisms. Not every organism reacts the same way to a pesticide application as others do. By nature, some are less susceptible to such poisons than others and might not get killed by the pesticide. If these resistant organisms replicate, all of the offspring organisms bear the same resistance in them, making further application of pesticide less effective, more costly and much more difficult, often forcing the farmer to resort to stronger pesticides or more frequent applications.
    - Another reason for resistance is frequent mutations that regularly can be found inside an insect, bacteria or virus population. Applying a pesticide means a process of selection favouring

those mutants that survive in spite of the chemical. Since such resistant organisms do not compete with fellow organisms (which have been killed by the chemical) for food, they enjoy the best conditions for rapid development. All told, application of pesticide can easily end up in self-enhancing processes in favour of future pest infestation and in ever growing needs to continuously apply more and stronger chemicals.

- Under small holders' conditions in tropical and subtropical regions, **safe application of pesticides rarely happens.** Safe application normally requires at least wearing of gloves, masks and protective suits when handling these chemicals. Such efficient means often are lacking due to either financial reasons (that poor people cannot afford them) or due to inconvenient environmental conditions (e.g. high outside temperature and high humidity are not conducive to wearing gloves, suits and masks).

- It should also be borne in mind that the supply of such chemicals could prepare the ground for people to become acquainted with pesticides and get used to them triggering off not only the negative effects described above, but also alluring the people into a market economy in order to get the money needed to buy such chemicals. This can be very difficult in case of remote rural and poor communities.

Alternatives to chemical pesticide application:

There is a whole range of biological means of preventing pests from reaching a stage of severe damage to the crops and of controlling and decimating pest infestation already occurring. The main principles are:

- *Also in this sense one can say that prevention is better than cure. Avoid proliferation of pests and diseases by mixed cropping, crop rotation and using resistant varieties. A healthy soil brings about healthy crops that can better withstand such enemies.*
- *Practise good field sanitation and other good cultural practises:*
    - *removal of infested plants,*
    - *good ploughing under, or working in for rotting of infested plant parts,*
    - *plant in time, prepare the seedbed well, use varieties that are less susceptible to pests and diseases, planting of trap crops (like in the "push & pull" system against stemborers, etc. (from: Berthold Schrimpf)*
- *Multiply the predators (e.g. by collecting eggs of predator insects and breeding them under controlled condition in a laboratory or whatever facility exists) and finally release a huge number of such eggs into the infested fields).*
- *Do not disrupt predators like spiders by protecting their nets.*
- *Artificially raise diseases among pests. As any other living material,*

also pest suffer from diseases. One can identify what causes diseases among pests (bacteria, viruses) and multiply those.

- *Apply botanical (natural) pesticides like Neem extract, which in most cases do no harm to predators and therefore do not show the negative long-term effects described above.*
- *Examine a threshold by counting pests and predators on a given piece of land. Pesticides will only be applied when the pests outperform the predators to such an extent that a significant reduction of pests by the predators cannot be expected.*

Another alternative often cited is the so-called "integrated plant protection" which some people consider as a compromise between chemical and biological systems. Critical voices say that this is just an attempt to give chemical pesticide an ecological label.

- It should be noted again that pesticide application is closely interconnected with the farming system applied in a given area. Healthy soils and resistant seed, for example, can significantly reduce the risk of a pest or plant disease infestation. However, under present conditions around the World, which are characterized by ever increasing migration from rural areas to cities (more than 50 % of the World's population already lives in cities) there seems to be a need for high intensity farming on remaining farm lands in order to feed the urban population. On such remaining land where monocultures and objectives to achieve maximum yields are combined, the application of chemical inputs including pesticides might often be indispensible.

- For DKH projects, application of chemical pesticides should be restricted to very exceptional cases, e.g. the epidemic infestation of locusts jeopardizing food production and food security in the affected areas to a large extent which would require food aid (and, possibly, with food that was produced in conventional farming systems with pesticides applied).

Derris field in Vietnam producing botanical pesticides

Typical examples of DRR interventions:

Supplying animals to farmers

In many poverty –stricken situations, animals are a very good means of precaution against the vagaries of life. For many people they are a sort of insurance in case something unforeseen and unwanted happens like a disaster (or a disease). The traditional purpose of animal husbandry in many tropical and subtropical regions was to harness resources which otherwise are of no use to human beings: like grass in arid and semi-arid zones or organic waste in farming areas. It is only a recent phenomenon to give animals high quality feed that could as well be used for human consumption directly. In the light of long-term global food security, high intensity animal husbandry systems based on protein-rich concentrates is an anachronism both from an environmental and social point of view.

Stable for cattle and goat in Rwanda

On top of this, some animals and in particular cattle are important emitters of the greenhouse gas Methane. In Europe, approximately three tonnes of greenhouse gas emissions per human being are caused every year through food consumption of which 85% is related to meat only. And consumption patterns around the World among middle class citizens are changing towards more meat, milk and cheese uptake. Before pointing at pastoralists and poor farmers in developing countries as emitters of GHG who hardly can afford meat once a month, better-off citizens in developed and developing countries are obliged to drastically reduce their emissions which to a large extent are related to excess protein supply and luxury items.

From that perspective, supplying animals to poor people if applicable as means of disaster risk reduction can still be justified. However, many attempts have failed in the past trying to achieve lasting economic success and to use the potential of animal husbandry for DRR efficiently. Some important points and questions should be raised before starting such supply schemes:

1. Type of animals supplied: Who has decided on what animals to supply? Did the decision makers take into account past experiences with animals in the region, expert advice, ecological concerns? Will the animals supplied fit into the existing animal husbandry system of the beneficiaries?
2. Is the selected type and breed adapted to the economic, social and environmental conditions of the beneficiaries? There are examples from the past that beneficiaries received cattle who never had cattle before and who did not know how to keep them, they even were afraid of such large animals.

3. Is veterinary service available at affordable costs? Has the veterinary service been contacted before in order to find out what services and expertise it can and will provide?
4. How about the fodder situation? Is fodder production already taking place on the farm? In case of grazing: is there a risk of overgrazing, taking into account that animals replicate? Animal supply can also cause competition for land between grazing and farming areas.
5. Who are the persons to look after the animals (providing fodder, water and protection)? Men, women, children? Will this task perhaps excess the capacity of such people?
6. How about access to drinking water by the animals? How far away from the place where the animals are kept is the source of water?
7. Is there provision for keeping the animals close to the farm or under confined and controlled conditions and for collecting manure?
8. Was there a proper and realistic assessment of marketing conditions for animals or animal products in case beneficiaries are supposed to make money out of their livestock?

Feeding one cow program in Thailand

The two most common types of animals distributed in aid programmes are ruminants and poultry. Bee keeping will also be mentioned here because it looks interesting especially for small scale farmers.

Ruminants

By and large one could say that sheep or goats are less difficult to keep and less care-demanding than large animals like cattle or camels. Whereas for pastoralists large numbers of animals are a means of preparedness to the next disaster (making sure that at least a few animals will survive and allow for re-stocking), sedentary farmers in many cases find it easier to provide fodder and water to smaller numbers but higher quality animals than to large flocks especially when environmental conditions deteriorate or disasters strike.

For sedentary farmers, integration of livestock into the farming system (by e.g. growing fodder plants intercropped with food crops and by using animal manure to

keep up soil fertility) makes a lot of sense and can stabilize yields and farm activities against many natural disasters.

When considering animal distribution schemes, it is worth mentioning the so-called “passing on the gift” approach that is perceived to have been invented by “heifer project international”, a US-based NGO. It means that pregnant mother animals (heifers) are distributed to beneficiaries on the condition that the first female off-spring has to be returned to the project holder (which in turn can further distribute these to other beneficiaries).

This approach could be interesting especially in a situation where different levels of vulnerabilities exist in a community with a need to prioritize support according to the vulnerability status of a family.

Poultry (chicken):

Poultry, especially chicken, is very difficult for a project to successfully distribute to a beneficiary trying to provide a long-lasting and self-sustaining income base. In the case of broilers and layers, one can only purchase hybrid birds in larger numbers. Local chicken are almost impossible to obtain because traditional small holders usually rear them just for themselves and perhaps in small quantities for a market. Hybrid hens don’t hatch and need high quality feed concentrate with a guaranteed percentage of protein. This feed in most cases has to be bought on the market from specialized companies otherwise the desired results in terms of meat or egg production cannot be achieved. Under poverty conditions, farmers rearing such hens often spend a lot of money for feed, for vaccines and for the one-day old chicken with a high risk involved that the whole production process gets distorted due to fake or spoiled concentrates, due to animal diseases and improper environmental conditions. At the same time, farmers´ revenue margin usually is very small in remote areas where they depend on merchants to fetch their products and to deliver their feed and other inputs. Therefore, one can hardly find poultry production patterns among remote poor farming communities that managed to provide the cash people needed and expected as a reliable source of income.

Chicken project of Amity foundation in China

However, there are also alternative chicken projects showing good results. In Ethiopia, improved cocks were given to farmers and mixed with local hens. The results were stable F1 animals of good qualities. (But there are also examples that local

cocks have been eliminated before “improved” cocks were distributed; when the latter ones failed to adapt to the local conditions, chicken rearing in such regions almost got extinct.)

Highly successful examples exist in Southern Africa, where local chicken have been improved – with just a little uplifted management systems and in some cases with successful Newcastle vaccination carried out by farmers (using heat resistant inactivated vaccine strains). While cows are clearly belonging to men in most African cultures, chicken usually belong to women – thus a good approach to enhance women empowerment. Chicken flocks have risen from seasonally kept 2-3 chicken up to levels that households eat 1 chicken per month and sell some per month in addition (flocks of more than 100 or even 200 chicken are quite common with many women in e.g. Swaziland (source: Berthold Schrimpf)

Bee keeping

Bees can be regarded as animals of the landless or small land holders because bees “browse” on much larger areas than the property of a family.

Small holders’ bee keeping in Mexico

In many developing countries there is little investment needed to start with beekeeping, as the bees are abundant and inhabit the hives quickly. As hives might also be constructed using locally available inexpensive materials, the main costs are linked to protective clothing (veils, gloves) which can reduce the fear of people and limit the frequency of stings. Honey can be used as sugar substitute by the family itself or sold to the market and provide some income. Bee keepers also can get wax, pollen and Propolis. Modern bee hives can be transported and therefore taken to safe places when a disaster arrives. However, under drought conditions provision/availability of water in the neighbourhood of beehives is indispensable. There are reports that bees like other insects even try to take water from eyes and lips of human beings (young children and babies) when searching for water.

DRR and Nomads

Pastoralism is one of very few options to making sustainable use of arid and semi-arid areas which are too dry for farming. **Due to their fragile environment and economic hardship, pastoralists principally should belong to the core group of beneficiaries of DRR programs.** But in fact they seem to be rather neglected both by development and humanitarian aid organisations. There are various reasons for this like among others:

- It is difficult to reach pastoralists simply because many of them are not sedentary.
- Many pastoralists stick to their traditional way of life and preserve their cultures and customs which often do not comply with modernist development theories and objectives.
- Pastoralists often are considered by governments as a hindrance to economic development and a potential political threat, so that civil society organisations are not encouraged to access them.
- Often there is anything but an easy solution to help pastoralists overcoming their problems. Proposals on what to do may vary quite substantially e.g. from preserving their traditional way of life to converting them into sedentary farmers.
- Controversies on how to help pastoralist often become evident after disasters, when large numbers of livestock got killed. Some organisations start re-stocking, whereas others are offering a few heads of high quality livestock on the condition that the entire number of livestock is reduced substantially, what ultimately ends up in de-stocking.

What makes life of pastoralists much more difficult and increases their susceptibility to disasters are attempts to deny them access to grazing areas by governments, mining, agricultural or tourist industries. Due to this, traditional coping mechanisms have become obsolete and violent conflicts and clashes for land and water resources have rather increased than diminished.

In the light of such deteriorating conditions, many pastoralists have begun or are beginning to switch from animal husbandry to farming/vegetable production or a combination of both. There are other coping mechanisms like the use of wild plants for securing food supply in times of a crisis or making money out of natural resources (e.g. collection of aloe vera, but also by selling charcoal).

Rendille pastoralists in N-Kenya

As indicated above, there is no easy way to prepare pastoralists to natural disasters. The following points are just a few examples of what has been done in various projects in the past. They should not be regarded as recipes for new DRR projects. Such projects need thorough and expert advice and have to be designed in tight cooperation with communities affected:

1. **Pasture management**: this sometimes is also referred to as rangeland management. The basic idea behind is to take some pastoral land out of use by fencing it up so that

grazing animals don't have access. When the natural grass cover has reached a sufficient level, animals are allowed to enter again while other areas are taken out of pastoral use.

2. **Enclosures**: Fencing up (especially green fencing by using thorny plants) of areas for natural re-growth. Normally such enclosure have a longer time perspective than the above mentioned pasture management schemes. Often the aim is to allow secondary forests to get established (>20 years).

3. **Hay making**: When land was sufficiently available, herders just followed the rains with their flock. There was almost no need to prepare for stored food and fodder. Since grazing land becomes more and more restricted, this traditional coping mechanism no longer works. Cutting grass and storing it for the dry season could be a way of responding to these constraints, but requires labour force.

4. **Planting of grass, bushes and trees** to keep water in the soil: natural vegetation cover can significantly increase water retention of the soil, rain water infiltration into the soil and recharge the ground water table. Dry land trees often develop long root systems, sometimes reaching down several hundred meters, tapping and pumping up water from underground layers and thus enhancing growth of grass on the top soil.

5. **Veterinary services**: healthy animals are more resistant and resilient to disasters. In a project in Ethiopia, LWF has considerably enhanced pastoralist preparedness to droughts according to a project report (see. ACT Tackling climate change) by improving health conditions of animals.

6. **Ponds, dams, sand dams, shallow wells** etc with controlled grazing: The main goal of such water retention schemes is to avoid water losses due to run-off and to store the water for drier periods, as a source of water for animals. When doing this, one should bear in mind the following two aspects:

    a. the high water losses due to evaporation

    b. the risk of overgrazing surrounding such water places which can become birthplaces for desertification

7. **Additional income generation**: Opinions differ whether pastoralists should be and can be trained to embark on income generation activities different from animal husbandry. Some pastoralist communities have switched to farming, at least partly, others are producing handicraft, selling charcoal or wild plants or have moved away from their communities in search of jobs. There seems to be no general rule which would be applicable everywhere. Any decision making should be extremely sensitive and be based on intensive interactions with the communities concerned.

8. **Awareness raising and community-building**:
   One example: An elderly woman of the Pokot pastoral community in NW Kenya has been invited to Germany by DKH. When coming back to her village, her social status has risen and she could assess and comment on her community's life from a different angle. Her voice was heard and she managed, among other

things, to prevent her fellow citizens from cattle rustling which is a huge hindrance to reconciliation and development in her area.

Turkana women in NW Kenya

Pastoralism and climate change:

The FAO[19] estimates that restoration of grasslands and good grazing land management can globally store between 100 and 800 Megatons of CO_2 equivalents per year. If managed correctly these techniques could lead to healthier grasslands, which in turn could increase livestock productivity.

The study identified a number of barriers to good dry land management, such as unclear land tenure due to the 'common property status' of most dry lands and competition from crops, including those used for bio-fuels. Policies which focus on reducing livestock rather than grazing management are another obstacle. Good management would also be helped by policies which acknowledge the carbon sequestration value of dry lands. Existing international carbon trading mechanisms, such as the Clean Development Mechanism do not currently address grazing lands or soil carbon accumulation.

The research indicated that well-managed pastoralism could simultaneously secure livelihoods, conserve ecosystem services, improve carbon sequestration and honor cultural values and traditions. It called for greater support for sustainable pastoral systems. This could include providing incentives to support sustainable and adapted management of dry lands, establishing policies that

address barriers, such as land tenure, conducting targeted research, such as measuring the amount of carbon sequestration and promoting approaches that integrate the local, national and global aims.

Food Aid Convention and Codex Alimentarius

Presumably, people who are self-reliant in food are more resilient to disasters than people who depend on external supply. One example in favour of this assumption is Indian cotton farmers whose survival entirely depends on selling cotton. With the introduction of genetically modified cotton seed, many of them run into indebtedness. If a disaster strikes (what even can be low yields, poor rains or insect attacks), they have nothing to make a living on what prompts many of them to commit suicide.

Potentially, food aid can undermine self-reliance in food among recipient communities by

- *Distorting local market mechanisms to the detriment of local producers*
- *Changing local consumption pattern towards imported food and diets*
- *Favour large-scale farming to the detriment of small holders*

Therefore, the negative impact of food aid has to be avoided or at least minimized.

There is an international regulatory system, called the "Food Aid Convention" (FAC) that, among other objectives, tries to set-up criteria for this. It is worth having a look at this convention:

(Cartoon Unicef)

*The **Food Aid Convention** (FAC) is the main international agreement governing food aid. Under the convention, donors commit to a minimum level of food aid and they agree to provide "timely" aid, targeted at vulnerable groups. The FAC also sets standards for food aid quality and delivery, urging member countries to procure food aid at local and regional markets and to respect "local food habits and nutritional needs."*

Rural family in China

Food aid donors first negotiated the FAC in 1967, but have since renewed the convention several times. FAC members have agreed to re-negotiate the convention once the World Trade Organization (WTO) reaches a decision on the use of food aid as a tool to support domestic agriculture. But, WTO negotiations are scarcely moving and many NGOs and food aid experts have proposed renegotiating a strengthened FAC.

They argue that the FAC is not implemented well. Minimum requirements of food aid supplied by donors are not always met. The amount of food supplied often depends on food prices on global markets. Donors tend to give more food if World market prices of food are low and if perhaps surplus domestic production cannot be sold profitably. Currently, the FAC does not even publicly disclose governments' failures to meet their commitments. Also, reform advocates agree that FAC membership must be broadened to include all critical actors of the global food aid system, such as the new food aid donors (e.g. China and South Korea) and food aid recipient countries, as well as NGOs and social movements.(more on food aid and FAC: see Katarina Wahlberg, Global Policy Forum[20])

***Codex alimentarius**:*

When delivering food aid, the quality of food certainly matters a lot. Not only the nutritious value of food plays a critical role, but also a possible contamination with chemicals, the existence of additives with perhaps negative health effects on the consumers and techniques applied when producing the food, like using genetically modified organisms (GMO).

*For the safety of food to consumers, an international body was formed in 1963 called **"codex alimentarius".** It was formed by FAO and WHO to develop food standards, guidelines and related texts such as codes of practice under the Joint FAO/WHO Food Standards Programme. The main purposes of this Programme are protecting health of the consumers and ensuring fair trade practices in the food trade, and promoting coordination of all food standards work undertaken by international governmental and non-governmental organizations. Since the first steps were taken*

in 1961 to establish a Codex Alimentarius, the Codex Alimentarius Commission – the body charged with developing a food code – has drawn world attention to the field of food quality and safety.

Now, for almost 50 years, all important aspects of food pertaining to the protection of consumer health and fair practices in the food trade have come under the Commission's scrutiny. Simply stated, the Codex Alimentarius is a collection of standards, codes of practice, guidelines and other recommendations. Some of these texts are very general, and some are very specific. Some deal with detailed requirements related to a food or group of foods; others deal with the operation and management of production processes or the operation of government regulatory systems for food safety and consumer protection.

Seed

Seed is decisive when it comes to yield, to quality of fruits, to resilience of a farming system against vagaries of weather, resistance to insects and diseases, and in the light of income or farm expenditure.

Providing seed through a relief, rehabilitation or DRR project can have a tremendous impact on future farming conditions. Those who decide on seed supply should be extremely sensitive before taking any decision. Since seed supply seems to be happening quite commonly as part of humanitarian aid, it is worth to elaborate a bit more in depth on this subject.

Thai woman selecting seed

How nature works

There are 2 main categories of plants: ***Autogamous and allogamous plants.***

In autogamous plants, (male) pollen and the (female) pistils are in the same blossom (like in the case of wheat and rice), whereas allogamous plants are either female or male (e.g. Papaya).

The latter need a vector or agent like wind, bees or other insects to carry the pollen to the female blossom (e.g. maize) whereas autogamous plants normally are self-pollinating. This distinction is quite important to know when distributing

seed because autogamous plants don't significantly interfere with local crops of recipient farmers and can be replicated at least for some seasons without a serious yield decline.

Allogamous plants easily interchange pollen with local species or strains and often produce undesired results when farmers use them for their own seed production.

By and large, there are different categories of seed that farmers use:

- **Traditional seeds**, so-called land races. Usually, they are planted year after year, after a careful selection by farmers, in traditional societies often by women. But even then over a long period of time such land races can show signs of genetic deterioration so that farmers need new planting material from outside a community. Under traditional farming practices, often seed were exchanged from one community to another (e.g. as gifts, payment for services etc.) so that such deterioration could be curbed. The existence of large numbers of traditional seed varieties was "key" to the survival of humankind and still is the foundation of modern plant breeding. When looking at climate change with its largely unpredictable effects on farming in various parts of the World, plant and seed diversity could be as important for food security in the future as it was in the past.

Traditional threshing in Ladakh, India

- So-called **improved varieties** (also referred to as high yielding varieties: **HYV**), a term often used for autogamous plants. These are breeds which have been released by research or breeding stations or private companies. Such varieties can be reproduced by farmers but after a few years will lose their yield potential and should be replaced by new ones. They normally are less resistant to natural adverse conditions and constraints and more susceptible to pest attacks, but under favourable farming conditions (especially with good water and nutrient supply) usually give higher yields than traditional varieties. But there are also examples of improved varieties that are more resistant to pest and diseases than traditional ones. Spohn reports on durum seeds in Ethiopia which are less susceptible to "rust" than native species as a result of modern plant breeding.

Here, a fundamental difference between modern plant breeding and traditional seeds should be highlighted: In the past, farmers did adapt their seed to different natural conditions (e.g. different soil conditions like from the top of a hill to the valley bottom). Therefore, these farmers sometimes had hundreds of varieties which were selected according to natural requirements of the plots. Modern farming just uses very few varieties but is trying to adapt the natural conditions of a plot to the requirement of the seed or plant. This adaptation usually is done by adding water, fertilizers, and pesticides. When using modern seeds without applying such adaptation means, the results in terms of yield can be even worse than in the case of using traditional seeds. It is a serious constraint to local farmers that traditional seeds become less and less eligible due to climate change. Among other effects, climate change often leads to shorter rainy seasons to which traditional varieties are not adapted to an extent breeders' varieties are.

- **Hybrid seeds**: This is seed that has been produced by crossing two genetically distinct parental strains of the same species. One can get such strains by constant in-breeding (crossing the off-spring with the parent). What farmers can buy is the so-called F1 generation of seed which normally produces considerable better results than the parental varieties. However, the next generation of this seed is of no or little use to farmers. Farmers have to constantly buy new seed before every planting season. (More on hybrid seed unpublished: Berthold Schrimpf, RSA travel report[21])

Good cassava harvest in Rwanda
(Photo: Dr. K. Egger)

- **Open pollinated seed**: This in a way is an alternative to hybrid seed. It is the high yielding variety (HYV) of allogamous plants and can be replicated by farmers through natural (open) pollination. Due to cross-pollination with other strains, their genetic properties are likely to deteriorate in the course of time so that farmers sooner or later are forced to get new seed.

- **Genetic Engineering** (GE): This offers plant breeders a new quality because it allows to breed into a plant a gene coming from a completely different organism (e.g. breeding into potatoes a gene from a leguminous plant which could allow the potato to fix nitrogen from the air; or breeding into a plant a gene from a fish which would increase the frost tolerance of the plant). For most civil society organisations and the churches, risks and disadvantages related to GE exceed by far the advantages. There are statements of ACT and WCC requesting their members to refrain from such seed both in food production and food aid. DKH fully subscribes to this policy.

- Other plants, in particular tubers, usually are replicated through **clones** (which, for example, can be a harvested tuber or just a piece of it) which genetically are identical with the mother plant. However, it can easily happen that such off-springs are infested by viruses, fungi or bacteria without necessarily showing clear signs of such a disease. When such infected planting material is used as seed, also such disastrous organisms will multiply and can cause huge damage to the crop and even neighbouring plantations.

Good practice example of a DKH seed supply project in Indonesia

Traditional paddy seed almost have become extinct in Indonesia. But modern varieties demand fertile soils. They do not tolerate salinity. Due to sea level rise and frequent cyclones as well as Tsunamis, coastal areas in Indonesia increasingly suffer from salt water intrusion. This makes paddy production difficult, if not impossible. Many areas adjacent to the sea already have been abandoned by farmers. On the other side of the Indian ocean, along the east coast of India, traditional, salt-tolerant paddy varieties are still being used by the farmers.

Elements of SRI, Picture by IPPHTI

Navdanya, a DKH partner in India, is collecting such seeds, testing them, storing them and multiplying varieties of high potential. A handful of such salt-tolerant seed has been brought to IPPHTI, a farmer's organisation and DKH partner in Indonesia. There, the seed was given to a few farmers for testing in salt-affected regions. When it became clear that both yields and taste were good, multiplication of this seed started. Out of four kilogram of seed that was carried over from India, more than 150 tons have been reproduced and spread to Indonesian farmers.

The seed is used in a so-called "System of rice intensification" (SRI) which needs less water than usual paddy fields, less amount of seed and can give higher yield. IPPHTI is very active with assistance from DKH to promote this type of paddy

farming which is more adapted to climate change than traditional practices. The main elements of this SRI approach are shown in the pictures above in this box.

- Participatory plant breeding (PPB): It gets farmers involved in the breeding process. There are three major success stories (J. Kotschi, unpublished): in the Middle East with barley, in South East Asia with rice and with Sorghum in W-Africa. The results are very competitive to High Yielding Varieties (HYV) of scientific or commercial breeding in terms of yield or drought tolerance. PPB can enhance the efficiency of breeding, because farmers' knowledge and preferences are included (demand-driven breeding) and speed up the breeding process (less time needed until a new variety is released). (See also Kotschi, J.[22])

Distribution of seed- what to bear in mind

It is of crucial importance to find out before distributing any **food** item, whether farmers might perhaps use these items as **seed**. In the latter case this can have serious implications on farming conditions and on the environment affecting the future of people's livelihood.

If seed is distributed, one should make every effort to look for guaranteed quality seed in order to avoid negative impacts on local flora through diseases and unwanted weeds.

In case the recipients are traditional farmers who still use their own traditional varieties, the situation is quite complicated. Because it often is impossible to get exactly the same type of seed for distribution which farmers were using before. Traditionally, farmers don't store seed in larger quantities for sale, but just in quantities they need for the next planting seasons. Therefore, if a project tries to purchase seed for distribution, it is difficult to get traditional seed and one has to resort to seed companies or governmental supply services which normally don't keep traditional varieties on stock. The matter then becomes complicated because the recipient farmers might not be capable to grow the new seed in a successful way without fundamentally changing their farming practices.

Key questions when distributing seed to farmers:

a) Why distributing seed? Is seed distribution a precautionary method or re-stocking after a disaster? If it is precautionary, what are the advantages of the seed distributed compared to the one farmers have been using so far? If it is re-stocking, can the same type and quality of seed be provided?

b) What seeds did farmers use in the past/before in the region concerned? Their own traditional seed? Improved varieties? Hybrid seed? Will it be possible and reasonable to supply the same type of seed? Could it happen that the new seed by mistake replaces traditional varieties?

c) Is the fact that diversity of seed and of plant varieties increase farmers´ resilience to future natural disasters taken into account?

d) When are farmers going to use the seed supplied? Will they have to store it? How about storing conditions (be aware that stored seed easily gets affected by pests and therefore might need protection). What is the size of land where farmers usually grow the crop for which seed is supplied? What is a required amount of seed per area? Does the seed supplied comply with such requirements?

e) Does the seed demand special soil preparation, irrigation and fertilizer? Are such measures and inputs traditionally available? What are the recommendations given by the seed company?

Woman selling seed in Ladakh

f) Is the seed adjusted to the local environmental and weather conditions? Has it been used in the region before? On farmers' fields, on research plots? What are the results in terms of yield and under what conditions (fertility, water, pesticides) have these results been achieved? How realistic is it to expect that poor farmers can meet the requirement of modern seed in terms of water, nutrients and protection against pests and diseases?

g) Will seed supply enhance resistance to pest and plant diseases? If not, how can farmers combat such pests and diseases?

h) Does the plant comply with the consumption pattern in the region or would people be forced to change their traditional diets?

i) Can the seed be replicated by the farmers for the next growing season? If they do, will they have to face considerable yield losses? If the seed is not replicable or if it is not recommended to replicate it, is it realistic to assume that farmers can manage to buy seed on the market? What is the background for this assumption

j) How about germination rate of the seed supplied? Was it checked by a reliable institution before distribution takes place?

k) Will the seed supplied be free from viruses and other harmful organisms?

l) Was the crop of which the seed is taken examined in the field before harvest by an official authority?

m) Before distributing seed, one should carefully check whether farmers still have seed in traditional storages which sometimes are difficult to find for outsiders.

***Good practice on seed**: Organizing seed fairs where people get together and share their seed with each other, either commercially or by way of barter. This can provide for diversifying the varieties of seeds farmers use, for spreading of varieties with desired qualities like tolerance to disasters (drought, wind, hail, floods) and stimulate local farmers to produce seed in quantities above their own needs.*

B, Water

Since water affects all aspects of life, it certainly matters in everything related to DRR. Most climate-related natural disasters in one way or another are caused by abundance or scarcity of water. Prevention and mitigation usually are applying means to counteract hazards posed by water, whereas preparedness primarily tries to make sure that people have access to save drinking water once a disaster has happened. Chapter 3 covers water-related disasters (like floods or droughts). This paragraph provides some basic information on irrigation as an important user of water and on drinking water quality and requirements.

Irrigation with groundwater in Bangladesh

Some common ways to access water:

- **Roof**: there are various roof water harvesting systems, with gutters and concrete or plastic tanks (subsoil or above the ground) or cement floors surrounding houses where the water is prevented from percolation and channelled into a cement cistern. One can calculate the amount of water that can be stored this way: 1 mm of precipitation is equivalent to 1 litre of water per square meter. A roofing area of 100 square meters would yield 10.000 litre of water if the precipitation is 100 mm. Big water tanks for households usually can store up to 10 cubic metre or 10.000 litres.

- **Surface water ponds** or surface water catchment/harvesting systems are means of harvesting water from an extended area and store it in cisterns, open ponds or a dam. One can calculate the amount of water to be stored in a similar way as above by

measuring the area from which water is harvested. However, on natural surface heavy losses of water due to percolation into the soil have to be taken into account. Depending on the type of soil, the occurrence of rock, stones, plants on the surface and depending on the amount of water during precipitation events, the water losses can be substantial. Experts need to calculate the size of the storing capacity based on such natural parameters. If the storing capacity is too small, there is a risk of water overflow with potentially very destructive effects on the physical properties of the water store. If the storage capacity is too large, the cost-benefit ratio can be negative and water losses due to evaporation and infiltration are very high. The cost-benefit analysis should also take into consideration that run-off water always carries sediments down into the pond or water basin and thereby is steadily decreasing the water holding capacity. In order to avoid that, beneficiaries have to permanently scoop out such sediments.

Irrigated onion production, Chad

On open water ponds and basins, water losses due to evaporation can be extremely high. The amount of evaporation depends on air temperature and humidity. It can reach up to 12-15 mm a day which means a loss of water level of almost half a meter in a month. It would be worth making efforts to reduce this evaporation by e.g. covering the ponds with material that reflects the sun and keeps the water cool at the surface.

- Whereas sedimentation is harmful in case of surface run-off water catchment systems, it is required and intended in case of **sand dams**. Such dams (made of brick, concrete or stone walls) are built across small rivers or brooks/creeks which periodically dry out. Due to the sand accumulated at the site of the dam, water gets stored underneath the surface and is largely protected from evaporation due to the texture of the soil (sandy) which does not support a capillarity movement of water to the top. The water normally is lifted by hand from holes dug into the sand or by hand pumps at the fringes of the river and mainly used for drinking and/or vegetable production.

- An interesting source of water is **artesian wells**: If ground water is under pressure because there is influx of water from surrounding higher elevations (with penetration of water into deeper layers being impossible due to impermeable soil or rock), such underground water can be tapped without sophisticated pumping devices.

Surface water (rivers and lakes) in modern times often is polluted with agro-chemicals and litter and the water is not conducive to human use without expensive cleaning. Since such cleaning facilities often are lacking, the best way to protect water from contamination would be to refrain from applying such chemicals. A switch to organic farming can be very beneficial to the quality of drinking water and further on to the health conditions of local people.

One interesting option to store water is implemented in Brazil by Diakonia: At the bottom of a slope, people dig a trench, sometimes 2-3 metres deep. Then, a plastic sheet or tarpaulin is placed against the side of the trench and fixed a t the bottom with concrete. Afterwards, the trench is filled again with soil. When water is running-off the slope, it is caught by the plastic sheet and stored in front of the trench creating a sort of marsh from which water can be lifted by hand pumps and wells (see ACT: Tackling climate change[23])

Some water lifting devices:

As for many other technological inputs, when providing water lifting devices, one should take into account the following questions:

- Can local people and local mechanics handle or master the device (machine) or do they need outside support for maintenance and repair? In the context of poverty-stricken beneficiaries, this likely will turn out to be un-sustainable.

Traditional well in India

- What are the running costs and do they comply with the income people may get from water use? There is a tendency to overestimate the income people can make by starting an irrigation project not sufficiently taking into account growing competition with people in other areas doing the same type of business, or the power of middle men to enforce unfavourable producer prices, or quality problems related to the product and water scarcity in the course of time (to mention but a few).

- What are potential environmental side effects (e.g. some water lifting device may lead to exploitation of the ground water resources; watering sites for animals can lead to overgrazing around such sites due to a high concentration of animals).

- The cheapest solution might neither be the best economic one nor the best environmental one (because for example it does not allow for profitable production modes or goes along with wastages of huge amounts of water).

- One should clearly determine at the very beginning what purpose such devices are supposed to serve: for drinking, watering animals, or for irrigation. If a pump is installed for drinking water, the question is whether people can pay for the water. If

not, the running costs should be as small as possible and a hand pump would be the better option than a fuel or electric pump.

Pond irrigation with raised beds in Mexico

- Any open source of water (including open wells) can easily become spoiled with non-potable water in times of floods. Protection of such water sources can either be achieved by constructing walls surrounding the water place (e.g. high ring walls surrounding the open well or embankments surrounding water ponds) or by sealing the entrance (e.g. by a lid or plastic cover on the well).

For drinking water and for watering animals, often hand pumps are being installed. Such pumps are simple and quite robust and can easily be repaired by local people (since spare parts are also easily available in most cases). However, the amount of water lifted is not more than 40-50 litres per minute or around 2500 litres per hour. For irrigation this is insufficient (one could irrigate at best smaller vegetable gardens in the vicinity of the pump). Water can be lifted up to a height of 7 – 8 m at most from the underground water source (this is due to natural laws of gravity and air pressure on the ground which creates a pressure gradient between the water entrance in to a pump underneath the ground and the water outlet above the ground). If more sophisticated pumps are use in boreholes, water can be lifted by hand pumps from much deeper sources. (A good paper on wells, boreholes and pumps : Peter Wurzel, drilling boreholes for hand pumps, SKAT, 2001[24])

- **Irrigation:**

There is probably little doubt that irrigation has the potential to reduce the risk of disasters, especially the risk of drought. Well designed irrigation schemes can increase people's income and alleviate poverty. Irrigation also allows for making use of areas which otherwise would be hostile to human beings.

This paper is not intended to be a manual on irrigation, only a few important aspects will be highlighted which decision makers/project administrators etc. might always bear in mind when deciding on irrigation projects:

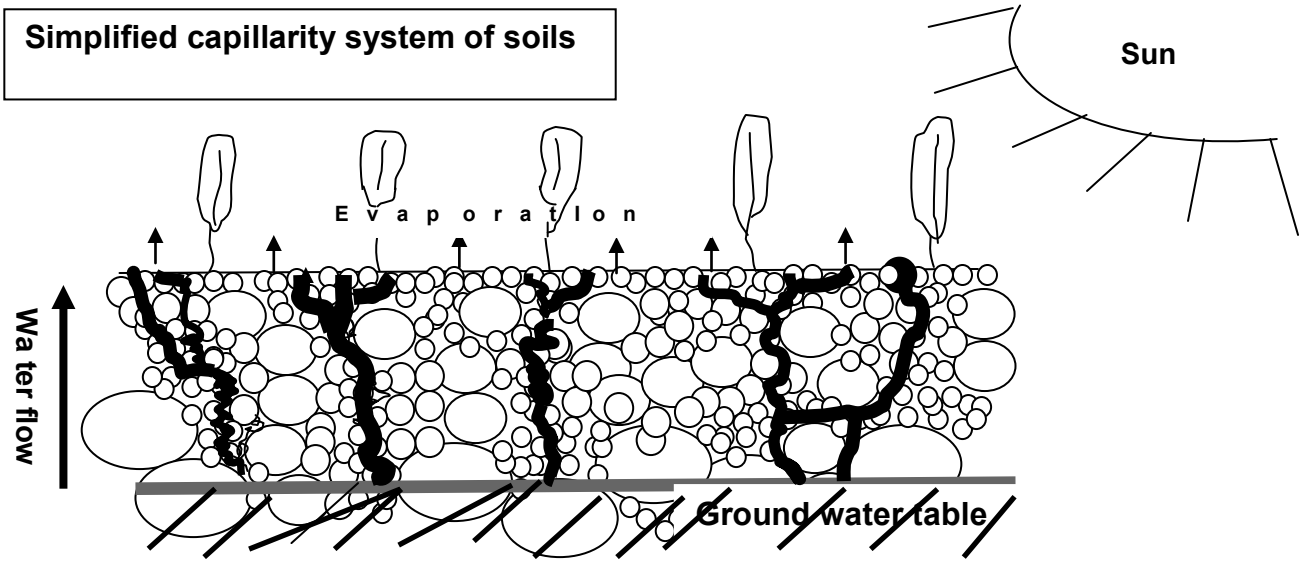
- Underground water is likely to contain high levels of minerals (salt) which can soon lead to salinity problems when applied to the field.

- Diverting rivers, streams into low-lying plains without proper drainage can lead to water logging in irrigated areas if there is now proper drainage system. This again can seriously undermine the fertility of the soil making growth of cultivated plants impossible.

- In hot temperatures, evaporation is high. This is caused by the sun heating up the top layer of the soil. Due to the capillarity system (see graph below) there is a constant flow of water from deeper layers to the top soil where the water evaporates (depending on the amount and size of pores in the soil and the availability and depth of ground water). Arid and semi-arid zones are defined according to the ratio rainfall/evaporation. In semi-arid zones, evaporation is higher than rainfall during 8-10 months of the year, in arid zones evaporation during 10-11 months is higher than rainfall.

  The following graph is showing the capillarity system in a simplified way (water flow from below to the surface):

Simplified capillarity system of soils

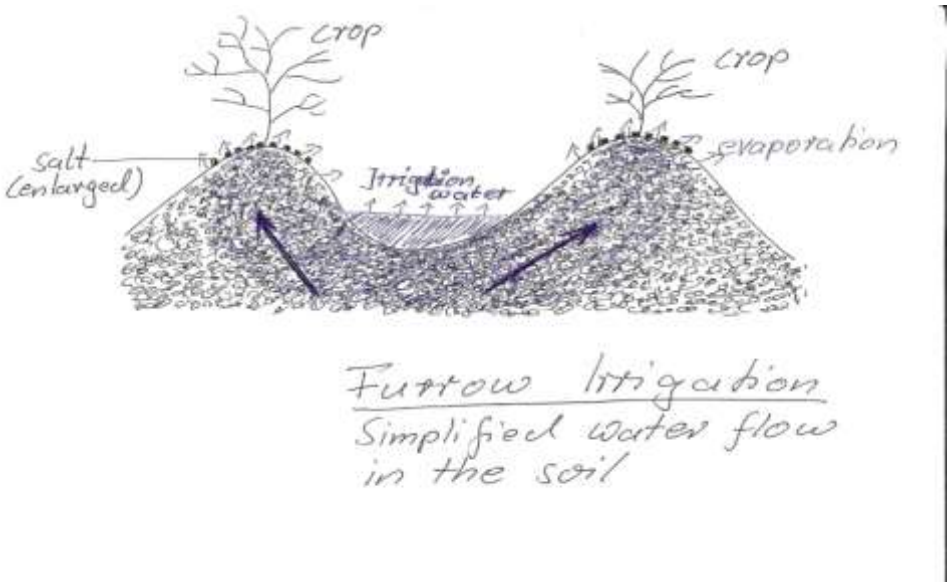


Please note: The capillarity flow of water upstream (against gravity) is determined by the surface temperature, the proximity of the ground water table and the size of the soil particles. The finer the particles (e.g. clay fraction), the finer the soil pores and the longer the distance the water can climb from the ground water table to the surface (but reduced water storage in the soil). Coarse particles prevent water flow upstream (like sand). Pure sand or clay is not conducive to plant growth.

- The same pattern of evaporation applies to irrigation water: After initial penetration into the soil, the water can move up to the top soil and evaporate. On its way downwards and upwards, it usually dissolves mineral salts carrying them to the top soil. On the surface, the salts crystallize while the water evaporates. In the course of time this can lead to an accumulation of salt with detrimental effects on plants.

- Different irrigation techniques are causing different salinity problems. The least risk is related to drip irrigation where a comparatively small amount of water is channelled directly to the root of the plants, substantially avoiding salt being diluted in adjacent soil layers. However, one should bear in mind that drip irrigation systems need constant maintenance especially related to exit wholes of the water from the pipe because such wholes easily get choked up. Drip irrigation needs proper training of end users because they tend to considerably “overwater” the plants (as the soil looks much drier than with other irrigation techniques like furrow irrigation).

- The highest risk of salinity problems goes along with furrow irrigation (see graph below):



- If salt accumulates in the top soil, many cultivated crops will suffer. Therefore, the salt has to be washed out in regular intervals. This can be done by a drainage system in which salt-free water (either rain water or through irrigation) is washing out the salt and carrying it off through a drainage system. The drier a given area is and the more complicated it is to get access to sufficient water; the more costly and complicated drainage becomes and the more often it is neglected.

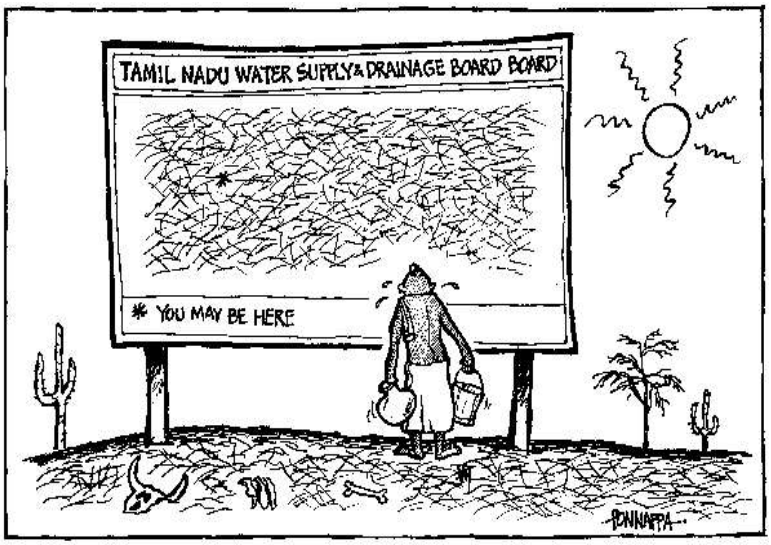
- It is sometimes striking to see that in the driest region the most water demanding crops are grown for export or urban centres (like paddy in arid or semi-arid zones) once an irrigation system is in place. In comparison to this, local staple food crops often are neglected. Unfortunately, there are few supplementary irrigation projects in which water is used for irrigating staple food crops just in order to ensure a good harvest. Such supplementary irrigation schemes (supplementary to rainfall) could diminish overall water demand, costs involved and environmental risks and would often directly benefit the poorer section of the societies.

- Irrigation and desertification: Many wells and boreholes have been established in Sahelian countries during the 1970ies and 80ies. The water was meant to be used for watering animals of pastoralist. But often, the availability of fodder around such water sites was insufficiently taken into account. In the end, serious overgrazing occurred in the neighbourhood of such places leading to desertification.

- Irrigation, more than any other farming systems, can cause irreversible damages to the soil and the environment. It needs expert advice and constant monitoring when embarking on such a project as a humanitarian aid organisation.
- Every irrigation project requires a careful and detailed planning starting with the engineering part at the water sources, bringing water to the field, the agronomical part choosing the appropriate water distribution method and crops, and should include marketing and processing aspects. Many irrigation projects were technically successful but failed because of lack of a market outlet.

One can summarize on irrigation:

- The drier the area, the higher the need for irrigation, but the higher the risk of negative impacts
- The larger the size of irrigated lands, the more water used for irrigation and the higher the running costs involved, the larger the risk of failures and of bypassing local peoples´ needs
- In areas with more than 600-800 mm of rainfall, salt usually gets washed out by the rain



Drinking water:

Like food, access to drinking water is considered to be a human right. Bread for the World started a campaign on the “right to water” in 2003 with the following objectives[25]:

- We want to inform about the scope of the “water crisis” and how this interacts with political decisions, consumption and production patterns in the Northern hemisphere.
- We want to contribute to the Human Right to Water becoming internationally known and a guideline for the future water policy of the decision-makers.
- We want to confront the German government with proposals for a socially just and ecologically sustainable water policy.
- We want to help our partners working on the issue to make their voices and experiences heard.
- We want to sensitise people in the developed countries for the water issue and thus support our partner organisations worldwide.

This campaign was carried out against the background of the global water crisis where international water industries aided by the World Bank pressured many developing countries into privatising their water supply. The results are often disastrous, in particular for the most vulnerable people.

Quality and quantity of drinking water:

In the Sphere handbook, one can find the following water supply requirements and criteria[15]. According to the nature of the handbook, the criteria primarily target relief programs and refugee camps. However, they can give indications what usually is considered decent water supply and therefore can serve as quality scale or "objectives to achieve" in DRR projects.

Drinking water from a borehole in Kenya

However, when looking at the following Sphere criteria, one should also mention that for the majority of poor people in developing countries reality of access to water is much different:

- Appropriate water source for the situation is identified taking in to consideration the quality, quantity, environmental impact on the source.
- Average water use for drinking, cooking and personal hygiene in any household is at least 15 litres per person per day .
- The maximum distance from any household to the nearest water point is 500 metres
- Queuing time at a water source is no more than 15 minutes
- It takes no more than three minutes to fill a 20-litre container (end of Sphere quote)[26]

„In vino veritas, in aqua sanitas" (Plinius the elderly)

Clean drinking water often is the most immediate need after a disaster. As a DRR strategy, every effort should be made to ensure that drinking water supply remains intact even when a disaster strikes. The modern way of drinking water supply is a community water supply scheme with pipes installed by governments or companies bringing the water to individual households. This normally is combined with charging for the water which can exclude poor families from access to this crucial resource. When such central water supply installations are in place, there is also a tendency to neglect traditional water supply schemes which makes it even more difficult for poor families to get the water they need.

In case of a disaster (e.g. an earthquake) more people will be affected if such central schemes are damaged compared to small, localized systems.

When looking at water supply in the context of DRR, some of the obstacles to tackle are quite obvious like:

- In arid and semi-arid regions where droughts are looming, drinking water supply often is insufficient and difficult to manage. The scarcity of clean water will increase when droughts occur. It is certainly not easy to tackle such a situation. One option is to store the little rain that comes down from the sky (e.g. page 73) Often, poor people in rural areas even don´t have proper containers for storing water just for one day. Providing (and storing) bottled water often is too costly, insufficient in quantity and quality. Traditionally, people living in such areas have very good knowledge of where to find water sources and of wild plants that can be used instead of drinking water.
- In flood-prone areas the problem is abundance of water which usually is not potable when a flood occurs. Here the task can be to avoid contamination of potable water by non-potable water. Another option would be filtering the water until the contamination is over. There are modern filters available which often are the only solution. Traditional, natural water treating and filtering devices (by using special plants, stones, sand and sometimes fish) in many cases get affected by the floods as well. Against water-borne diseases, cooking of water is required (if there is no chemical treatment). However, when a flood occurs normally firewood is not available or got soaked. Solar cookers could be a way of replacing firewood, but in times of floods often there is little sun shine.
- In coastal areas, cyclones (hurricanes, typhoons) often trigger off surges which are flooding the land with salt or brackish water. Desalinisation is feasible, but requires rather big investment and might not be useable immediately after the cyclone.
- In both flood and cyclone situations, usually heavy rain fall accompanies the disasters.

Women meeting in North Vietnam

Rain water is clean and potable and is/can be a significant source of drinking water in times of crisis. One very cheap way of collecting rain water is a plastic sheet (of a few square meters with a whole in the middle), a few wooden poles for pitching the plastic sheet like a tent and any sort of container (made of plastic, iron barrels, earthen pots etc. When there is heavy rain, such devices can easily yield the water required by an entire family.

C, Health and DRR:

A poor family in a developing country might do fairly well, as long as all family members are healthy. If one member falls sick, poverty can turn into a nightmare. This is due to the fact that usually transport of sick people to a doctor, medical care, treatment and medicine has to be paid with cash. In order to get the money, many people either sell their productive assets like land, livestock and seed or take a loan from a money lender what can easily render them economically bond to such a person.

In a more specific context of DRR, health is a critical issue in three different aspects:

- **Outbreak of (epidemic) diseases**: In this case, the disease is the disaster which has to be tackled. There is scope for prevention, mitigation and preparedness, e.g through vaccination campaigns, mosquito nets or enhancing the immune system of human beings.

- **Health affected by (natural) disasters**: e.g. construction of houses so that they don´t kill but protect from landslides, cyclones etc. Often, not the disaster kills but the post-disaster period due to health problems and epidemics, malnutrition as a result of a disaster affecting agriculture; lack of medical care including clinics and hospitals etc. (see below primary health care as alternative to such medical infrastructure).

- **Health as a tool or component of preparedness, capacity and resilience to a disaster:** Healthy people undoubtedly can better withstand and cope with most disasters. It is a matter of primary health care and especially hygiene and nutrition which certainly is part of many development programs.

Here again, the linkage of humanitarian aid to development cooperation becomes quite obvious because primary health care is one of the major components of development programs. Any improvement of health among people endangered by disasters can be considered as a milestone in disaster risk reduction.

But still, humanitarian aid from time to time definitely needs to address health as well. And even if it is only supplying medicine in times after a disaster, it is important to know and understand the limitations of allopathic medicines and costly medical infrastructure as compared to grass-root bottom-up health strategies. Some of the limitations, even disadvantages, of modern health technologies can be described as follows:

- Undermining the role of traditional medicine and healers
- Replacing local, herbal medicine by expensive imported one
- Disequilibrium in terms of financial investments when comparing centralized infrastructure and broad bottom-up awareness-and capacity-building

- Severance between people´s habits and their health conditions; health becoming an issue of experts only

In order to avoid such shortcomings of modern, western-based health approaches and to promote a rather holistic understanding of health and related issues, we explain more in detail....

a. **the basic principles and benefits of primary health care.**

b. **health and nutrition**

c. **hygiene**

On **Primary Health Care (PHC),** there is an interesting publication called "Disaster Risk Reduction Through Strengthened Primary Health Care", written by Roderico H. Ofrinand and Ilsa Nelvan.[27] The following excerpts of this publication portray some practical experiences from different developing countries. By doing this, it becomes evident what elements of PHC have been implemented in these countries:

- All health workers in Bangladesh are trained and equipped in the management of diarrhoea. This is part of the regular work and training for health professionals. During monsoon floods, extra attention is given to the management, prevention and control of diarrhoeal diseases. This effort has been supported for long, such that during the most recent floods of 2007, a case fatality rate of only 0.2% was observed for all types of cases of diarrhoea.

- In Myanmar, following the cyclone Nargis, the intensive larvicidal campaign to prevent a potential dengue and malaria outbreak in the cyclone-affected area was made possible only by tapping community health workers within a very well-structured health system. No outbreaks were experienced during the malaria and dengue season that set in weeks after the cyclone.

Trad. diversified food in Akha Minority, Thailand

- In Indonesia, staff and management of health facilities are prepared to provide services in the aftermath of a disaster. A support mechanism for decision-making is being institutionalized nationwide to assist health workers in assessing and acting promptly on issues such as evacuation of people and normalization of affected services, as well as their continued provision during the critical hours following an emergency.

- The physical structure of health facilities is a big issue that Nepal has started to act on. Hospitals in the Kathmandu valley and blood banks in selected areas in the

country have been assessed for structural and non-structural vulnerabilities, and suitable interventions have been formulated. Emergency training provided to hospital staff proved to be useful in 2006 when Nepal's internal conflicts reached their peak. The trained hospital staff was fully ready to implement its conflict management knowledge and skills. Following this success, work on structural and non-structural assessment of PHC centres is also now being planned in Nepal.

- Following a successful nationwide campaign against measles in late 2004, Sri Lanka opted not to go in for emergency measles immunization as that would have been redundant and a waste of resources. A properly conducted immunization campaign protects populations from a sudden onset of disease that impacts on health.

- For improvements of the health conditions, one should both look at hygienic conditions and the nutritional conditions of people living in disaster –prone areas. For children and in some cases also for adults, vaccination is an important means of preparing people against future disasters and their effects on health. (end of quote Roderico et al.)

Health and Nutrition

The WHO (World Health Organisation) puts a lot of emphasis in its work on nutrition, because ...."nutrition is an input to and foundation for health and development. Interaction of infection and malnutrition is well-documented. Better nutrition means stronger immune systems, less illness and better health. Healthy children learn better. Healthy people are stronger, are more productive and more able to create opportunities to gradually break the cycles of both poverty and hunger in a sustainable way. Better nutrition is a prime entry point to ending poverty and a milestone to achieving better quality of life" (WHO 2005)[28]

In its report (2005) WHO summarizes the following aspects of nutrition-related health problems:

- Poor nutrition contributes to 1 out of 2 deaths (53%) associated with infectious diseases among children aged under five in developing countries.
- 1 out of 2 children in Africa with severe malnutrition dies during hospital treatment due to inappropriate care.
- 1 out of 4 preschool children suffers from under-nutrition, which can severely affect a child's mental and physical development.
- Under-nutrition among pregnant women in developing countries leads to 1 out of 6 infants born with low birth weight. This is not only a risk factor for neonatal deaths, but also causes learning disabilities, mental, retardation, poor health, blindness and premature death.
- Inappropriate feeding of infants and young children are responsible for one-third of the cases of malnutrition.
- 1 out of 3 people in developing countries are affected by vitamin and mineral deficiencies and therefore more subject to infection, birth defects and impaired physical and psycho-intellectual development.
- Zinc deficiencies: magnitude unknown but likely to prevail in deprived populations; associated with growth retardation, diarrhoea and immune deficiency.

- 40 million people living with HIV/AIDS are exposed to an increased risk of food insecurity and malnutrition, especially in poor settings, which may further aggravate their situation.

But this is just one side of the problem.

- 2 out of 3 overweight and obese people now live in developing countries, the vast majority in emerging markets and transition economies.
- By 2010, more obese people will live in developing countries than in the developed world.
- Under-and over-nutrition problems and diet-related chronic diseases account for more than half of the world's diseases and hundreds of millions of dollars in public expenditure.

Especially after a disaster, joint planning of health-related short-, mid- and long-term interventions between humanitarian aid and development work could achieve lasting beneficial effects on risk reduction. Even under poverty conditions, people often have a choice on what they spend the little money for. It is quite astonishing to see even in a poverty context how much western soft drinks, to take just one example, are consumed. Commercials are nowadays entering remotest communities changing food consumption patterns substantially to the detriment of health conditions of the people. It is certainly difficult, but worth trying to counteract such changes.

First Aid- Mock drill on the Andaman Islands, India (pic. VHAI)

Hygiene

Programs to improve hygienic conditions in poor communities of developing countries often can be considered as efficient and very necessary interventions. However, what seems to be generally accepted and applied by well educated and modern citizens of the World, can become quite difficult if not impossible for poor people in tropical and subtropical regions:

- to wash hands after defecation with water, if there is even not enough water for drinking
- to set-up a pit latrine on pure rock or on ground water tables up to the surface
- to keep animals/livestock away from food and dishes in rural households

As mentioned already under the section on drinking water, excreta disposal is essential to avoid all sorts of human diseases. Sphere has set up a sort of check list projects involved in and embarking on hygiene and excreta disposal[29]:

- What is the current defecation practice? If it is open defecation, is there a designated area? Is the area secure?
- What are current beliefs and practices, including gender-specific practices, concerning excreta disposal?
- Are there any existing facilities? If so, are they used, are they sufficient and are they operating successfully? Can they be extended or adapted?
- Is the current defecation practice a threat to water supplies (surface or ground water) or living areas?
- Do people wash their hands after defecation and before food preparation and eating?
- Are people familiar with the construction and use of toilets?
- What local materials are available for constructing toilets?
- Are people prepared to use pit latrines, defecation fields, trenches, etc.?
- Is there sufficient space for defecation fields, pit latrines, toilets, etc.?
- What is the slope of the terrain?
- What is the level of the groundwater table?
- Are soil conditions suitable for on-site excreta disposal?
- Do current excreta disposal arrangements encourage vectors?
- Are there materials or water available for anal cleansing? How do people normally dispose of these materials?
- How do women manage issues related to menstruation? Are there appropriate materials or facilities available for this?

Again, these questions mainly relate to camps and similar situations, but can also guide planning and decision making in projects implementing latrines for individual households.

There is more on latrine construction on page 91.

Psycho-Social Support after a disaster

Some disaster victims might be traumatized due to the loss of relatives, friends or neighbours and the nightmare they experienced. Such people need special assistance and care what can also be considered a sort of preparedness to the next disaster. The following

recommendations are taken from: Psycho-Social Support Programme of the IWTHI Trust, December 2004[30]:

a. Listen
b. Convey compassion and caring
c. Assess practical needs
d. Provide practical help as and when required
e. Ensure basic physical needs are met
f. Do not force people to talk. Listen to what they want to share with you.
g. Support people in solving or handling problems. The problem management techniques involve identifying the problem, looking at causative factors, listing courses of action to alter causative factors, evaluate courses of action and choosing what seems to be most feasible and appropriate under the circumstances. Help the person in carrying out what action they have chosen, although this may not be in line with what you've thought about.
h. Point out how well they have coped and how they have been resourceful during the crisis, where appropriate
i. Do not give simple reassurances to people such as "it is God's will" or "at least you have your children" or "look how others have suffered".
j. Provide or obtain company for people, preferably family or known people
k. Encourage social support but do not force this
l. Protect people from further harm
m. Do not organise single sessions where people are forced to talk deeply about their personal experience, especially beyond what they would naturally share.
n. In these circumstances, many people are forced to talk repeatedly about their experience to all those who want to know about people's particular experiences. This will get repeatedly difficult for those concerned. Discourage people being forced to talk about their experiences again and again for the benefit of the curious.

Traditional Farm house in Central America

D; Housing

The poorest of the poor often do not have a choice: the most disaster-prone areas are the only sites where they are allowed to construct their houses (or huts or even tents). This can be the steepest slope, where landslides are a huge hazard or a locality on the seaside of the

dike (and not behind the dike) in coastal areas. Protection from and preparedness to disasters under such conditions is extremely difficult.

On top of that, poor people are forced to use any material for house construction which is locally available and cheap. Often, this is material with little resistance to natural disasters and which also frays and deteriorates rapidly due to extreme humidity, termites, erosion etc. As a result, poor people spend a lot of time for constantly repairing their homes.
Time that they could use much more profitable for other (economic) purposes. This is one reason why many families buy corrugated iron sheets (CIS) as roofing material as soon as they get/or are able to borrow money for this. CIS saves them the toilsome work every two to three years in repairing traditional thatch roofs.

Houses normally fulfil three major purposes:

- **Shelter against normal and extreme weather events**
- **Protection of assets (including livestock)**
- **Privacy**

In addition, one can say that houses provide facilities that make life easier and more comfortable among which one can mention kitchen, food storage, electricity and also toilet facilities, to mention but a few.

In humanitarian aid, housing projects normally take place as part of rehabilitation schemes in areas where houses have been destroyed by disasters (e.g. earthquake, cyclone, flood, landslide) or in programs of preparedness to the next disaster which is likely to come. In both cases the following questions can help guiding the decision making process:

1. What type, frequency and intensity of disasters have occurred in the past and are likely to happen in the future?
2. What were the major damages caused by these disasters to houses?
3. Are there examples (e.g. construction design, material used, precaution applied) showing how to minimize or avoid such damages
4. What material commonly is being used for construction of houses and why? What are advantages and disadvantages of these materials to be used in new housing schemes?
5. What are official (and perhaps unofficial) rules and regulations any construction

Fortified plinth in Bangladesh

work has to abide by?

6. What does the cultural, social, ethnical and religious context look like? Also in developing countries, houses can be status symbols. Therefore, house construction and provision programs can easily interfere with traditional social and power conditions.
7. House construction schemes usually encompass clusters of houses either integrated in existing communities or by setting-up entirely new communities. How villagers are organized can be of crucial importance for the long-term success of such housing schemes.

Some rather general recommendation for house construction or fortification might be useful when conducting a housing program as part of rehabilitation or DRR intervention (some of the following points have been taken from: "Basic planning criteria for simple buildings worldwide" in: GTZ, Guideline for Building Measures after Disasters and Conflicts, 2003[31]):

- Not every house needs to be re-built at once. Sometimes one can expect people to share one house or houses can be expanded and enlarged when times go by
- No house construction without carefully identifying, assessing and involving the beneficiaries (those who are supposed to live in the house constructed)
- Since house construction normally is expensive, the construction work should be done preferably by the beneficiary family itself. In developing countries, many people still know how to construct houses. People often just need assistance with some construction material: turnkey housing schemes rarely achieve lasting success.
- It is of utmost importance to take traditions, religious requirements, habits and cultural preferences into account. That includes space for adults and children, for women and men, for extended families, house direction (e.g. Mecca), design of toilets etc.
- Houses in many cases have to be spacious enough to cater for livestock, forage, seed and other agricultural tools and certainly for the storing food and water
- The prevailing economic conditions (e.g. sources of income) have to be taken into account when deciding on site selection, size, design and functionality of the houses constructed/supported
- Security is a big issue, even in traditional societies. Burglary, for example, can undermine the utility of cyclone shelters. In Bangladesh, when people are moving into cyclone shelters, often the granny stay at home in order to prevent thieves from entering the house. Such concerns need to be addressed when getting involved in house construction.
- The ecological side effects of house construction need to be considered. Especially the production of construction material (e.g. burnt clay bricks need a lot of energy which often is charcoal or wood) can be very detrimental to the environmental conditions (and enhance future disasters)
- Material which is dangerous to health should be avoided. Among most critical ones are Asbestos, wood preservatives, Phosphogypsum etc.

- Renewable or regenerative resources should be given preference (e.g. roof water harvesting, composting of waste, biogas, solar and wind energy). These sometimes require high investment costs but become remunerative in the long run
- One should also consider space for subsistence gardens and animal husbandry when providing houses to poor beneficiaries. In addition, green fencing can be a means of firewood provision. When using roof water for drinking, the roof material should not contain Asbestos (like e.g. Eternit)". (from: Friedhelm Göltenboth)

More specific recommendations related to major natural disasters can include:

Hurricanes:

- Proper site selection which is not exposed to such risks (but often in reality difficult to achieve; in coastal areas, many people depend on fishing and therefore need to live close to the sea shore)
- Roof slopes should exceed 30 degrees in order to avoid suction which can dismantle the roof
- Large roof overhangs should be avoided because they are susceptible to storms. On the other hand, such overhangs often are preferred to keep household material or farm products and tools protected from rain
- Similar to earthquake (see page 47) fortification of walls, plinths and roofs can help houses better withstanding strong storms
- Wind break (and also wave break) plantations surrounding a house or settlement area can mitigate the velocity of such natural forces. But they can become a deadly hazard in case trees get uprooted. Therefore, proper distance between the houses and such plantations should be kept. It is also important to note that as a result of increased salinity of coastal areas (e.g. as a result of more cyclones or sea level rise), some tree species traditionally used as wind breakers (like coconut palms) are becoming weaker and finally dying off what makes them very susceptible to storms.

Heat waves in arid and semi-arid areas:

- Traditionally, houses or huts in hot climates were built in such a way that heat was prevented from penetrating into the house by thick adobe walls and thatched roofs with very small openings (sometime windows lacking entirely).
- The thickness of the walls, of roofs and the material used are

DKH House construction program in Serbia

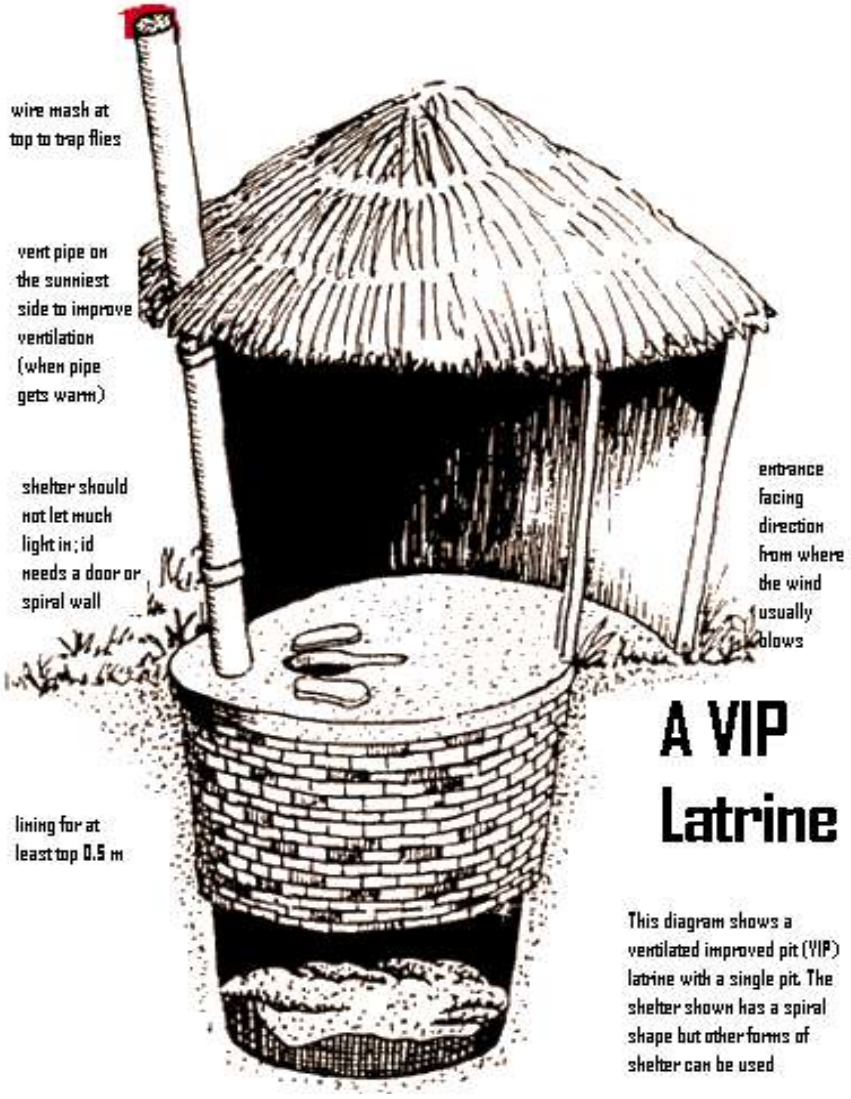
decisive regarding insulation against heat. Corrugated irons sheets (CIS) are not very conducive in this context. If they are being used, house construction should be shaped in a way that hot air can circulated from the interior parts to the outside through the roof and thereby causing a cooling effect.

- Shading the house by, for example, trees can be a very efficient means to protect from heat. Since living plants also transpire (converting liquid into vapour for which they are absorbing energy from the environment), there is an additional cooling effect on top of the shade.

Floods:

- Similar to hurricanes (cyclones), the selection of construction sites is decisive when it comes to susceptibility to disasters.
- Where people have little or no choices when selecting sites, they can build mounds in order to construct houses above a critical, flood-affected level
- In many poor peoples´ houses, the foundations are made of compacted soil. These foundations get eroded and washed away easily by the slightest floods. When this happens, the entire house is in danger of collapsing. Fortification of plinths can help avoiding this problem and protecting houses at least from normal, frequently occurring floods.

Latrines:
Latrines certainly play an important role in various housing projects. A good deal of projects focuses on latrines rather than on house construction in order to improve hygienic conditions which are a prerogative of disaster preparedness. (There are many recommendations on how to construct pit latrines. One example is : Tearfund, Planning a pit latrine[32] from which the graph on the right is taken).



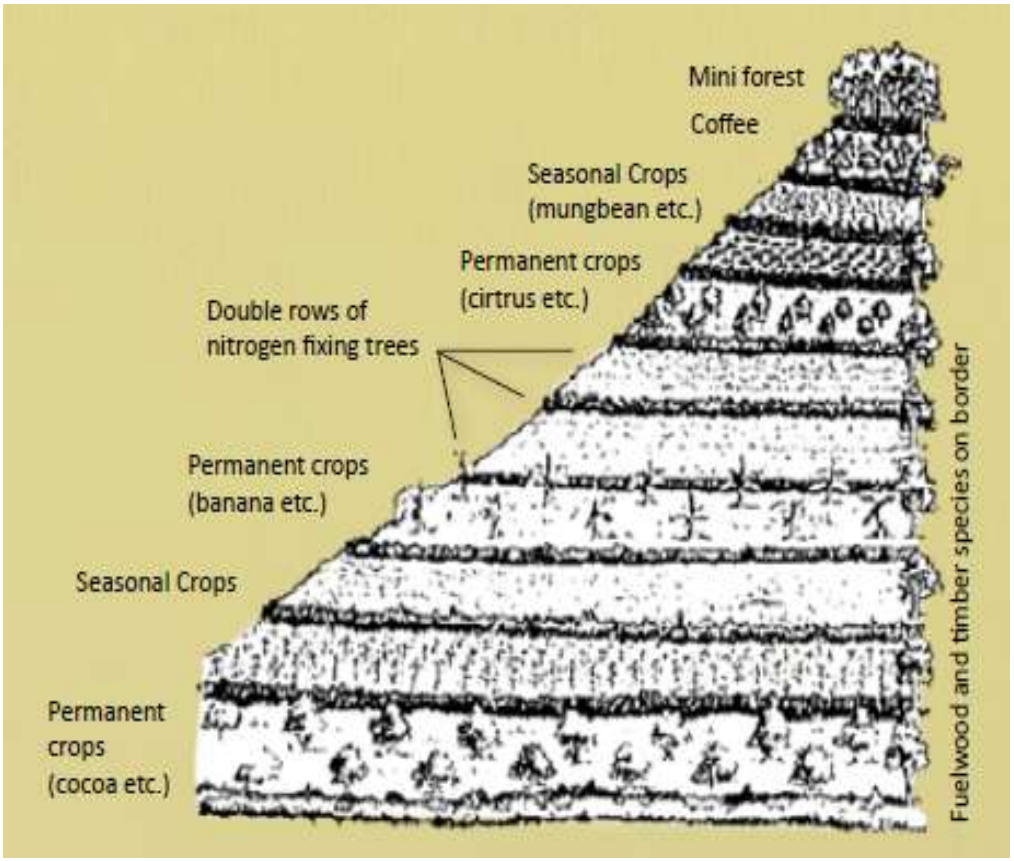
E, Environmental protection

As a means of protecting people from natural disasters and in particular climate change, healthy, sound and resilient environmental conditions are of crucial importance. Perhaps in the past, environmental protection was not considered to be the core business of humanitarian aid organisations. But with DRR it definitely has to become a subject to embark on very seriously.

Environmental protection is a very wide subject. Here, we focus on topics which directly influence on or relate to DRR, namely erosion control and watershed management, reforestation, fruit trees and renewable energy without intending to comprehensively cover these subjects.

Erosion control:

There is water erosion and wind erosion. When erosion takes place, the most fertile particles of the soil are getting lost, which also means a heavy loss of nutrients.



Sooner or later erosion can lead to totally degraded lands which are of no use to human beings.

Therefore, every effort has to be made to stop erosion. Some of the most important means to control erosion are:

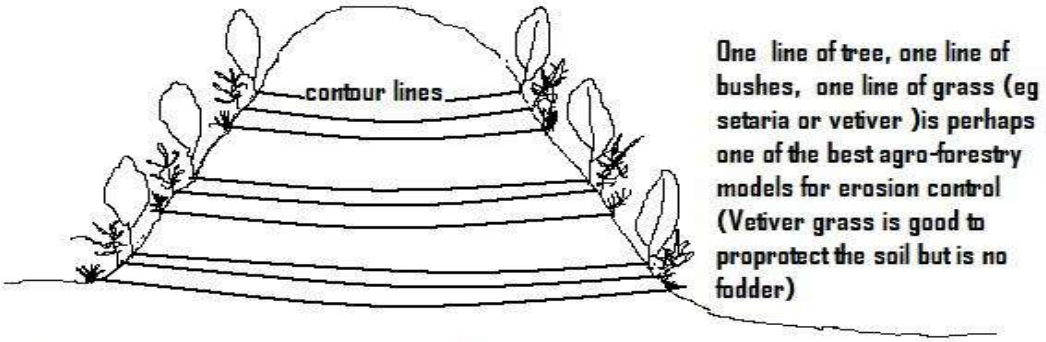
- Well textured and structured soil
- Roots keeping soil particles on the spot
- Barriers to water run-off and wind (like trees and bushes)

- Terracing (to reduce the speed of water run-off)
- Contour planting, mixed cropping and covering the soil (e.g. mulching)

Contour planting – planting trees and crops horizontally across the inclination of the slope- is seen as the key to success against disasters caused by soil erosion, siltation and floods. It also slows the flow of water. The graph above shows an ideal land use pattern strictly applying contour planting.

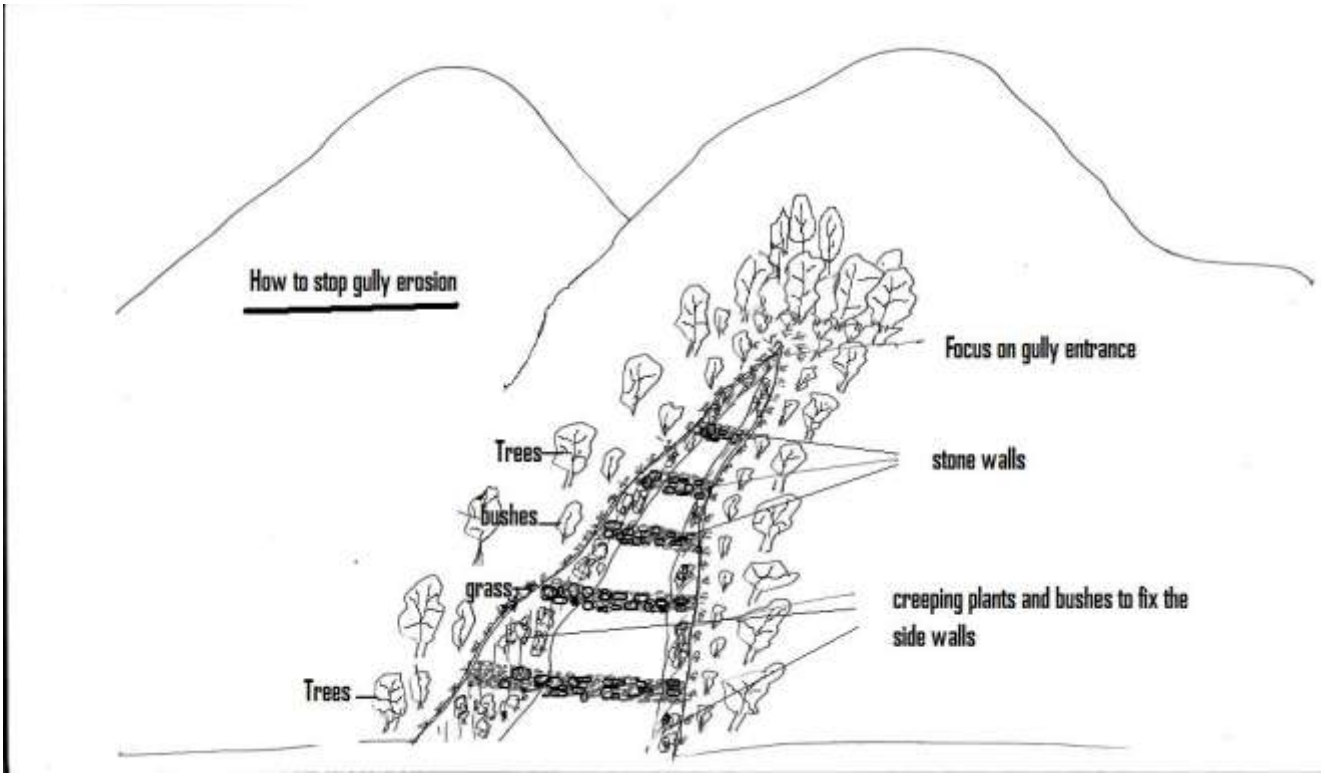
Often, contour planting goes along with agro-forestry which is a combination of farming/agriculture and forestry, for example, by planting trees on farmland or pastures.

The graph below shows how this can be combined in a very efficient way with contour planting:



Simplified erosion control agro-forestry system

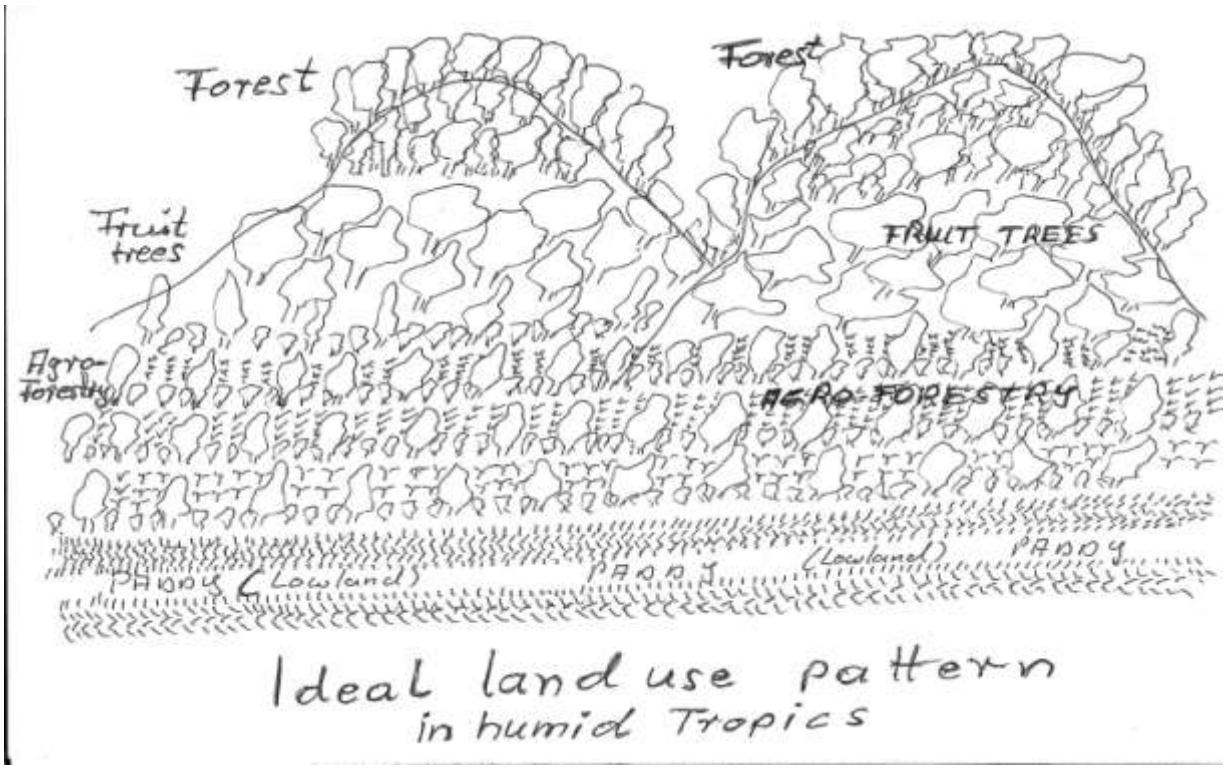
Some soils and some underlying parent rock materials are very susceptible to so-called gullies (deep trenches cut into the soil) which in some cases can seriously affect settlement areas and destroy houses and infrastructure. The following graph shows measures to stop and to rehabilitate gullies:



Contour planting with terraces in Tanzania

Water catchment area approach

Simply doing some type of tree planting, contour farming or terracing on one particular site without looking at the larger picture, rarely produces sustainable results. In many regions a water catchment approach is needed which combines -from the mountains or hill tops down to the valley bottom - different integrated measures of farming, forestry, orchards and erosion control. What this ideally could look like is illustrated in the following graph:



According to this ideal pattern, interventions would start on the top of the hill or mountain, covering the steepest slopes with forests and fruit trees, in order to avoid barren soils which under such sloping conditions would be very susceptible to erosion. Further down the hill, when inclination gets less steep, agro-forestry shaped farming could be applied, finally followed by permanent and intensive cropping systems or vegetable production in the lowlands.

Agro-Forestry and intercropping in Rwanda

Forest and trees

Trees can be very efficient means of disaster risk reduction in tropical and subtropical areas. They can stabilize farming against all sorts of natural disasters (drought, floods, cyclones, landslides, erosion), prevent heat and water stress, mitigate storms and waves, provide energy and increase natural resilience to adverse climate effects due to:

- Shade and favourable micro climate for annual crops
- Infiltration of rain water into the soil
- Increased water holding capacity of the soil
- Structured soil due to intensive root system and less soil erosion
- Nutrient pump from deeper layers
- Wind breaking potential in dry zones: wind can have significant drying effect and worsen period of rain water scarcity quite drastically. Using trees and bushes in hedgerows one can reduce such effects.
- Fire wood resources and
- Biological diversity

Degraded Landscape in Tanzania with gully erosion

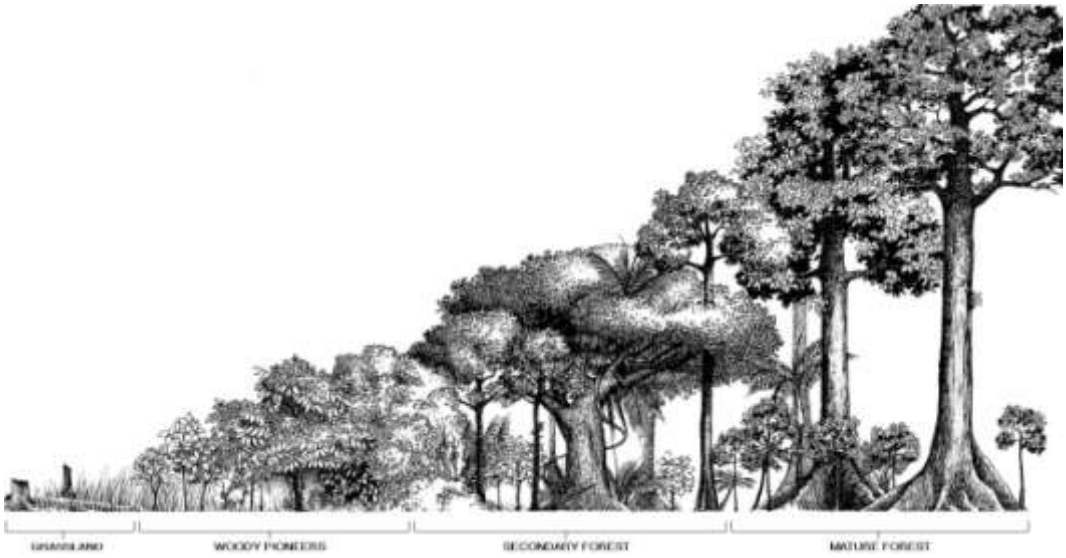
In spite of these advantages and benefits of trees, a lot of mistakes have been made when planting trees and doing reforestation work. In simple words: not every tree is the right one for the right spot, and not every tree planting serves the right group of people.

Many reforestation programs around the World are characterized by monocultures favouring fast growing economic species without showing any regard to the environment.

The following criteria should be kept in mind when embarking on tree planting and reforestation programs: (source: Dr. Gölthenboth, University of Hohenheim, Stuttgart):

- Prefer local species to exotic ones and a diversity of different species to monocultures
- Local people have to have a perspective to usufruct the trees planted. In the light of the life span of trees, this user right should preferably be on paper (either by an agreement with government, a sort of land title or a certificate for each tree planted).
- Use additionally the area by planting shade-tolerant crops like e.g. Ginger, Cardamom etc.
- Respect and apply the “law of nature” which basically means to adopt natural ways of re-growth and plant succession.

  The graph below shows a simplified succession on degraded land consisting of pioneer plants, grass, small bushes and shrubs, short trees in restricted diversity, increased diversity of species and finally tall forest species:



(from: **Göltenboth et al., 2006. Tropical Ecology of Insular South East Asia, Elsevier, Amsterdam)**[3324]

Often in conventional reforestation programs on degraded land, the tallest tree species (which in such a succession would be the last one to grow naturally, in the graph above on the extreme right hand side) are planted right from scratch. This not only requires huge inputs like water and nutrients, it also often suffers heavy losses of seedlings planted. A better option would be to just enhance or speed-up the natural succession by bringing in additional seeds or seedlings in accordance with the succession stage a reforestation site is in (like, for example, collect seeds of pioneer plants at the start and spread them in the area of reforestation rather than waiting until they are brought in by birds, wind or other vectors).

Good practices: Ethiopia *(from H. Spohn): A successful way of reforestation program is the so-called "closed area approach". Degraded areas have to be fenced up and guarded in order to prevent grazing animals and people from entering. Within a short period of time, local woody plant species will show up. After a couple of years, additional tree species are being introduced (enrichment planting). Since such projects often take place on communal lands, people do not feel responsible to maintain these sites properly in the long run. Many of them got destroyed. Where people were allowed to cut the grass for their animals and take some firewood under controlled conditions, success rates were much higher.*

Fruit trees

Fruit trees combine many excellent ecological and economic advantages and suit very much a DRR strategy because…..

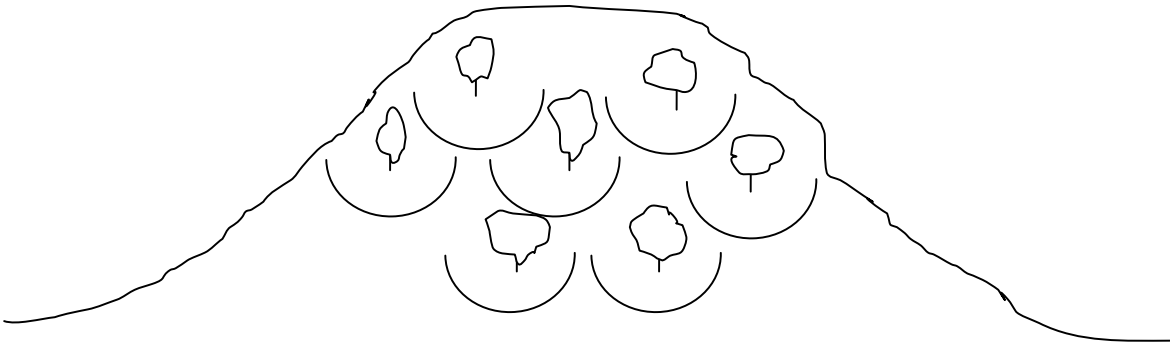
- they withstand drought and floods and cyclones much better than annual/seasonal crops
- they provide food and essential vitamins even when there is no other food left and thus contribute to the health of the people

- they provide shade, prevent soil erosion, increase biodiversity, provide fuel wood, fodder and honey and allow intercropping with spices, vegetables and forage plants
- they can even be used as shelter in times of floods as was reported by people in Mozambique
- fruit tree management can break labour peaks and get the entire family involved in maintenance, harvesting and processing (elderly, women, children, men)
- they also can be used efficiently as wind breakers
- they fix C02 and store it as carbon for a long time
- they can provide income

It is essential to distribute high quality seedlings in order to get high quality fruit. But the physical properties of the seedlings are only one aspect. Others are the fertility of the soil, climatic conditions and how the trees are maintained by the people. From this it follows that special attention should be laid on….

- The selection of the right species and variety
- The source of the seedling (it should be a reliable nursery)
- The way a seedling is planted (e.g. application of water, compost and often poles to stabilize the seedling against wind and water run-off
- Protection against animals (e.g. sheep, goats)
- Training of people on how to coppice and properly maintain the tree
- Harvesting, processing and storing of fruit
- Eventually bee keeping for pollination
- When planting fruit trees on a slope, erosion control and water harvesting techniques might be necessary. Often people apply the so-called eyebrow terraces to reduce water run-off and soil losses which is shown in the graph below:

Eyebrow terraces with young tree seedlings



***Good practice on fruit trees**: Community-based nurseries where good quality fruit tree seedlings are raised by the beneficiaries. Such nurseries can continue to produce seedlings well beyond the duration of a project. People should also be trained in grafting, soil fertility maintenance and pest and disease control. There are many examples that in the long run small-scale entrepreneurs can take over such nurseries and run them as an income-generating enterprise.*

Renewable energy and DRR

In emergency situations, energy supply certainly matters a lot, either for camps or when distributing relief items, to mention but two examples. As part of a DRR strategy, renewable energy is regarded both an incentive for local people to implement measures that can provide protection, mitigation or preparedness and as a means of protection and preparedness itself:

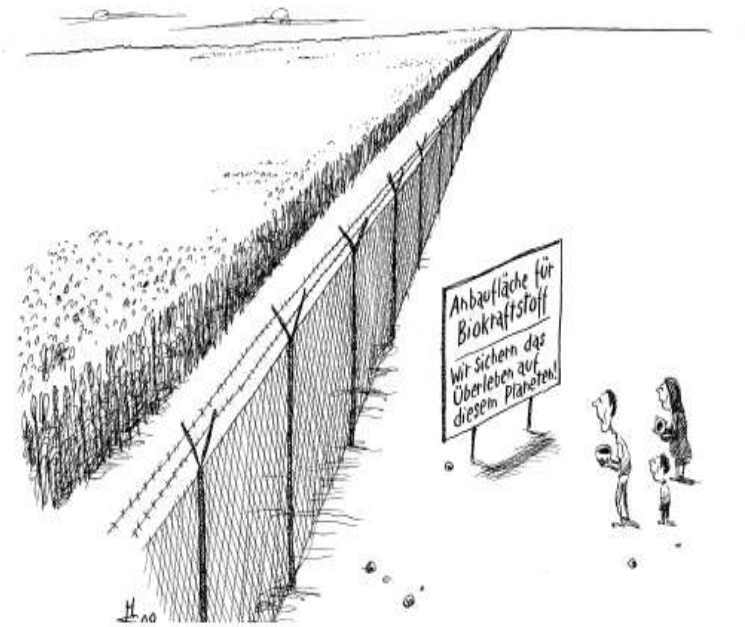
The following table shows direct effects of renewable energy on relief, rehabilitation and DRR programs:

Type of renewable energy	**Use for relief, rehabilitation and DRR**
Electricity production by • Photovoltaic system • Windmills • Hydro power • plant oil (fuel/diesel substitute) • Biogas (including wood gasification)	• Electric light for shelters, camps • Recharging batteries (e.g. for mobile phones and other means of communication) • TV and radio sets as part of early warning systems • Water lifting devices
• Solar heating	• Drying and preserving of food • Sterilisation of medicinal tool
• Plant oil • Biogas	• Lifting water • Running agricultural machines and vehicles • For cooking

The next table shows indirect effects of renewable energy on relief, rehabilitation and DRR:

Measures	**Indirect effects**
Planting of trees	Prevention of soil erosion Prevention of run-off water Biodiversity Nutrient pumps Water storage
Wind break plantation	Breaking waves and velocity of storms
Mixed cropping systems (e.g. by integrating renewable energy plants like Jatropha)	Stabilizing of farming Resistance against pests and diseases
Biogas	Reduce deforestation

In addition to renewable energy, any approach to prevent the destruction of natural vegetation is crucial. One tool for protecting the environment can be firewood saving stoves. Still 25 % of the World's population is using firewood for cooking, light and heating. Forests are huge "sinks" of C02. Estimates (pro Regenwald 2005[34]) assume that up to 400 tonnes of wood are stored in one hectare of forests which is equivalent to 200 tonnes of carbon or up to 700 tonnes of C02. There are many different models of firewood saving stoves available which all can significantly reduce the amount of wood needed. DKH has distributed in Indonesia a German model called "Save 80", because it needs 80% less firewood than the traditional 3-stone-stoves used in rural areas of this country.



Biofuel Plantation: we save survival on this planet

In spite of their beneficial effects, such stoves not really became the mainstream way of cooking under rural poverty-stricken conditions. There are many reasons for this. To mention but a few:

- People need open fire as light and for heating
- People use fire wood which perhaps is too large to fit into improved stoves
- Stoves are uncomfortable to women used to sit on the ground or on their ankles
- There might be a conflict with tradition and culture

When looking at climate change, the contribution of firewood used by poor people in tropical and subtropical countries sometimes seems to be exaggerated. Poor women hardly have the means to cut entire trees.

They rather use dead branches and twigs which would decay and release C02 anyway. What matters much more in this respect is commercial logging and the replacement of tropical rain forests by palm oil plantations or other plant fuel production.

Good practice in renewable energy *and DRR:*

In Sri Lanka, small holders´ agriculture is hampered by alternating floods and drought. Tree integration into arable lands would be a means of stabilizing food production against vagaries of weather. However, poor people normally are reluctant to embark on tree planting (as stated earlier), because the benefits can only be felt in the long run. Therefore, promotion of trees needs to go along with other incentives related to such plants. ASPIRA, a Sri Lankan NGO and partner of DKH, has developed a wood gasification device which generates electricity out of wood chips. In remote villages which have little chances to get connected to the national grid, electric light means a huge improvement of living conditions and is very much appreciated by the people. Households that want to benefit from the project, have to grow trees in their fields in order to produce the raw material feeding the gasifier. The trees promoted by the project are leguminous trees capable of stabilizing farming, fertilizing the soil and supplying fodder for animals.

Filling in the wood chips

F, Community-based disaster risk reduction (CBDRR)

For many humanitarian aid organisations, CBDRR is the most important strategy when implementing a DRR project, for some organisations, it is the only acceptable strategy because they critically assess individual support to single families.
There are many good reasons to emphasize on community approaches. Just a few are mentioned below:

- Individual support can easily split communities into those who received support and those who didn't and undermine a community spirit of helping each other
- Communities have (must have) a long-term vision as compared to rather short-sighted project interventions
- When working together as communities, people can master ambitious and large-scale projects like infrastructure, dikes or shelters with their own means and resources which positively contributes to peoples self-respect and self-sufficiency

- Community-approaches can achieve sharing of resources between better-off, healthy and active families on the one side and poor, handicapped and incapacitated households on the other side (e.g. by sharing information in an early warning system)
- Community-based approaches can address lobbying and advocacy issues much more effectively than individual families

Two good practice examples of DKH on CBDRR in Latin America:

Example one: Honduras

DKH´s partner, **UNICORASS** (Asociación de comunidades organizadas de la region del AguanSico-Paulaya y Costa Atlántica), a member of ACT, is a highly recognized and respected organisation among local people for its efforts to strengthen self-reliant and sustainable communities. When assessing the food security situation in its project area, UNICORASS realized the impact of frequent natural disasters like hurricanes, thunderstorms, drought and floods on the livelihood of the population. People´s vulnerability to such disasters to a large extent is linked to poverty, illiteracy, being poorly organized on a local level and lack of governmental support. Already in 2005, when a series of hurricanes devastated large parts of Honduras, UNICORASS started initiatives to overcome natural disaster risks by agricultural production means and enhancing self-help mechanisms on a grass-root level.

CBDRR programs consist of awareness-building of local communities on disaster risks and how to prevent or mitigate them. Local committees for prevention and response (CODEL) were supported in order to strengthen and foster local cooperation and institution-building. The participation of women in local emergency committees was increased in the process of forming working groups with unmarried women and women heading households. Entire communities engaged in lobbying activities in favour of construction of shelters by responsible governmental institutions.

In addition, communities started to reflect on land use patterns negatively impacting future disaster risks like deforestation of natural fauna, the burning of plastic waste and the pollution of drinking water through chemicals and detergents.

Maria O. Cruz, living in the community of Zapamatepe, Honduras, summarized her understanding of disaster management: “A strengthened community can well manage to diminish the risk of disasters. Therefore, we organize ourselves in committees for the prevention and response to disasters (CODEL) trying to reduce their negative impacts. There is always a time when hurricanes happen, but when we are organized and dispose of local infrastructure like shelters, people can be protected.”

Enhancing disaster risks: charcoal production in Central America for export

One should stress the need to not just **use** communities for implementing projects, but to **enhance the resilience of communities** through capacity-building, training and assistance to local (informal) institutions/organisational structures.

But act with caution, please!

In spite of the obvious advantages and undisputed needs for community approaches in DRR projects, there are constraints and traps on the way:

- Community-based projects often are less easy to implement successfully than many people think. Failures often do not become visible because it is difficult to measure the success of such projects within the usual lifespan of projects.
- Success of community approaches often becomes only visible when the next disaster strikes. But even then so many variable factors matter that it is very difficult to trace the degree of resilience in a community back to a single project intervention
- One has to acknowledge the fact that local communities never have been, and never will be, homogeneous in social terms. Nor are they democratic, equitable and fair in decision making and resource sharing. The poorest of the poor like elderly people, woman-headed households, small children, rarely have a say in public meetings and they hardly show up in such events. Any assistance given to an entire community always runs the risk of supporting the more powerful community members, the clever ones and the better off.
- In order to avoid such negative effects, there is a tendency among project holders to refrain from material support and stick to “soft ware “means like awareness-building, setting-up of organisations etc. Impact of such means can be very limited if they do not get along with material support (provided either by the community itself, by the project or by the government or other stakeholders).
- Risk Assessments aiming at identification of the most vulnerable people inside a community makes little sense if these people do not get tailor-made support which is likely to be different from the other, less vulnerable community members. Usually, this selective approach is not a problem for the community, as long as the selection process is transparent and convincing. This requires the whole community to be involved in such risk assessment exercises.
- A well-balanced mixture of individual support to the most vulnerable families and of community awareness-building, training and lobbying work might in many cases be the most efficient way to deliver appropriate assistance.

Successful examples of community-based DRR elements:

Afar Nomads in Ethiopia depending of food aid

- Similar to primary health care programs promoting so-called barefoot doctors (who themselves would train villagers in basic health issues) one can recruit and train **village-based barefoot disaster risk reduction agents**. They would not only identify existing hazards and vulnerabilities, but also establish early warning systems, organize and mobilize villagers and implement or enhance risk reduction activities

- Adopted from "farmers field schools" (FFS) one can organize **Risk Reduction Village Schools** where adults regularly gather, exchange views and opinions on disasters and how to counteract them, get additional advice and expertise from outside trainers or experts and conceive measure of risk reduction

- Setting –up of **community disaster risk reduction cooperatives**/institutions. This has been tried many times but often without success. Therefore, it is generally accepted that such institutions need to encompass other functions and tasks than just DRR, like for example joint economic activities (commercializing goods), cultural or sport-related actions

- **Community saving schemes** to collect small funds from participating households which will be used in order to finance risk reduction activities and also for urgent needs and rehabilitation works after a disaster

- Building-up of **lobby groups** consisting of vulnerable families that will put pressure on the government and other stakeholders for addressing their needs more efficiently

Good practices of DKH in Latin America

Example two: Peru

In 2004, a very serious cold spell affected parts of Southern Peru, causing widespread human distress and economic damage in high altitudes of the Andes Mountains. Many families suffered from mainly respiratory diseases, food production was hampered and heavy losses of livestock, which is the "bread earner" of local "Aymara" people, occurred.

This was a triggering event for "**LABOR**", a civil society organisation working in the area since 1998 with a rights-based approach focusing on working conditions in the mining sector, to start off with emergency aid and disaster risk reduction. Main components of LABOR´s community-based disaster risk management approach are:

- Risk reduction based on daily needs and requirements of the beneficiaries
- Creation of interest in and understanding of risk management practices among beneficiaries and local authorities
- Strengthening the role and recognition of LABOR in its working area as agent of disaster mitigation
- Drawing public attention to the need for embracing disaster risk reduction in every aspect of life

In its methodological approach, LABOR concentrated its efforts on capacity-building, training and organizing of local people within communities. The challenges were huge and resembled a paradigm shift among the mainly alpaca, vicuna and lama herders in this region: To change people´s mentality which was characterized by passively waiting for the next disaster that was perceived as inevitable, to actively preventing and preparing for such events. The following practices have been implemented in the project region:

Animal husbandry in high altitude mountains of Peru

- A disaster management plan was worked out consisting of risk assessments, possible negative effects of disasters, ways to get local people involved in such management schemes and the role of different stakeholders
- Capacity-building of highly vulnerable communities in prevention, protection and mitigation and preparedness related to natural disasters. Special emphasis was placed on human health, development of productive assets and community-based emergency plans and organisational structures
- In human health, both traditional medicine and modern medical care have been promoted what included improvement of housing as well as production of cheap and easily available local medicine (herbs)
- Development of productive assets mainly focused on livestock. Village leaders were given advice and training on how to reduce mortality rates of off-spring, on how to improve nutritional status of the flocks by supplying sufficient and high quality fodder. Training of such traditional leaders was a means of overcoming shortcomings caused by the non-availability of governmental extension services. The project also introduced improved breeds of alpacas and lamas that allowed reducing mortality rates and offered higher economic return. Exotic pasture plants also have been disseminated in order to improve and rehabilitate degraded natural pastures and to provide a minimum amount of feed even in times of drought or cold.
- LABOR right from the beginning promoted participation of local beneficiaries and of all relevant stakeholders in the area. This was quite difficult to achieve in the light of very

scattered settlement schemes. Strengthening of existing community-based organisational structures and, wherever necessary, forming new ones, was a corner stone of the project. The local authorities have been trained on disaster risk management and by this became convinced of being part of such community-organisations.

The project not only achieved a different perception of and attitude towards natural disasters by local people, it also enhanced and created a spirit of cooperation between different stakeholders in the villages. People gained a new level of self-confidence in tackling occasional extreme events as well as the vagaries of daily life.

DRR and Gender:

It is quite obvious that women and men can be affected differently by disasters. For example, in many developing countries women are much more confined to the homestead than men. If the home is a safe place, they might be better off. However, homes often become a trap. Either because they are poorly constructed so that they don´t withstand a landslide, a cyclone or an earthquake. Or they are placed in highly hazardous areas just because a family cannot afford a house on less risky plots.

Cultural, ethnic and religious circumstances can also be detrimental to women mastering risks of disasters. In traditional communities of Bangladesh, women usually do not leave the house and move to the next cyclone shelter without permission from their husbands, even if a cyclone warning was issued. In addition, women generally are the ones to take care of children, sick people and the elderly and wouldn´t take shelter at the expense of those at home.

It goes without saying that any DRR approach has to take such gender differences into account, right from scratch. This is not a guide on all facets of gender-balanced DRR. A special publication is needed if one wants to cover this topic comprehensively. Here we just want to highlight the importance of gender-sensitive risk assessments which can be a corner stone in addressing this issue further. For example, when interviewing individual households, it is important to separately interact with men and women. For this, interviewing teams should be composed of men and women. When it comes to determining project´s actions on prevention, mitigation and preparedness, focus group discussion with men and women in clearly separated groups is a “conditio sine qua non” for addressing gender-sensitive needs and capacities.

As in almost any humanitarian and development aid program, a prerequisite for a gender-balanced approach would be to have both women and men equally represented in decision making structures and among senior staff within the implementing organisation. This is also key for guaranteeing that women and men to the same extent are eligible for training, capacity-building and exchange programs on technical, social and environmental matters.

Risk Transfer:

As stated before, DRR tries to reduce or diminish the risk of disasters for poor, vulnerable families. But in most cases, this will only be possible to a certain extent while a certain degree of risk often remains. Transfer of risks means spreading them on various

shoulders. Such shoulders can be companies, a local society, the government or even the international community.

For example, there are many voices related to climate change saying that the poor in developing countries should not bear the risk of climate change but that these risks should be borne by those who are causing climate change due to their emissions of greenhouse gases. One way of bearing such risks would be to pay the insurance premium for the poor which would be a transfer of climate change-related risks from the victims to the perpetrators. Such disaster insurances have become quite popular in recent years, not only in the context of climate change. There are increasing numbers of commercial insurances offering services also to poor, farmers and other vulnerable groups.

However, such insurance schemes often make more sense when it comes to better-off people with some assets rather than helping very poor people. Slum dwellers or landless people who depend on temporary employment on landlords´ fields cannot be included in such schemes because they hardly got any material value that could be insured.

But it looks as if the full scope of such insurance schemes has not been sufficiently explored. Therefore, it is recommended to embark on pilot projects of this type in order to develop a conceptual approach that can also benefit DKH´s beneficiaries in the longer term.

Chapter 5: Some DRR-related questions to bear in mind during relief and rehabilitation

1. **What are the basic needs** of the people affected (food, water, health, shelter, mental assistance)? What is the traditional diet of the people and can this be the guiding thread for supplying food aid?
2. What support is needed for the affected people to reach at least a **living standard as before the disaster happened**? What can people do themselves, what outside support do they need?
3. Is it necessary and feasible to **differentiate among the affected people** according to different needs of support?
4. How big is the risk that the region and the people affected will **experiences the same or other types of disasters in the future** because the area affected is part of a disaster-prone area? Or was it rather a coincidence that the region was affected?
5. If it is a disaster-prone area, what **types of disasters normally do occur** against which people need to be protected?
6. Which areas most likely will be hit next time and which are the most vulnerable people living in such areas? This can be investigated by **Risk Assessments**.
7. **What coping mechanisms** helped people or communities to suffer less and can those be supported and enhanced by a project?
8. **What would have helped** people to suffer less if it was in place (and which has helped perhaps in other regions)?

9. Often after a disaster, **people recognize the value of social relationship**, mutual non-monetary assistance, neighbourhood support schemes and local community-based organisations. Can such a mood be used to foster local community-based DRR mechanisms functioning in the long-run without outside support?
10. What are the lessons learnt in terms of **different responsibilities** from a local to a district to a regional and finally to a national level and what does this mean for lobbying and peoples´ lobby and advocacy organisations?
11. For effective relief, rehabilitation and DRR, it is important to have **efficient local partners** in place. For financial reasons and in regions which are not frequently affected by disasters, humanitarian aid organisations cannot financially sustain local partners in times when no disaster occurs. Therefore, it is essential to **cooperate with development organisations** in order to maintain such partner structures on the ground. These local partners should be constantly trained and capacitated in order to be able to do this kind of humanitarian aid and DRR properly in times when it is needed.
12. Preparedness certainly includes provision for efficient **relief and rehabilitation** programs after a disaster has happened. The following preparatory steps are (among others) suggested by IUCN for agencies engaged in temporary shelters and camps (IUCN 2009)[35]:

Step 1: Identify clearly where temporary shelters will be put up in the event of a natural disaster.

Step 2: Identify the sources from which natural resources such as water and fuel wood will be obtained in the event of a disaster

Step 3: Identify locations at which sanitation facilities will be built/put up in the event of a disaster

Step 4: Identify locations at which solid waste will be disposed of in the event of a disaster both from past disaster debris and from shelters

Step 5: Ensure that emergency kits minimize disposable waste

Step 6: Ensure that gender sensitivity is incorporated into all the above steps

Chapter 6: Checklist for disaster preparedness

(Just some examples of what such a checklist could look like)

Checklist for disaster preparedness					
Sector	**Likely effects of drought, flood, cyclone etc. on:**	yes	no	**Quick solution**	**Long-Term solution**
food	Food/seed stored at home			Providing resistant reservoirs/boxes for food and seed	Construction of disaster-proof stores outside the house
	Community stores			Up-grading of existing stores	e.g. proper construction and commercial use
	Standing crop			e.g. distributing appropriate seed	Building dikes, irrigation systems, enhancing organic soil matter, bio-diversity
	Wild vegetation			Distribution firewood saving stoves, community agreement to refrain from	e.g. enclosures, nature reserve

				charcoal production	
	fruits			Training by local people on how to use local plants	e.g. distribution of tree seedlings
	Animals/animal products			e.g. heifer approach, elevated pastures against floods, water catchment water stores	Genetic improvement of stocks, livestock-farming combinations; improvement of pastures
water	Water quality Water quantity Tap water			e.g. providing filter e.g. storing water bottles	Reduced garbage, reduced pesticide application, sewage treatment, latrines
	wells			Plastic sheet to cover wells	e.g. properly raised side walls
	Reservoir at home			e.g. plastic tanks	Cement floor surrounding the house plus cisterns; iron sheet instead of thatch
	Bore holes			Proper maintenance, limited numbers of users	Recharging ground water tables
	Water catchment			Avoid overgrazing in the surrounding areas, proper de-siltation	Controlled pasture management, experiments to reduce evaporation
	spring			Spring user groups in control of use	Environmental protection of water catchment
	ponds			No litter, only proper use	e.g. raising embankments
	Water holes				
	Rivers/brooklets				e.g. sand dams
	Water transport				
health	injuries Contaminated water Contaminated food Malnutrition Poisonous/dangerous			e.g. distribution first aid kits/mock drill e.g. bottled water stores Testing of food and awareness-building e.g. training/awareness e.g. distribution of mosquito	Increase number and qualification of trained health workers Biological, sustainable food production e.g. improved farming Drying out of water holes and other breeding places;

	animals/insects			nets	replication of diseases and beneficial organisms against pests
	Hygienic condition			e.g. training/awareness	
	Defecation			Washing hands	e.g. pit latrines
	Heat stress/cold stress				e.g. shade trees, proper construction design
	Access to clinic/doctors				Lobby government
shelter	Collapsing houses			Supply of construction material	e.g. construction of shelter training on house construction
	Falling trees			Observation of health of trees,	e.g wind break forest, mixture of varieties
	fire			e.g. improved stoves	Fire fencing surrounding forests
	flooding			Early warning	e.g. raising plinths, shelters, mounds
	Cooking facilities				

Annex I: Glossary and important terms being used in relation with DRR

Capacity

A combination of all the strength and resources within a community, society or organisation that can reduce the level of risk, or the effects of a disaster. Capacity may include physical, institutional, social or economic means as well as skilled personnel or attributes such as leadership and management (ISDR 2007)[36].

Climate Change

Is a natural process that takes place simultaneously on various timescales – astronomical, geological and decadal. It refers to the variation over time in the earth´s global climate or in regional climates, and it can be caused by both natural forces and human activities. According to the IPCC most of the observed increase in globally-averaged temperatures since the mid-20th century, the phenomenon known as global warming, is very likely caused by human activity, principally the burning of fossil fuels and deforestation. (FAO)[37]

Contingency Planning

A management tool used to analyse the impact of potential crisis and ensure that adequate and appropriate arrangements are made in advance to respond in a timely, effective and appropriate way to the needs of the affected population(s). Contingency planning is a tool to anticipate and solve problems that typically arise during humanitarian response. (IASC 2007)[38]

Building back better

This term was often used after the 2004 Tsunami in Sri Lanka, India and Indonesia. People affected by this disaster should be better protected from such hazardous events and enjoy better living conditions than before. UNICEF for example has reiterated in its report the need to provide education, health, drinking water and food to children in those countries to a much higher degree than prior to the Tsunami. Applying DRR methods after a disaster often fulfils the criteria of “building back better”.

Do no harm

Established as a project in 1994 by Mary B. Andersen, originally it only covered conflicts and war-related disasters. The assumption was that humanitarian interventions could be used by any party involved in conflicts for its own purposes and might lead towards a prolongation of such conflicts. In the meantime, “do no harm” often is also applied in disasters different from war and conflict. One example can be material support provided as part of relief and rehabilitation operations which might jeopardize self-reliance of beneficiaries.

Early warning system

The provision of timely and effective information, through identified institutions, that allows individuals exposed to hazards to take action to avoid or reduce their risk and prepare for effective response. Early warning systems entail a chain of concerns, namely: understanding and mapping the hazard, monitoring and forecasting impending events, processing and

disseminating understandable warnings to policy authorities and the population and undertaking appropriate and timely action in response to the warning. (ISDR 2007)[39]

Humanity

Its purpose is to protect life and health and to ensure respect for the human being. It promotes mutual understanding, friendship, cooperation and lasting peace amongst all peoples. (IFRC)[40]

Impartiality

It makes no discrimination as to nationality, race, religious beliefs, class or political opinions. It endeavours to relieve the suffering of individuals, being guided by their needs, and to give priority to the most urgent cases of distress. (IFRC)[41]

LRRD

Integration of humanitarian aid into a broader development context has been an issue of concern for many decades. The term" Linking relief and rehabilitation" (LRRD) was used for the first time by the EU commission in 1996 a report to the EU parliament. The idea behind is to tune up immediate relief, rehabilitation and long-term sustainable development. The EU commission highlights in its report the advantages of LRRD: »Better >development< can reduce the need for emergency relief; better ›relief‹ can contribute to development; and better ›rehabilitation‹ can ease the transition between the two« (cited from: VENRO, Arbeitspapier Nr. 17, Linking relief, Rehabilitation and Development)[42]

Neutrality

In order to enjoy the confidence of all, aid organisations may not take sides in hostilities or engage in controversies of a political, racial, religious or ideological nature. (adapted from IFRC)[43]

Recovery

Decisions and actions taken with a view to restoring or improving the pre-disaster living conditions of the affected community while encouraging and facilitating necessary adjustments to reduce disaster risk. Recovery (rehabilitation and reconstruction) affords an opportunity to develop and apply disaster risk reduction measures. (ISDR 2007)[44]

Relief/Response

The provision of assistance or intervention during or immediately after a disaster to meet the life preservation and basic subsistence needs of those people affected. It can be of an immediate, short-term, or protracted duration. (ISDR 2007)[45]

Underlying risks

Underlying risks increase people's susceptibility to disasters. Poverty is one of the underlying risks of disasters most often cited. Others are chronic diseases like HIV, population growth, unfair terms-of trade or global environmental degradation. There is consensus that a successful risk reduction approach can only be achieved when such underlying risks are taken into account and properly addressed to. Therefore, DRR needs to be embedded in a more comprehensive strategy that includes lobbying, advocacy and international networking.

Annex II: DKH's Methodological Approach to Conducting Risk Assessments

(This paper was produced by "Support to Life", a Turkey-based NGO and regional office of DKH for West and Central Asia, building upon Peter Rottach´s risk assessment concept)

As a fundamental process, risk assessment is the fist step of disaster risk reduction. The goal of a risk assessment process is to provide objective and transparent information for making decisions on countermeasures to reduce the risk of disasters.

Based on the risk assessment exercise, proposals and suggestions can be drafted in close interaction with vulnerable groups of people on how to protect households and communities in a participatory and efficient way. Interventions for disaster risk reduction can be implemented after the risk assessment exercise, either at the community level or tailor-made for individual households.

Conducting the risk assessment as it is explained in this paper will provide the user and its agency with various benefits:

- The implementing agency will be able to make appropriate plans and implement concrete actions to reduce and/or eliminate disaster risks through genuinely sound disaster risk reduction programmes.
- Participatory approaches that are suggested here will improve local capacities; enhance people's knowledge on present and future hazards affecting them, increase awareness of their own vulnerability and how to protect themselves. Local government will know what needs to be done in addition to existing disaster risk reduction practices.
- The implementing agency and other NGOs will gain additional expertise in disaster risk reduction, risk assessment and risk mapping, applying this concept regularly in future project planning and climate change adaptation projects.
- The implementing agency will have a well-defined set of measures for protecting their communities from existing and future natural disasters and in helping them adapt to climate change.

1. Risk Assessment

Risk assessment is crucial as the first step in designing projects for disaster risk reduction. The purpose of this paper is to provide details on how to complete a risk assessment exercise.

An understanding of disaster risks helps in forming the basis for effective disaster risk reduction programmes, while enhancing the importance and priority of disaster prevention, mitigation and preparedness. Risk assessment also helps communities make risk-based choices to address their vulnerabilities, mitigate hazards and prepare response to and recovery from hazard events. Undertaking an assessment of risks also reduces the need for emergency aid.

The main elements of risk assessment are as follows:

1. hazard analysis
2. vulnerability analysis
3. risk mapping
4. definition of actions/strategies for disaster mitigation and preparedness.

It is of utmost importance for the success of the risk assessment exercise that local people, beneficiaries, communities and all relevant stakeholders in the relevant area participate at every stage of the risk assessment process in order to ensure negotiated decisions between the community and other stakeholders.

As an understanding of risk includes both hazard and vulnerability analysis, both components need to be tackled in an analysis of disaster risks. Given a scale of 1 to 3 for both variables, a community with high **vulnerability** and **hazard** levels of 3 would be more at **risk** than would a community with low risk levels of hazards and vulnerability.

Hazard	**:**	Potential threat to humans and their welfare
x		
Vulnerability	**:**	Exposure and susceptibility to losses
=		
Risk	**:**	Probability of occurrence
Disaster	**:**	Realization of a risk

1.1. Hazard Analysis

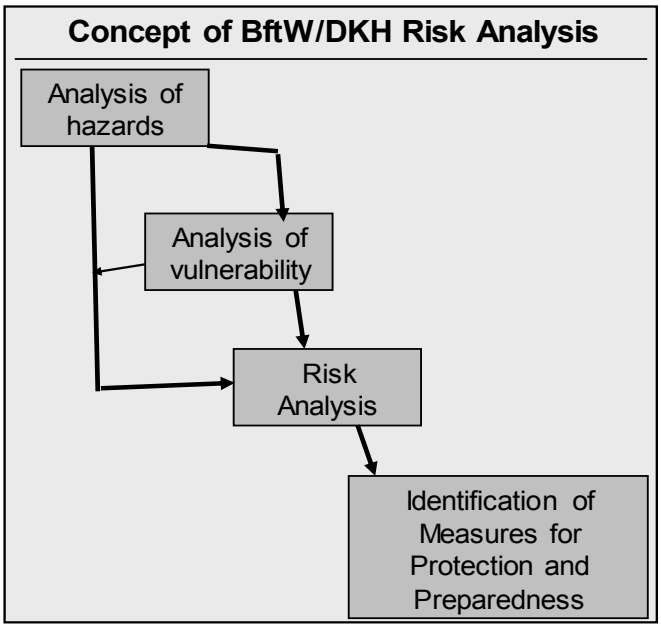
Definition

A hazard is defined as a potentially damaging physical event, phenomenon or human activity that may cause loss of life or injury, property damage, social and economic disruption or environmental degradation.

Hazards include latent conditions representing future threats and can have different origins: natural (such as earthquakes) or induced by human processes (environmental degradation and technological hazards). Hazards can be single, sequential or combined in their origin and effects.

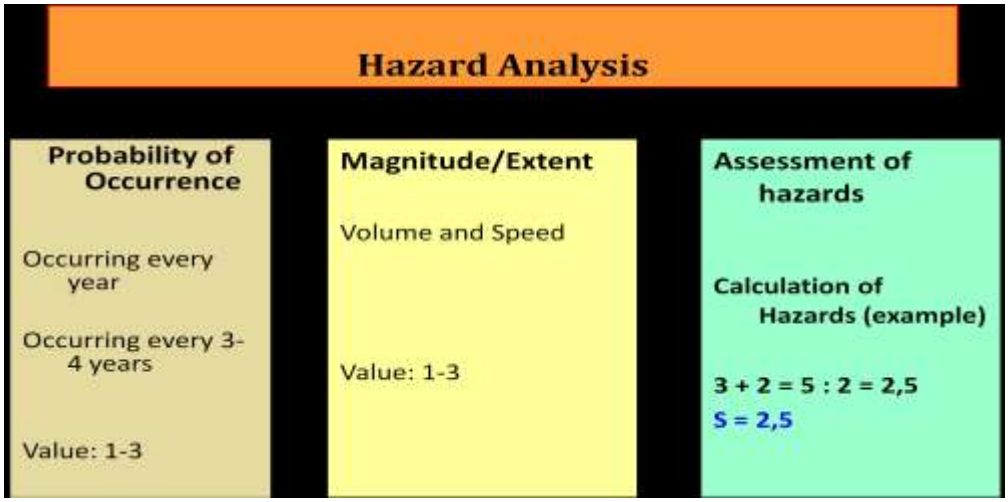
Hazard analysis is the process of estimating, for defined areas, the probabilities of the occurrence of potentially damaging phenomenon of given magnitude within a specified period of time.

Hazard analysis consists of assessing the frequency (in the past) or probability (in the future) of a hazard and the magnitude (or extent) of it such as flood levels, duration of dry days in case of drought, velocity and speed of storms, height of tidal waves, and so on.



For undertaking a hazard analysis, possible sources of information include national and local government and related institutions, meteorological institutions, disaster-related institutions (e.g. disaster management committees), NGOs, etc. Other important sources are the local people who often know very small patches of land that have been differently affected by previous hazards. Discussions with village representatives and elders is useful, as well as walking around together in the village to record and map past hazards and damages.

Looking at climate change, it is most likely that hazards will increase, both in terms of probability and magnitude. However, scientific forecast does not yet produce the precise information needed to do a hazard map on a local level. However, there is almost unanimous agreement by scientists that climate change will primarily show its negative impact in areas that in the past frequently have been affected by weather- related disasters.



For an analysis of hazards, information must include location, **probability of occurrence** (frequency), and **magnitude**/extent.

Probability of occurrence (frequency) describes how often a hazard of a specific magnitude, duration, and/or extent typically occurs, on average. For instance, flood frequency analysis uses historical records of peak flows to produce guidance about the expected behaviour of future flooding. To be able to analyse the frequency of hazards, the question to ask is “How often do floods occur in the given area?”

Magnitude/Extent describes the strength or force of an event. Only occurrences exceeding some defined level of magnitude are considered extreme, disastrous, or even hazardous. In the case of floods, for example, magnitude is often described as the maximum height of floodwaters above average sea level, flood stage, or simply above ground. For seismic events, magnitude describes the total energy released by the earthquake; for a rock fall it is the volume of material expected from a rock fall.

The formula for calculating the hazard risk value is:

[Probability (Frequency) + Magnitude (Extent)] / 2 = Hazard risk value

The ranking scale system starts from 1 (lowest risk) and goes up to a maximum value of 3 (highest risk). So both parameters, as well as the average value, have a minimum value of 1 and a maximum value of 3. Areas with similar values can be marked on a hazard map of the area under study. (We do not use the value 0, because it would mean there is either no hazard or no vulnerability; in that case according to our definition of disaster which is a combination of hazards and vulnerability there would be no disaster)

The above formula is simple and easy to use in areas with one hazard only. However, it is often the case that the area under study is affected by two or more hazards. The calculation of hazard risk values becomes more complicated in case of several hazards overlapping, such as the presence of drought and flooding in a given area.

For such situations in which two hazards are present in the area under study, DKH recommends the following ranking system for the calculation of combined hazard risk values:

Hazard 1				
	3+0 = 2,25	3+1 = 2,5	3+2 = 2,75	3+3 = 3
	2+0 = 1,5	2+1=1,75	2+2 = 2	3+2 = 2,75
	1+0 = 1	1+1 = 1,25	1+2 = 1,75	3+1 = 2,5
	0	1+0 = 1	2+0 = 1,5	3+0 = 2,25

Hazard 2

As an example, let's say that the hazard risk value of drought in village A is 2, while the hazard risk value of flooding in the same village is 1. The combined hazard risk value for this village is 1,75. On the other hand, the neighbouring village B is prone to drought only with the highest hazard risk value of drought = 3, the combined hazard risk value for village B in a hazard map consisting of village A and B would be 2,25. In such a risk map, the highest value 3 would only be attributed to villages with 2 hazards of which each gets the score 3 according to the matrix above.

In order not to make things too complicated, it is recommended to choose one hazard value for an entire village/community. Only in case of landslides or localised floods, one has to differentiate within villages.

For hazards covering large areas like extended floods, droughts, cyclones and so on, it is relatively easy to produce a hazard map provided that sufficient information is available. The mapping of more localized hazards is more difficult because the level of accuracy required increases.

Maps conveying hazard assessments can cover large areas at the global level down to district level. At the district level, assessments would be encompassing several communities. Only in case of very localized hazards like floods along small rivers crossing just one particular village, the hazard assessment would have to be done on a village/community level or even on sections of a community.

Hazard Mapping

Hazard mapping is one of the tools used in hazard analysis. The hazard risk values of different areas are indicated on hazard maps. Thus, hazard mapping is the process of establishing geographically where and to what extent particular phenomenon is likely to pose a threat to people, property, infrastructure and economic activities.

Hazard maps give qualitative and quantitative information about hazards by presenting the expected danger or maximum level of danger of the event, such as slopes at risk of landslides.

There is a variety of methodologies for creating hazard maps.

Assuming that it would give a fairly good indication of what is likely to happen in the future, hazard assessment can be based on past disasters. For example, a simple mapping of local experience can be achieved using local knowledge. The living memories of community elders can be valuable input into the disaster history of a given community. Similarly, reports and written evidence compiled on historic events can form the basis for predicting future disasters. This approach is particularly useful for recurring disasters such as floods, cyclones, and so on.

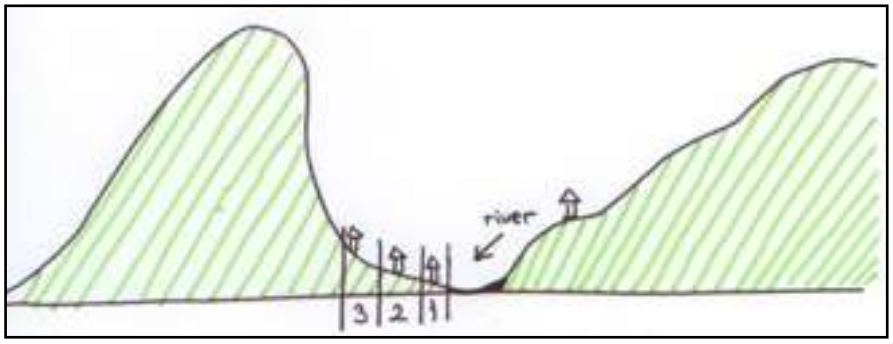
However, this methodology cannot be used for specific types of hazards like earthquakes and landslides. Where a landslide has happened it is quite unlikely that another one will happen again on the same spot. Therefore, a second methodology for hazard assessment would be to predict future disasters by scientific methods. For example, soil analysis would be required to predict the probability and magnitude of a potential landslide. Landslide hazard mapping would require skills of geologists, geo-technical engineers, geomorphologists, and topographists, among others.

Disasters linked to climate change especially require scientific research. Scientific investigation and research are carried out through teamwork with experts from an array of different disciplines. But it is important to note that even with scientific expertise, the degree of accuracy in assessing hazards in most cases is still vague.

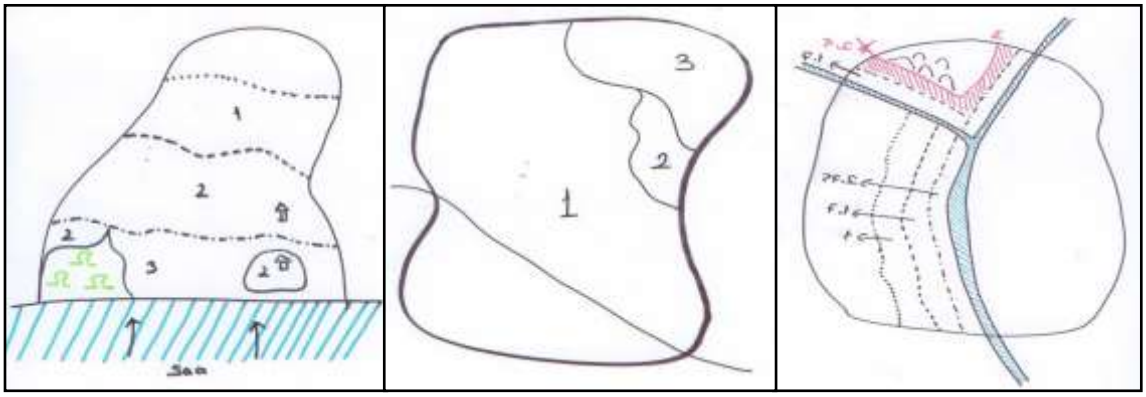
Before developing a hazard map, the following conditions should be considered:

- Ensure that the area is disaster-prone, affected by one or various types of disasters.
- Get acquainted with the area; get to know the people and authorities in that area.
- Define a project area that is composed of different regions where different hazards and vulnerabilities occur.
- Identify relevant sources of information and resource institutions that could possibly include one or more of the below:
  - state disaster management agencies,
  - meteorological institutes and their climate change-related publications
  - nationally, regionally and locally available statistics on disasters, rainfall patterns, temperatures, etc.,
  - institutions supplying agro-ecological data such as yield changes, cropping patterns, seeds, etc.,
  - hydrological institutions and their documents for information on levels of salinity in water and soil, demographic changes, land distribution and ownership, etc.,
  - political influences, both national and international.

Below are some examples of simple hazard maps for different hazard types:



Landslide



Cyclone Drought Flood

Following are the steps to follow in producing a hazard map:

- First determine your study area and identify the boundaries: What will be the criteria to select the area? Capacity, needs, hazards, etc.
- For directions, mark down major natural and human made cornerstones by inserting major roads, bridges and buildings before marking minor roads.
- Always use a legend. Use different colours in the legend.
- Mark the rural settings such as farm lands and forests.
- Define what is important; use what is important for you.
- Start from bottom to draw the map.
- To identify where the hazards are, talk to the officials, get information you need from local people.
- Ask people the magnitude of the hazard (they will show you indicating their body parts), past disasters, and which areas are affected.
- Prioritise the most vulnerable in terms of lack of resources
- Keep the scaling system simple: a scale of 0 to 3 is sufficient.
- Hazards of different types are displayed as different sub-elements so that they can be more easily distinguished. Indicate the areas where different kinds of hazards overlap.
- Once you finish creating all your graphical hazards, merge them into a single hazard map.
- Areas where merged hazards overlap in space and time are displayed in a hatching pattern to indicate that more than one hazard is defined for that area/time and a higher score is given.

Community Mapping

Community mapping is simply about putting community information into a picture and helping communities to collectively understand the 'big picture' of hazards in their communities. Mapping is a tool to help communities express their situation and needs. Hazard maps produced by communities can be made using materials such as earth, beans, stones, and branches.

Community members participating in this activity start chatting and then put the landscapes in a flip chart. They are also required to mark the infrastructure and to indicate the distances. After finishing the drawing, it is important to walk through the village and compare the findings with the community map. Transect walk helps to complete the picture, especially if you are new in the area. Thus, you will also have the possibility to see if there are any groups excluded from the community meeting.

After this exercise, it is important to note down what problems are encountered and what lessons are learnt so as to make it better next time.

Hazard mapping, done in this way with the participation of the local community, is a very vivid and informative process. Good communication is essential for a successful outcome. When carrying out the hazard mapping exercise with the participation of the local community, you need to understand the rhythm and dynamics of the community: When do people work? What time are they at home? When is the best time to carry out activities? You should make sure that competent staff is available for the entire process.

When conducting the hazard mapping exercise with the local community, below are some additional tips on holding community meetings:

- Ensure participation and involvement of as many community leaders as possible, gaining their approval of and commitment to the process.
- Include both women and men in community meetings.
- Prepare an agenda and a presentation with the key messages that you wish to communicate.
- Avoid creating unrealistic expectations of your organisation and the consequences of the mapping exercise.

Community maps are the basis for not only hazard maps but also vulnerability and risk maps, as will be elaborated in the following sections.

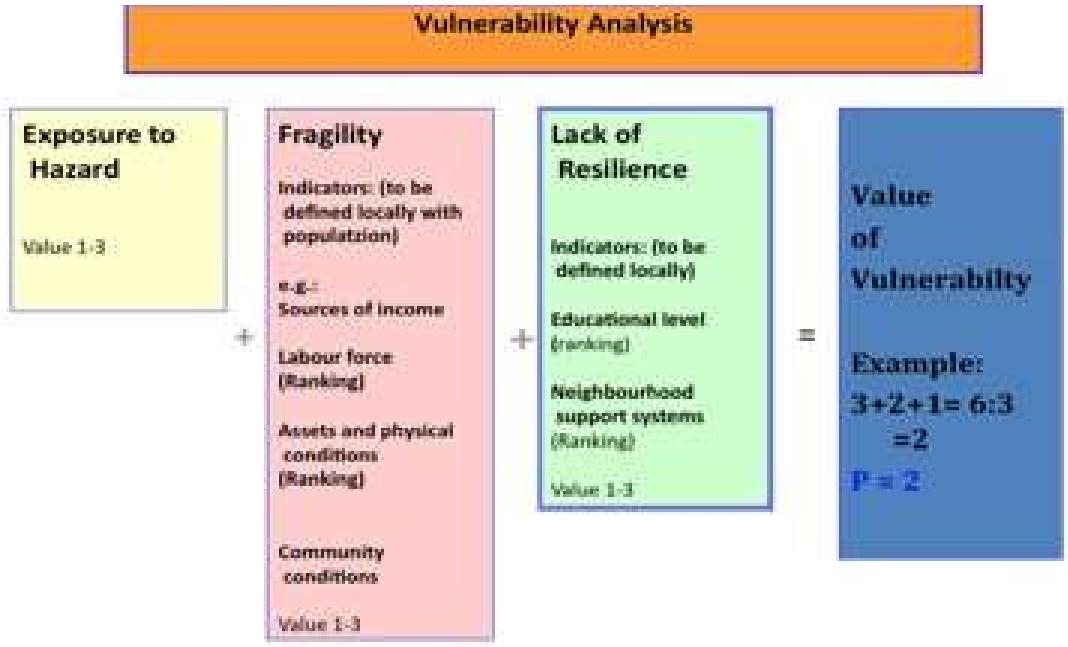
1.2. Vulnerability Analysis

Definition

Vulnerability expresses the level of possible loss, injury or damage to humans, objects, buildings and the environment resulting from a natural hazard. Vulnerability always relates to a concrete hazard. It arises out of the interaction of physical, environmental, social, economic, political, cultural, and institutional factors. Vulnerability is related to the lack of capacity to anticipate a hazard, cope with it, resist it and recover from its impact.

Vulnerability is generally greater where poverty and/or inadequate social protection make people less capable of resisting hazards. However, vulnerability is not the same as poverty. It is interesting to note that the poorest are not always necessarily the most vulnerable. For example, in earthquake zones, those living in houses made of concrete could be more vulnerable than those in bamboo huts.

Vulnerability is more than just poverty, but the poor tend to be more vulnerable.



For an analysis of vulnerability, information must be collected based on the parameters of **exposure** to hazards (physical weakness), socio-economic **fragility**, and **lack of resilience** (inability to recover). The formula for calculating the vulnerability value (using again a score between 1 and 3 for each parameter) is as follows:

[Exposure + Fragility + Lack of Resilience] / 3

People may differ in their exposure to risk as a result of their age, class, gender, ethnicity, identity, and other factors. Addressing such vulnerabilities forms the basis of the vulnerability analysis.

To assess and estimate relevant degrees of vulnerability, it is necessary to develop indicators. Indicators for determining vulnerability depend very strongly on the local, regional and national political, social and economic environments.

Exposure

Exposure to hazards refers particularly to the physical aspects of vulnerability. The best criteria of exposure can be based on the susceptibility of the population, assets, investment, production, livelihoods, historic monuments, and human activities. Other criteria include population growth and density rates, as well as agricultural and urban growth rates.

Exposure can easily be mixed up with hazard assessment. The difference is that a hazard assessment is done without looking at people whereas the exposure assessment looks at people and to what extent they might be affected by a hazard. The principle behind exposure is that if a hazardous event happens, some families will have to cope with the full velocity or strength of this event, whereas others will feel the event less severely due to the fact that only a portion of their property will feel the negative effects of the hazard.

Exposure is assessed by looking at the physical condition of infrastructure such as housing, vehicles, and so on. In the case of housing, one assesses its protective function against earlier identified hazards and gives values between 1 and 3. It is recommended to jointly define these criteria, ideally with the involvement of the community, for assessing the physical conditions of infrastructure.

Let's say that one farming family has all its lands and assets close to a flood-prone river. This family would receive an exposure value of 3. Another family has part of its land resources in the highest hazard zone, but another part in a lower hazard zone. This family would receive an exposure value of 2. A third family has all its land resources in a low hazard zone and would therefore receive an exposure score of 1.

In another example from a cyclone area, there might be some forest left. The houses behind the forests are better protected from the storm and the waves than those without this protection, although all of the families are in the same hazard zone. Therefore, families whose homes are located behind the forest would receive a lower vulnerability value compared to families whose homes are directly on the coastline with no such protection. The families in the latter group are obviously more exposed to the potential damage of a future cyclone.

Finally, for an example from a drought-prone area, the arable land of a household located in hazard zone 2 could be found in a relatively humid valley bottom stretch and therefore be less exposed to the drought than that of a family in the same hazard zone whose lands are on higher plateau and who will immediately suffer from drought spells. The latter family will receive a higher score for exposure to drought.

Fragility

It is crucial to recognize that while some risks are inherent, some exist or can be created within socio-economic systems. Although there is no worldwide blueprint for choosing the right indicators, socio-economic and cultural **fragility** may be represented by indicators such as poverty, lack of personal safety, dependency, illiteracy, income inequality, unemployment, inflation, debt, environmental deterioration, and so on.

There is a need to standardise objective and quantifiable socio-economic indicators that can be applied by the assessment team. These indicators reflect relative weaknesses that increase the direct impacts of dangerous phenomena. The selection of the appropriate indicators can be done locally or regionally with the participation of the community, also taking into account the validity of the data collected from the interviewed people. During the vulnerability assessment it is important to clearly describe which indicators will be used and for what reason.

For the assessment of socio-economic and cultural weakness, possible indicators are:

- Household assets (e.g. having a vehicle, bicycle or washing machine),
- Sources of income (e.g. agricultural output, salary, off-farm income),
- Access to productive resources (e.g. size of arable land),
- Household composition (e.g. women headed household, ratio of working adults to family members, presence of elderly or handicapped),
- Situation of infrastructure/Access to basic services

Taking as measure the type of houses that local people live in is a good indicator of vulnerability. Looking at the quality of house construction, values of 1 to 3 could be assigned to the following 3 different types of houses in the target community:

Indicator: Quality of house construction
Value 1: fortified concrete poles with corrugated iron sheets
Value 2: wooden poles with corrugated iron sheets
Value 3: traditional with wooden poles and thatch

In the event of a cyclone, homes built with stronger frames and walls will be more resistant to the negative effects of the disaster, while traditional houses with a weak frame and straw walls and roof will be the most affected.

Given the context of the country in which the assessment is being undertaken, enquiring about bicycle ownership might give more relevant results for vulnerability compared to asking about the ownership of motorized vehicles. Similarly, owning an ox as opposed to a tractor in a village community would be a sign of low vulnerability. In agriculturally based communities, the size of land could be an alternative indicator to socio-economic fragility.

Looking at the composition of the household under study, a household headed by a woman with children would receive the highest score for vulnerability, while a household headed by a bread earning man would receive the lowest score for vulnerability. Alternatives for measurement of fragility would be to look at the insurance systems utilized by individual households.
Other similar indicators can be developed and designed based on the socio-economic and cultural references in the country, region, and community under investigation. It is strongly recommended to keep this procedure simple for each indicator, especially when assessing all individual households in a community.
The formula for calculating the value of socio-economic vulnerability is as follows:

Sum of indicator scores for ¨fragility¨ / number of indicators

Lack of resilience

Lack of resilience of a household or community refers to the inability to recover from a disaster, and is inversely proportional to variables that measure human development, human capital, economic redistribution, governance, financial protection, community awareness, the degree of preparedness to face crises, and environmental protection.
Possible indicators for lack of resilience are:

- Education level of family members/head of family
- Availability of neighbourhood support systems (or extended family systems)
- Percentage of family labour force compared to total number of family members

The number of family members with formal school diplomas could be an indicator for the resilience of that particular household. Similarly, the number of adults who are earning an income would be a good sign of resilience. A household with no adults in the labour force would be the most vulnerable (with score of 3), while a household with two adults in the labour force would be the least vulnerable (with score of 1).

It is recommended to use a maximum of 3 indicators and to formulate one question for each indicator.
The formula for calculating the value for lack of resilience is as follows:

Sum of indicator scores for ¨ lack of resilience ¨ / number of indicators

Conducting Vulnerability Analysis

Vulnerability analysis should be capable of directing humanitarian and development aid interventions, seeking ways to protect and enhance peoples' livelihoods, assist vulnerable people in their own self-protection, and support institutions in their role of disaster prevention.

In contrast to the hazard analysis, vulnerability analysis usually covers individual households. The assessment is done by individual interviews with representatives of households.

Households that are not affected by hazards under investigation do not need to be included in this analysis (because where there is no hazard there is no disaster).

If the social, economic and cultural situation in one community is rather homogeneous and if the purpose of the assessment is to conduct a rapid appraisal, families can be clustered for group interviews. However, in order to verify the data collected, cross-checking based on random sampling is recommended.
In order to reduce the time spent in the village and the frequency of visits to individual households, a questionnaire can be produced in which all the selected indicators are listed with the related scores based on a previously fixed ranking scale, so that during the interviews the study team can simply tick where appropriate. This will allow the project to recruit people from the communities to do the interviews and by doing so speed up the whole process significantly.

Following are some tips on conducting vulnerability analysis:

- Do vulnerability assessment house by house.
- Develop your indicators according to the context of your study area.
- Indicators must be clear, precise and short. For each indicator one question can be developed.
- Formulate criteria to observe physical vulnerability.
- Fine-tune your indicators during the visits, if there are any indicators that are not relevant, modify them.
- Every questionnaire must have the name of the village/community, name of the family, corresponding number of the household, number on the map, number of family members and age, if valuable.
- Rate the exposure from 1 to 3 (low, medium or high), then rate the fragility according to the answers given to the questionnaire, finally rate lack of resilience and calculate the value of vulnerability.

A sample questionnaire for analysis of vulnerability is given below:

	SAMPLE QUESTIONNAIRE			
Parameters	**Indicators**	**Scale**	**Rate**	**Score**
Exposure (A)	High (all property has exposure to hazard)	3	ŏ	3
	Medium	2		
	Low	1		
Sub-score (A)	3 /1 = 3			3
Fragility (B)	**1 - Income** (Bicycle / Car)			
	None (the poorest has no bicycle)	3		
	Old	2	ŏ	2
	New	1		
	2 - Assets (House)			
	Rent	3		
	One	2	ŏ	2
	More than one	1		
	3 - Access to Resources (Field)			
	Less than 2 hectares	3		
	2-4 hectares	2		
	More than 4 hectares	1	ŏ	1
	4 - Women headed households			
	Women and children	3		
	Women alone	2		
	Both men and women	1	ŏ	1
	5 - Average age			
	More than 40	3	ŏ	3
	30-40	2		
	Less than 30	1		
	6 - Community set-up			
	Bad	3	ŏ	3
	Medium	2		
	Good	1		
	7 - Insurance systems			
	None	3		
	Either house or crops	2	ŏ	2
	Both house and crops	1		
Sub total (B)	(2+2+1+1+3+3+2) / 7 = 2			2
Lack of resilence (C)	**1 - Labour force**			
	More than 50% of adults are included in labour force	3		
	50%	2		
	Less than 50%	1	ŏ	1
	2 - Education level			
	Up to primary school	3		
	Up to high school	2	ŏ	2
	Above high school	1		
	3 - Neighbourhood/ Support systems			
	Low	3	ŏ	3
	Medium	2		
	High	1		
Sub total (C)	(1+2+3) / 3 = 2			2
Vulnerability	(A + B + C) / 3 (3 + 2 + 2) / 3			2,3

1.3. Ranking Risk

For the final assessment of risk, the values of hazard analysis and vulnerability analysis have to be multiplied with one another. The complete formula looks like below:

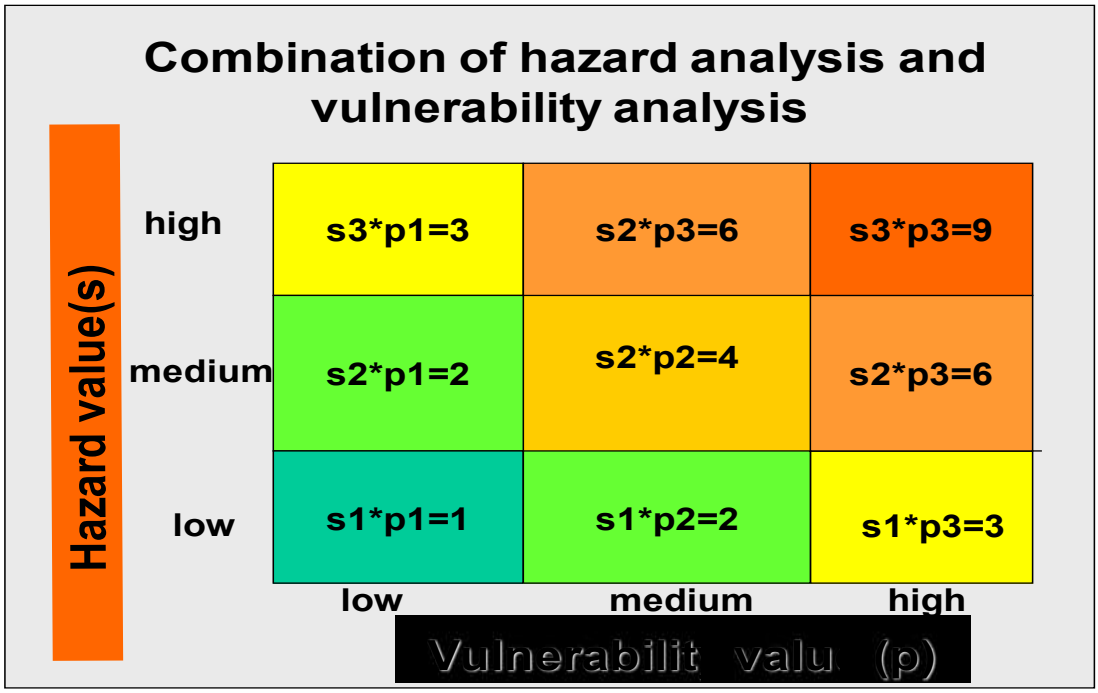
$$Hazard \left(= \frac{frequency/probability + magnitude}{2} \right)$$

X

$$Vulnerability \left(= \frac{exposure + fragility + resilience}{3} \right)$$

= RISK

After calculating the combined risk values for each household, one can classify household(s) in areas of low risk, medium risk and high risk, and mark them on the map. These final risk values may vary between 1 and 9. Therefore, households of low risk will receive a value of 1-3, while households of medium risk will receive a value of 4-6, and households of high risk will receive a value of 7-9.



For the example above (see sample questionnaire), assuming that the entire village community is located in a zone with hazard risk value of 3, the final risk value would be 3 x 2,3 = **6,9**, which would be located in the **high risk zone**.

Similar to resource mapping, in a risk map, one can also include the resources that are available at the community level, such as means of transport, first aid kits and centres, mobile phones,

stores of food and drinking water, schools, mosques, shelters etc. This can be a combination of a vulnerability map and a resource map related to disasters.

1.4. Final Remarks on Methodology

The following tips will ensure a successful risk assessment exercise:

- While conducting a risk assessment, be as clear and transparent as possible.
- Define your study area bearing in mind the scarce resources and focusing on the places where hazard potential, vulnerability and needs are greatest.
- Do not use different teams to conduct the risk assessment exercise. It is better to have one team looking at the same locations to ensure a common understanding throughout the entire process.
- All risk maps should be nicely drawn and, preferably, should be electronically saved.
- Each stage of the risk assessment process should be recorded appropriately and saved. This includes the detailed results of all questionnaires, interviews, focus group meetings, interactions with authorities and so on. Assumptions, methods, data sources, analyses, results and reasons for decisions should all be recorded and saved.
- Photographs should be taken during each and every step of the whole exercise.
- If extraordinary human life stories are encountered during the process, these should be noted down, where applicable and needed.
- At the end, a summary report highlighting the methodological approach, findings, suggestions for improvements, and recommendations for future actions will be useful, as well as a copy of the risk maps of the communities under investigation.

2. Actions for Protection, Mitigation and Preparedness

After the risk assessment has been completed and interaction with local people, governmental institutions, other NGOs has taken place, sound proposals can be drawn on how to reduce the risk of present and future disasters for most vulnerable communities and people. Project ideas can be developed on short-, mid- and long-term strategies consisting of material support, training, capacity building, awareness-raising, lobbying and advocacy, among others.

DKH suggests that once the assessment is done and proposals for follow-up measures are on the table, a workshop with relevant stakeholders can be organized in order to evaluate the process and in order to determine future actions. Critical projects as well as the type of asssistance requested by the target community must be taken from the community members.

Focus Group Meetings

Focus group meetings are one means of identifying in a participatory manner possible strategies and projects for disaster mitigation and preparedness. DKH recommends to undertake this sort of interaction with the villagers in focus group discussions involving all sectors of the community,

including men, women, youth, elderly and village leaders. Focus group discussions help to learn about the solutions that the community itself suggests and their priorities.
Focus group discussions can take place during the risk assessment exercise in which the locals are asked about their past experiences with disasters, about positive elements that have helped them in the past to alleviate their suffering, about their proposals for actions designed to reduce the existing risks, and to prepare for future disasters. It is important to differentiate between actions that people are already taking, actions that can be taken by the people/community themselves, actions to be taken by the government, and actions proposed for NGO intervention.

The following tips are important for conducting focus group meetings:

- Identify the social groups that you want to interview and make the focus groups as diverse as possible.
- Have separate focus groups for villagers and community leaders to foster an environment of open discussion. It is best to not have authority figures present in meetings as they will lead and limit the discussions. It is best to interview them separately.
- Schedule the meeting some days before the actual event.
- Limit the size of each focus group to 6-12 participants.
- Arrange two facilitators for each focus group – one to lead the discussion and one to observe and take notes.
- Start the discussion with a courtesy introduction, telling about your organization and the study.
- Make sure everyone has a chance to speak and that the discussion stays focused.
- You can give a direction to the discussion by asking open-ended questions that are relevant to the context and discussion topic.
- At the end of the session, give a brief summing up of what has been said in case someone has something to add.
- Check if the written record has captured the main points and reflected the level of participants' involvement in the discussion.
- Conduct a few focus group meetings and compare the information you are collecting from these and other sources.

Below are some sample questions that can be adapted during the focus group meeting:

1. Where did the disaster happen?
2. What was particularly harmful? (e.g. lack of doctors, health facilities, means of transport, means of communication, etc.)
3. What was particularly helpful? What helped you to save lives and property? (e.g. first aid kits in the village, good response system, etc.)
4. What would you suggest to do if a disaster happened tomorrow? What should be in place to prevent damages/loss of lives?
5. What can you do as an individual, as a group of people or as a community to reduce the risk of a disaster? (e.g. self help initiatives)
6. What should the government do to better reduce the risk of future disasters?
7. What should the government do to better prepare for future disasters?
8. What would you expect from an NGO project?
9. Is there particular support for vulnerable people in the community?
10. Would targeting the most vulnerable households cause tensions within the community?
11. What are the means of disaster intervention for (i) individual families and (ii) the entire community?

3. Challenges to Disaster Risk Reduction and Risk Assessment

There are a number of challenges for effective disaster risk assessment and consequent risk reduction, especially in the context of climate change. These challenges include, but are not limited to, the factors listed below.

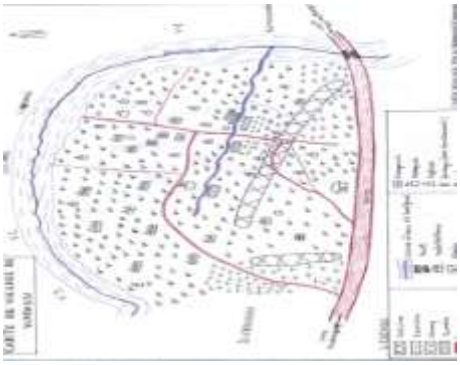
- Risk assessment should reflect local knowledge and culture. The importance of this approach should not be underestimated.

- Risk assessment should be part of a comprehensive disaster risk reduction programme. Only assessing the risks and not following up by mitigation or preparedness projects might raise false

Good practice DKH: Risk Assessment Trainings in Africa and Asia

Since 2008, DKH is offering trainings in risk assessment to partner organizations. Such trainings took place in different countries with different disaster backgrounds like floods, cyclones, droughts and landslides. After the trainings, partner organizations were able to conduct risk assessments in their working areas. The general feedback on these trainings has been very positive and the results of the risk assessments done by the partners can be regarded as successful and helpful. Concern was raised in regard of the personal resources needed for covering highly populated areas and the costs involved. By recruiting personal from the communities under investigation such problems can be avoided (see final chapter of annex II). Many partner organizations confirmed that the methodology applied in this risk assessment can also be used for their development work, because it helps identifying groups of beneficiaries in particular need of assistance.

Pictures below show risk maps produced during trainings and by partners:



expectations in the community and/or among individuals.

- Risk assessment of multiple hazards are difficult to accomplish due to the different approaches in assessing individual hazards. But multi-hazard assessments are important to produce comprehensive and accurate disaster risk reduction strategies. Hazards should not be considered in isolation.

- Often times there is a gap in the understanding and application of risk assessment tools between technical or academic institutions and local authorities or communities. One way of reconciling the two parties is to remember that community-based risk assessments can be complemented by verifiable scientific information and appropriate research into the local impact. However, more experience is needed to match current scientific knowledge with local knowledge. It is also difficult to validate climate change risks at the community level over other risks due to the uncertainties of extreme weather events.

Implementing agencies are encouraged to look for ways and means to overcome these challenges when selecting and applying risk assessment tools and case studies.

Concern has been raised that the vulnerability assessment would not be feasible in extended and densely populated areas because of the very labour-intensive individual interviews. In order to avoid constraints related to this, it is recommended to recruit people from the communities under investigation to carry out the interviews by using questionnaires.

The indicators applied have to be simple and neutral in a way that they do not depend on subjective assessments. Tests in various countries revealed that such simple and objective indicators can be developed and that in every village a few local people can be found who are capable of reading and writing and who can work with questionnaires.

Calculations of vulnerability scores and risk ranking can be done by project staff later on.

Climate change related risk assessments:

The method of risk assessments is a useful instrument in a disaster risk reduction strategy. Methodologically, by assessing past disasters and their effects it tries to predict what disasters should be expected in the future and what means and methods of prevention, mitigation and preparedness might help to better cope with them.

However, this assessment tool does not sufficiently allow dealing with unprecedented changes of weather pattern as projected in the context of climate change. In order to incorporate climate change into such assessments, one would need to know precisely the effects on a local level what at this point of time still is not feasible. Accurate forecast is difficult because ….

- The future of greenhouse gas emissions is uncertain and depends on unpredictable political decisions
- Weather patterns are complex and not yet fully understood. Even without climate change, weather cannot be predicted over more than a couple of days. But one can indicate long-term

trends, like change of monsoon seasons, approximate changes of precipitation in larger geographical regions etc.

But that does not mean that local people and their organisations have to wait until scientists are in a position to exactly forecast climate change effects on them. They themselves can observe and monitor on-going changes. Very often, people (especially rural people) record such changes and try to adapt (e.g. in farming). Some, often elderly, people have very good knowledge about the local environment and can precisely describe environmental changes which have occurred over 20 or 30 years (e.g. by watching breeding periods of local birds, disappearance or spreading of plant species/indicator plants etc.)

Such local knowledge and observations not only allow for identifying current changes of climate and weather trends in a given locality, they can also allow for predicting future trends within the planning horizon of local people.

Risk Assessments related to climate change should also include slow-onset effects like changing rainfall patterns in a given area or the spreading of diseases due to warmer temperatures.

There are useful tools for climate change adaptation and vulnerability assessments which also contain relevant and useful information on DRR-Risk Assessments:

Care international 2009: Climate vulnerability and capacity analysis. Handbook

Tearfund 2009: Climate change and environmental degradation risk and adaptation assessment.

Annex III:

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