giz Dutch-German Partnership
Energising Development

Environment Assessment and Watershed Action Planning
related to GIZ ECO MHP Projects:

FIELD MANUAL

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1 INTRODUCTION

In order to provide a sustainable use of the micro hydropower (MHP) projects, it is crucial to take into account the environmental state of the plant's catchment area. Since degradation might decrease the retention capacity of the soil, the discharge might be altered and thus the occurrence of the river drying out or flash flood events may increase. All of this negatively affects the sustainable use of the MHP plants, since without a continuous discharge, sufficient and sustainable electricity supply cannot be provided. In order to provide sustainable land use and hence sustainable electricity supply, it is of great importance to manage the catchment carefully, which includes 2 steps: environment assessment (EA) and watershed action planning (WAP).

The first step towards a watershed management plan is an EA, which includes the selection, compilation and mapping of data on the watershed, with the aim to show its current environmental condition. The implementation of EA helps to identify any existing environmental impacts and thus what mitigation techniques need to be implemented within the watershed action plan. Once the EA is finished, all involved stakeholders come together to draw up a comprehensive watershed action plan, taking into account the findings from the EA. Within this plan, all commitments are laid down and have to be agreed upon by the community. Depending on the crucial areas identified within the EA, these may involve a combination of various mitigation techniques ranging from biophysical to political measurements.

1.1 OBJECTIVE

The objective of this manual is to include EA and WAP in each MHP implementation. Carefully conducted EA and WAP can sustain or even improve the environmental condition of the watershed, including the natural flow of the waterways. Thus sufficient and sustainable electricity supply generated by the MHP plants can be provided. Due to the overarching approach, EA and WAP can have further positive effects on the ecological and social condition of the watershed such as improvement of soil fertility and income generation. EA and WAP should therefore be seen as essential parts of each MHP implementation.

1.2 ORGANIZATION

This manual is organized as the following: chapter 2 deals with the identification of stakeholders and responsibilities prior to the assessment and planning process. Chapter 3 deals with environment assessment, including the biophysical and socio-economic survey, the identification of major problems and problem areas as well as an overview of causes, features and effects of degradation. Finally chapter 4 deals with the watershed action plan, including the identification of appropriate mitigation and intervention techniques. Furthermore it is concerned with providing a list of mitigation and intervention techniques as well as information on identification of responsibilities between different stakeholders, implementation and the monitoring and evaluation process.

The manual is a general guideline and ought not to be considered complete. It strongly draws on the basis of the documents "Community Based Participatory Watershed Development Guideline, Part 1 and 2" (DESTA et al. 2005) published by the Ethiopian Ministry of Agriculture and Rural Development.

2 Getting the Planning Process Started

2.1 Participatory Approach

People's participation is of great importance in order to successfully establish and implement the EA and WAP. Taking into account people's needs helps to increase acceptance and thus their willingness to invest in long term conservation (Darghouth et al. 2008). Hence all stakeholders and the watershed community(ies) should be involved in all steps of the planning and implementation as well as the monitoring and evaluation process.

2.2 Identification of Stakeholders

In order to successfully implement a participatory approach, various disciplines need to be involved. Firstly a watershed planning team should be established that includes representatives from both, various disciplines and different levels of administration. The head of the team should be the kebele's Development Agent (DA). Secondly, it is recommended that stakeholders from forestry, soil conservation, agriculture and livestock be involved. In addition to this water management (water harvesting and irrigation), water mill and MHP representatives should be part of the team. If those representatives cannot be found in the kebele(s), they should be assigned by the woreda's rural development office. Against the above backdrop it is essential to also consider gender issues, which is why it is important to have at least one female team member. Finally the kebele's chairman should be part of the team (see figure 1) (Desta et al. 2005; Schnitzer 2009).

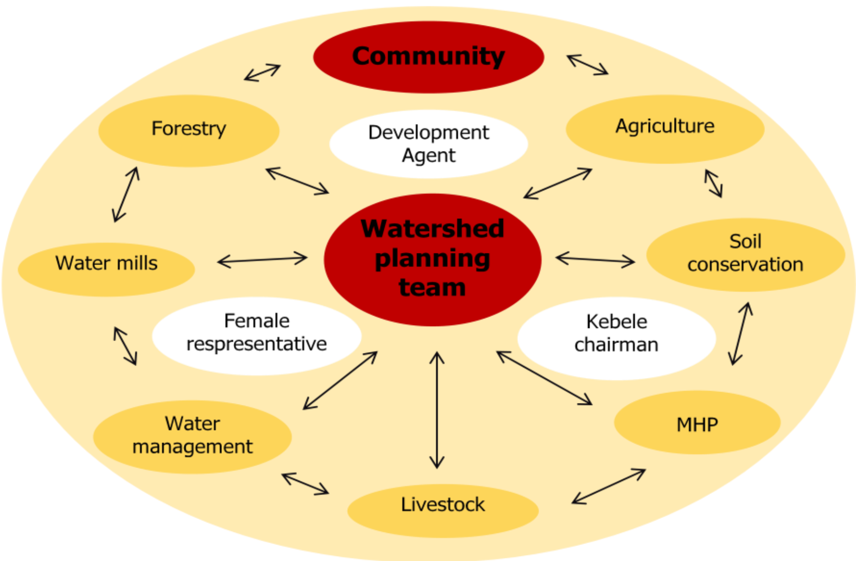

Figure 1: Organizational diagram of the watershed planning team.
Source: modified by Schnitzer 2009.

If there is more than one kebele in a watershed, representatives from each kebele should be part of the planning team (at least each kebele's DA and chairman) to represent possibly varying interests (keyword: conflicts between upstream and downstream areas, also see Box 2).

3 Environment Assessment (EA)

3.1 Biophysical and Socio-economic survey

In order to assess as much environmental information on the target area as possible, it is important to consider both, biophysical as well as socio-economic features of the watershed. The most effective way to do so is a combination of landscape observation, interviews and mapping. The questionnaire (Annex 1) and the checklist (Annex 2) attached are designed so as to help note down the findings of the landscape observation and the interviews. The map helps to illustrate the environmental condition of the watershed and thus to locate points of interest such as degradation features, wetlands and spring areas.

How to use the questionnaire and the checklist

The questionnaire (see Annex 1) and the checklist (see Annex 2) include a variety of questions and features, all of them having different answer modalities (ranging from qualitative to quantitative). In order to fill in the questionnaire and the checklist it is thus of great importance to not only observe the landscape and to take measurements but also to interview people (inhabitants and/or officials) when required. To make the results of the survey more detailed, the watershed should roughly be divided into (at least) two parts: the upstream and the downstream region. Depending on the size of the watershed, further subdivision might be useful. For each sub-region the questionnaire and the checklist should be filled in.

How to draw a map

To delineate the watershed boundaries, use a topographic map (scale 1: 50 000) of the area and enlarge it once (1: 25 000) or twice (1: 12 500). The outlet should be the location of the MHP station. To calculate the area of the watershed, use a grid square (print it on a foil and lay it over the map, see Annex 4, page 32). In order to map parts of the watershed in greater detail, the map can be further enlarged (see also Annex 4, pages 22 – 35).

Once the base map is drawn in accordance with the work scale (depending on how detailed the map must be), all information of interest (such as land use, land cover, springs, wetlands, rivers, degraded areas and so on) can be filled in. If there is no GPS available, landmarks such as rivers that are found on the topographic map can be used for orientation. Either all information can be noted on one map, or several thematic maps can be created, showing for example only springs and wetlands or degraded areas.

3.2 Identification of major problems and problem areas

Once the biophysical and socio-economic survey is done, the collected data should be analyzed carefully in order to assess major problems and problem areas within the watershed. Identified problems should be ranked according to priority (note: (1) identified problems can be causes and features of degradation as well as inappropriate land use techniques and (2) checklist classification might help with ranking). A list of possible causes, features and effects of the latter can be found below.

Results of the environment assessment should be A) a *list of the identified problems* of the watershed and B) a *map and/or several thematic maps*, showing the watershed's environmental condition and problem areas.

3.3 Causes, Features and Effects of Degradation

> ***Note**:*
> *The MHP will particularly be affected by **alternation of discharge** and **sediment load** of the river.*
> ***Alternation of discharge** will lead to insufficient and unsustainable electricity supply since, without a continuous discharge, the plant cannot be operated persistently.*
> ***Sediment load** of the river will wear out the turbine of the MHP and will thus decrease the durability of the plant's equipment.*

3.3.1 Causes

Deforestation and Destruction of Natural Vegetation

Destruction of natural vegetation is primarily caused by deforestation. Other major causes are wildfire and overexploitation. Deforestation not only occurs as a result of firewood extraction by the local population but also as a result of the creation of arable as well as pastoral land. As population figures rise, the extraction of firewood and thus the bias between firewood production and usage increases, therefore reinforcing deforestation and destruction of natural vegetation. Furthermore the growing firewood deficiency is not only often substituted by dung or harvest surpluses, which, if used appropriately, may be used as fertilizers (König 1997) but also by leaves, which will prevent the formation of a natural humus layer. Resultant to this substitute usage of dung, harvest excesses and leaves by the local population, soil fertility and infiltration rate may decrease which in turn will lead to alternation of discharge, increased runoff, erosion and sediment load.

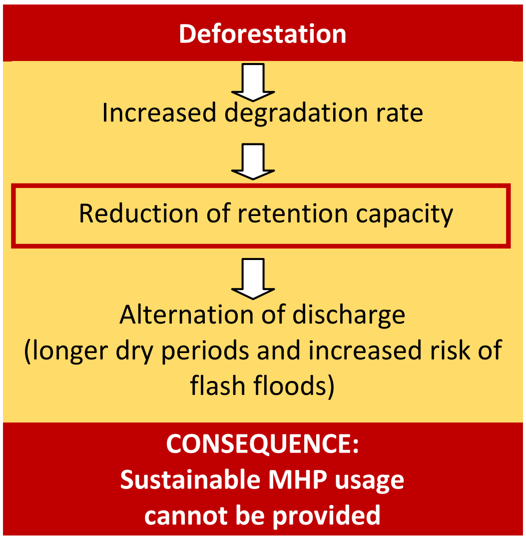

Figure 2: Deforestation and its consequences on MHP.
Source: K. Meder 2011.

Forests and vegetation cover in general act as buffers along water ways and around spring areas. If this buffer zone is removed, stream bank erosion might increase due to the destabilization of river banks which increases the sediment load (see box 1).

Thus, forest degradation can have severe effects on the MHP's sustainable use. Forests, often found in headwater regions, do not only improve the annual retention capacity of the soil and thus help to provide a stable discharge rate, which is crucial for the sustainable use of the MHP, but they also help to decrease the risk of flash floods and thus severe erosion after heavy rains (see figure 2 and chapter 3.3.3). Furthermore they stabilize the soil and thus decrease the sediment load of the river.

Overexploitation

Overexploitation occurs when arable land is used beyond its fertility potential without substituting the loss of nutrients by fertilizers or appropriate fallow periods (GRAINGER 1990). Contributing to this overexploitation might be the shift from rain-fed agriculture to modern agricultural methods, cash cropping and population growth. Overexploitation can lead to a variety of erosion features such as gully erosion, landslides and alternation of discharge and should thus be prevented in order to provide sustainable use of the MHP plant.

Overgrazing

Overgrazing occurs when the number of livestock on a unit of land is too large. Resultant to this is the destruction of natural vegetation as well as soil compaction and erosion (cattle step). Furthermore the photosynthesis and hence biomass production and carrying capacity is decreased. Vegetation damages occur not only due to cattle bites, cattle step and pawing but also show in a biased occurrence of fodder species and non-fodder species. Also the lack of a grazing plan which includes rotation of grazing ground, and, moreover, the lack of a national land use plan may contribute to overgrazing (MENSCHING 1990). Like overexploitation, overgrazing can result in various degradation features and effects such as alternation of discharge, change of soil moisture and gully erosion and thus might compromise the sustainable use of the MHP.

Unadjusted irrigation techniques

The implementation of irrigation techniques can lead to degradation, when the technical know-how and/or the appropriate instruments are missing. Degradation, primarily in form of salinization, occurs in this case due to a bias between water inflow and outflow or the use of salty water (MENSCHING 1990).

Socio-economic and political causes

Various socio-economic as well as political causes can lead to land degradation. As mentioned earlier, *population growth* is a major cause of degradation, since it might contribute to overgrazing, overexploitation and deforestation (if no appropriate and adapted land use practices are applied). Furthermore degradation occurs due to *underdevelopment*, since resources are often exploited to benefit developed countries and thus little profit is left in developing countries to manage or restore degraded areas (THOMAS, MIDDLETON 1994). Also *rural-urban migration* contributes to the occurrence of degradation, since urban population needs more firewood than rural population. Hence the growth of urban population in general goes hand in hand with an increase in deforestation and thus degradation.

Natural Causes

Not only human action can cause degradation to occur, but also natural causes such as the nature of *rainfall* (amount, intensity, variability, distribution…), *soil* (texture, structure, depth, moisture, infiltration rate…) and *topography* play an important role in the scope and scale of occurring degradation features. Under natural condition, soil erosion due to these causes is a natural process. However their negative effects can be amplified through human action (such as pastoral and agricultural land use for example) within the watershed (LAL 1990).

In the context of MHP implementation, two aspects should be kept in mind in particular:

- The erosion potential is particularly high, when high intensity rainfall hits aridificated soils (see chapter 3.3.3).
- The steeper the topography and the longer the slopes in the watershed the higher is the erosion potential (MORGAN 1999).

MHP related causes of degradation

The MHP project itself can have negative effects on the environment, which can in turn lead to degradation. Due to the MHP and the along going electricity supply, a population growth close to the powerhouse is likely to occur. Thus the pressure on natural resources and the risk of erosion in areas close to the powerhouse is increased. The increased degradation rate will lead to an increase of sediment load of the river as well as to a reduction of the soil's retention capacity, which will result in an alternation of the discharge rate, showing in longer dry periods and an increased risk of flash floods. Consequences will be that a sustainable use of the MHP cannot be provided (see figure 3).

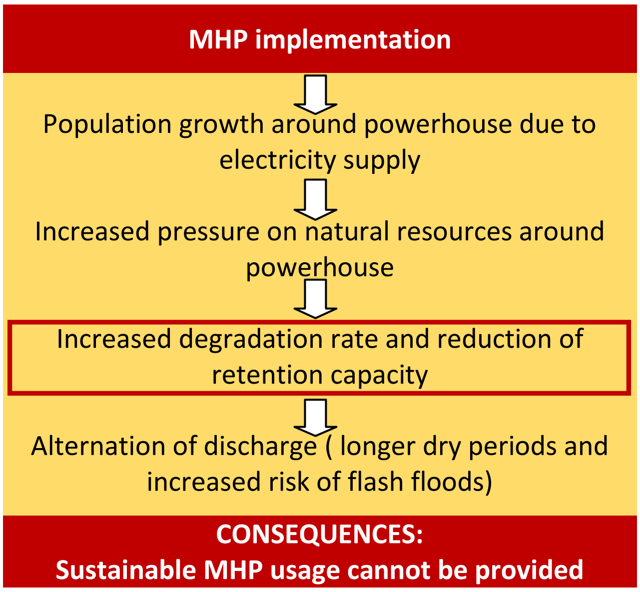

Figure 3: MHP implementation and its consequences.
Source: K. Meder 2011.

> ***Note:***
> *It is important to note that most causes of degradation are closely interdependent and thus mostly more than one cause lead to the prevailing erosion features.*

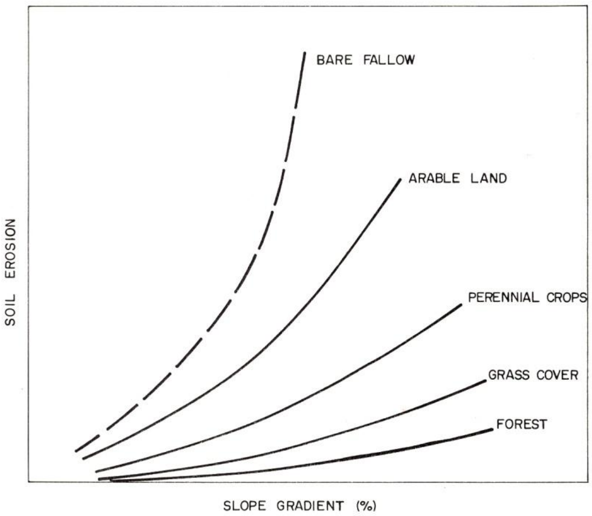

Figure 4: Hypothetical relation between erosion hazard, land use and slope gradient.
Source: Lal 1990.

The overall degradation potential of a catchment depends on the land use and land cover. Each land use has a different magnitude of soil erosion risk per se. As a general guideline, the hypothetical relation between erosion hazard, land use and slope gradient can be kept in mind, which says that forests have the lowest and bare soil the highest erosion risk. However it should be kept in mind that the latter can be increasingly or decreasingly altered by the application of appropriate or inappropriate land use techniques respectively (see figure 4).

3.3.2 Features

Landslides

Landslides (see figure 5) may occur due to a variety of natural and human causes. Geological and morphological and thus natural causes can be, for example, weak or weathered material, contrast in permeability of material or shrink-and-swell weathering. Human causes on the other hand might include deforestation, land use change, excavation of slopes or irrigation (USGS 2004).

The MHP will primarily be affected by the increase of sediment load in the water caused by the landslide event. In case the magnitude of an event is big enough, the river might even be blocked off completely, which could decrease or even stop the water flow and thus heavily affect the MHP use.

Figure 5: Landslide.
Source: K. Meder 2010

Changes in soil texture and cattle step

Soil compaction is primarily caused by cattle step (see figure 6). Due to the decrease of pore volume, the infiltration rate decreases, which can, depending of the topography, lead to an accumulation of water or an increased surface runoff (and thus increased erosion potential) (BALDENHOFER 2002).

Just like changes in soil moisture, changes in soil texture will negatively affect the MHP use due to a decrease of retention capacity as well as an increase of sediment load.

Figure 6: Cattle step.
Source: K. Meder 2011.

Gully erosion and Badlands

Gully erosion (see figure 8) occurs when, during a rain event, laminar surface runoff becomes linear and strongly deepens small rills/riverbeds. The intensity of deepening depends on the slope and the ground texture/structure. Mostly gully erosion occurs where the vegetation cover is degraded and the infiltration rate is decreased, for example on bare cropping plots or along cattle paths. Badlands (see figure 7), an extreme form of gully erosion, form as full molds between wide gullies and are hardly or not arable (LESER 2005).

Figure 7: Badland.
Source: K. Meder 2010

Figure 8: Gully erosion.
Source: K. Meder 2010.

Gully erosion contributes to an increase of sediment load in the rivers and can thus decrease the performance of the MHP in the long run.

Stream bank erosion

Apart from the vertical erosion in form of gullies, a further degradation feature is stream bank erosion (see figure 9), which is closely linked to increased runoff and associated alternation of river discharge. When land use changes, such as clearing land for agriculture, occur in a watershed, runoff increases and thus the stream channel adjusts to accommodate the additional flow, causing stream bed erosion. The process is further reinforced by the removal of vegetation buffers along the waterways to the point where it no longer provides for bank stability. Moreover, pastoral use along water ways reinforces this form of erosion (SURRY SOIL AND WATER CONSERVATION DISTRICT et al. undated).

Figure 9: River bank erosion.
Source: K. Meder 2011.

Stream bank erosion significantly increases the sediment load of the river, which not only results in the loss of fertile cropland but also negatively affects the sustainable use of the MPH plant.

Sheet and splash erosion

Due to the decreased infiltration capacity of the soil, surface runoff and thus sheet erosion increases (see figure 10). The process is further intensified by splash erosion, caused by the impact of raindrops hitting the ground (MENSCHING & SEUFFERT 2001). A typical feature of sheet erosion is the laminar lowering of the surface, which is indicated by uncovered tree roots.

The MHP will be negatively affected by the resultant increase of sediment load of the rivers.

Figure 10: Sheet erosion
Source: http://www.lram.com.au/projects/larc_top.htm (26.01.2011)

3.3.3 EFFECTS

Alternation of discharge

Alternation of discharge often shows in a decreased discharge amount or frequency. The latter often includes the occurrence of flash floods, which are short but very intense flood events. Alternation of discharge occurs due to a degradation of vegetation and the aridification of topsoil. Furthermore the process also increases soil erosion (due to floods) (MENSCHING 1990).

Alternation of discharge is the degradation effect which affects the sustainable use of the MHP the most, since without a continuous water flow, the electricity supply cannot be provided.

Changes in soil moisture and groundwater

Decrease of soil moisture and groundwater as well as a decrease of groundwater recharge are further effects of degradation (BAUMHAUER 2007). Due to the removal of the vegetation cover, the topsoil experiences an increase of evaporation and hence the formation of air spaces (aridification), which in turn reduces the water conductivity. This leads, on the one hand, to the creation of an evapotranspiration barrier, however, on the other hand it results in a decreasing infiltration rate and thus in increased surface runoff (MENSCHING 1990).

Changes in soil moisture and groundwater thus not only decrease the retention capacity of the soil but also increase the sediment load in the rivers which in turn negatively affects the sustainable use of the MHP.

4 Watershed Action Planning (WAP)

4.1 Identification of appropriate mitigation and intervention techniques

The filled checklist and questionnaire as well as the watershed map are the basis for the identification of appropriate mitigation and intervention techniques. Biophysical as well as political mitigation and intervention techniques are exemplary listed in figure 11 (see also figure 12 and 13).

Figure 11: Biophysical and political mitigation and intervention techniques, Source: K. Meder 2011.

Biophysical Techniques	Political Techniques
Gully control	Education and training
Terracing	Income generating measurements
Agroforestry	Participatory approach
Reforestation	
Revegetation	
Cultivation along contour lines	
Protection of springs and wetlands	
Water harvesting	
Crop rotation	

Figure 12: Terracing.
Source: K. Meder 2010.

Figure 13: Gully control.
Source: K. Meder 2010.

Box 1 shows three examples of how (rather simple) interventions can improve the environmental condition of the catchment. A more detailed list of mitigation and intervention techniques and the respective application can be found in Annex 3, pages 69 – 165 and Annex 4, pages 43 - 48.
Based on the EA findings, the watershed planning team should come up with a draft plan which ought to include the mitigation and intervention techniques that are supposed to be implemented as well as the respective responsibilities. It is recommended that the plan includes a map (in the same scale as the EA map), showing the type and locations of interventions as well as a time frame for the implementation process.

Box 1:

Fenced vs. unfenced springs/wetlands

Springs and wetlands not only guarantee the discharge in dry season, also they have a great retention capacity during and after rains. Springs are sensitive areas that react to disturbances easily. Protection of springs and wetlands is thus crucial for the sustainable use of the MHP projects. Protection measurements might include fencing (to protect the areas from cattle step and thus soil compaction), protection of natural vegetation around the springs as well as protection of a natural humus layer (in order to sustain sufficient infiltration and thus groundwater recharge). Furthermore fencing can help to improve the water quality, since pollution due to agricultural and pastoral use can be prevented (HELVETAS 2005).

Buffered vs. unbuffered riverbanks/wetlands

A buffer typically consists of a band of vegetation along a wetland or water body, preferably natural habitat, but including previously altered, stable native or introduced species. A buffer can perform a variety of functions, which can improve the environmental condition of a watershed, such as sediment removal and erosion control, runoff reduction through infiltration, reduction of human impacts by limiting easy access as well as barrier to invasion of exotic species (GALE undated). Thus buffers can benefit the sustainable use of the MHP and should hence be established and/or protected.

Eucalyptus vs. indigenous plants

Eucalyptus easily adapts to any soil and water condition, it is characterized by fast growth, high survival, long roots and hard leafs. Those features make it economically very beneficial. When it comes to watershed management, its negatives sides should be considered though: it does not only take a lot of nutrients and water and is hence a high competition to companion plants and decreases biodiversity, also soil erosion can occur which can negatively affect the MHP's performance. FAO thus recommends that large scale monocultures of eucalypt plantations be excluded from watersheds, aforestation projects should avoid monocultures and the use of eucalypts. The only way to include eucalyptus is to adopt it in agroforestry systems, but the proportion of each species should be planned out carefully (SUNGSUMARN 1993).

4.2 COMMUNITY INVOLVEMENT IN THE PLANNING PROCESS

Once the draft plan is completed, it should be presented to the community (upstream and downstream communities respectively). It is advisable that each mitigation and intervention technique be presented in detail, pointing out not only benefits (see box 3) but also ways of the community's participation in the implementation process. Any existing points of conflicts (see box 2) should be discussed carefully and compromises should be found.
The community's feedback, including critical comments, further suggestions and questions should be taken into account when revising and wrapping up the final action plan. As mentioned in chapter 2, this is crucial to increase people's acceptance and thus their willingness to invest in long term conservation.

Box 2: Points of conflict

Points of conflict may occur due to different interests of land users and stakeholders respectively. The MHP projects will primarily supply electricity to population living close to the powerhouse. Nonetheless, most of the mitigation and intervention techniques will most likely be implemented in upstream areas. These areas are most important for the retention capacity of the soil and thus for a stable discharge rate, which in turn is crucial for a sustainable use of the MHP. Hence the population upstream needs to understand the *long term benefit* (see box 3) they will gain from the implementation of various mitigation and intervention techniques, such as higher yields due to improved soils, although they will not directly benefit from the electricity supply.

Example:

Due to its economic benefit, Eucalyptus is extensively cultivated all over Ethiopia. Nevertheless it has negative effects on the ecological condition of the catchment are (see box 1) and its cultivation is thus not recommended in ecological terms (and in order to provide a sustainable use of the MHP). Hence there might evolve conflicts between economical and ecological interests.

Box 3: Economic benefit

The mitigation and intervention techniques will not only benefit the sustainable use of the MHP, also the ecological condition of the catchment area will improve as a whole. Due to the implemented measures, soil condition will sustainably be improved and thus economic benefit of the farmers will increase in the long run.

It should be noted that also more complex interrelations of benefits exist, as shown in the example.

Example:

The protection of springs is crucial in order to provide a sustainable use of the MHP. Fencing of spring areas will furthermore improve water quality, since pollutants will be kept from the springs. Thus, the health situation of the people living in the catchment area might improve.

4.3 Implementation

RESPONSIBILITIES

The community's investment in long term conservation and thus in the MHP's sustainability is not primarily of financial nature, rather the contribution of labor in the implementation process is the people's main investment (DESTA et al. 2005). Within the watershed action plan, the watershed planning team should thus lay down all commitments and responsibilities, including not only officials such as themselves but also the local population. Furthermore it is recommended to take into account whether there are any other projects (by NGOs, GOs and so on) on watershed management, conservation or alike in the area that might be incorporated in the implementation process.

TRAINING

In order to implement the various mitigation techniques properly, it is of great importance to train the local people that are involved in the implementation process. Agricultural training is provided by the rural development offices, hence it is recommended to incorporate the proposed mitigation techniques in the training that is already given. The alignment of existing training programs should be coordinated by the DA.

FINANCE

The financing of the implemented mitigation and intervention techniques should individually be aligned with the budget of the respective MHP project and its funders. Furthermore partial financial support should also be provided by the woreda's rural development offices as well as the community (as mentioned above for example in form of labor contribution).

4.4 Participatory Monitoring and Evaluation

It is recommended to also apply the participatory approach (chapter 2) to monitor the implementation process and to evaluate its outcomes. Making people, who actively participate in implementing the watershed action plan, part of the monitoring and evaluation process has the advantage that they can see for themselves how successful the implementation process is going and what changes should be made (Desta et al. 2005). During the monitoring and evaluation process it is important to collect repeatable and thus comparable data.

Since the sustainability of the MHP projects are closely connected to a continuous discharge rate as well as the sediment load, it is recommended to monitor the measures' effects on the water flow as well as on the sediment load (and thus to measure the discharge rate as well as the sediment load of the river over time). The monitoring data will not only provide information on whether the measures enhanced the condition for the MHP plant itself, but will furthermore show whether the overall environmental state of the watershed improved.

Since long term discharge and climate data in general is most often not available, it is recommended to measure the discharge once per day (e.g. at the intake), in order to establish a baseline for future monitoring results. In terms of sediment load it is recommended to remove and measure the sediment that builds up in front of the penstock every two to three months (but either way always in the same time interval). Data should be analyzed against the backdrop of the assumption that a reduced sediment load of rivers as well as a continuous discharge indicate an overall improvement of the catchments' environmental state and thus less erosion features and effects and an increased sustainability of the MHP plants.

It should be noted, that the recommended monitoring techniques are rather unparticular (discharge is for example highly dependent on precipitation, which is highly variable from year to year) and should only be considered a rough guideline. Hence it is recommended to repeat the entire environment assessment process every year in order to monitor the overall change in the catchment and to learn more about what measures were actually implemented successfully.

In order to get the best results out of the monitoring and evaluation process, it should be done consistently (repeating the same data collection after a specific period of time). All data collected during the monitoring and evaluation should be compiled by the DA.

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Annex 1: Questionnaire Environment Assessment

Name: ……….

Power house location (in degrees): ……………………………………………………………………………………….

Kebele: ……..

Woreda: …….

River: ………

Catchment Size (in ha)*: ……

Altitude (in m above sea level): Highest point: …………… Lowest point: …………………..

Topography (describe general topography, taking into account features such as valley types and slope**): …….

…….

…….

Discharge (in m3/s)***: annual: …………………..

seasonal:

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Discharge												

Hydrology (describe general hydrology, taking into account the discharge data). Leading questions might be: What is the prevailing stream pattern? Does meandering occur or is the river rather straight? Is the stream perennial (flow constantly), intermittent (may dry up) or ephemeral (flow only during or shortly after a rainfall event)?

……

……

……

Precipitation (in mm)***: annual: ………………………..

seasonal:

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Precipitation												

Agroclimatic Zone**** (also take into account the precipitation data, particularly the annual precipitation): ………

……….

Since when is the area populated? ……………………………………………………………………………………………

Current population of the catchment area: …………………………………………………………………………….

Density (population/ catchment area in km²): ………………………………………………………………………….

Distribution: ………

Are there any major changes in population (due to migration and/or fertility rate)? ………………………..

....

What do you know about the historic land use? ……………………………………………………………………………

………

Have there been any changes in land use? …………………………………………………………………………….

What kind of? ……

When and why? ……….

What do you know about the future land use, do you know of any planned changes/developments?

………………………..………………………………………………………………………………………………….

* see Annex 4, page 32
** see Annex 4, page 38 and/or Annex 5, page 20
*** check with responsible hydrological agency
**** see Annex 4, page 36

Annex 2: Checklist Environment Assessment

Land use			none	low	medium	high		unknown	notes
Cultivation	Permanent crops*								
	Annual/ temporary crops**								
Grazing***									
Forest ****									
Land use practices			Is applied		Is not applied				
Slash and burn practice									
Irrigation									
Drainage									
Rotational land use									

*list crop types according to quantity

**list crop types according to quantity

*** does a bias between fodder and non-fodder species exist?

yes	*no*

**** cross the prevailing forest type/use

natural	*human*
indigenous	*exotic*
timber/firewood	*no use*

Cultivation, Grazing, Forest

(in % of the respective area assessed)

Low = < 10 Medium = 10 – 20 High = >20

Natural resources			none	low	medium	high		unknown	notes
Wetlands									
Springs*****									
Waterways	With vegetation buffer								
	Without vegetation buffer								

Wetlands

(in % of the respective area assessed)

Low = < 1 Medium = 1 – 5 High = > 5

Springs

(Average number per km²)

Low = < 1 Medium = 1 – 3 High = > 3

***** cross the prevailing spring type

	buffered	*unbuffered*	

Water ways (with and without vegetation buffer)

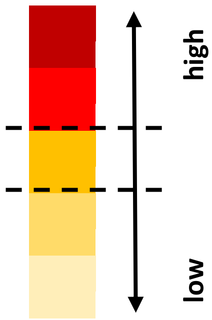
(in % of total length)

Low = < 25 Medium = 25 – 50 High = > 50

Degradation		none	low	medium	high		unknown	notes
Landslide								
Cattle step								
Gully erosion								
Badlands								
Riverbank erosion								
Sheet and splash erosion								

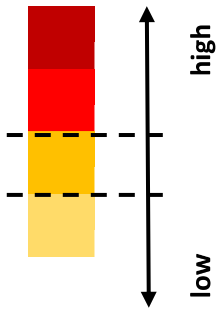
Landslides

		Average magnitude in m		
		< 5 x 5	< 10 x 10	>= 10 x 10
Average quantity/5 km²	> 1			
	1			
	< 1			



Cattle step

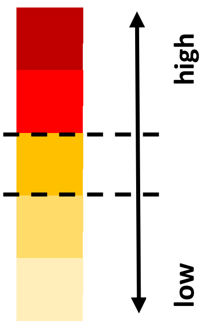
		Vegetation cover	
		Grass cover	Bare soil
Area in ha	> 10		
	5 - 10		
	< 5		



More than one cross is possible. Table above should be filled in according to prevailing color. In doubt cross the darker one.

Gully Erosion

		Average depth (in cm)		
		< 25	25 – 50	> 50
Average length (in m)	> 1			
	0.5 - 1			
	< 0.5			



Badlands, Riverbed erosion, Sheet and Splash erosion

(number of affected areas per 5 km²)

Low = < 1 Medium = 1 – 2 High = > 2

Mitigation Techniques		Is applied	Is not applied		unknown	notes
Terracing						
Afforestation						
Gully rehabilitation						
Agroforestry						
Cultivation along contour lines						
Fencing of plots						
Protection of sources and wetlands						

Red and green colors in the tables indicate, whether a low or high occurrence of the respective feature is rather positive or negative (Red = negative, Green = positive).

Note: The colors only give an indication, nonetheless it should be noted that for example forest which is used for timber and firewood is better than no forest for the environment condition of the watershed.

Annex 3: DESTA, L. et al. (ed.) (2005): *Part 1: Community Based Participatory Watershed Development: A Guideline*. Addis Ababa: Ministry of Agriculture and Rural Development.

Annex 4: DESTA, L. et al. (ed.) (2005): *Part 2: Community Based Participatory Watershed Development: Annex*. Addis Ababa: Ministry of Agriculture and Rural Development.

Annex 5: SCHNITZER, V. (2009): *Micro Hydro Power Scout Guide: A worker's manual know how to.*