



# Report of an integrated watershed management and water harvesting training workshop and experience sharing visit in the Ethiopian Highlands

Lulseged Tamene (CIAT), Kindu Mekonnen (ILRI), Kifle Woldearegay (Mekelle University) and Aberra Adie (ILRI)



Produced by

International Livestock Research Institute

Published by

International Livestock Research Institute

April 2014

[www.africa-rising.net](http://www.africa-rising.net)



The Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-for-development projects supported by the United States Agency for International Development as part of the U.S. government’s Feed the Future (FtF) initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three projects are led by the International Livestock Research Institute (in the Ethiopian Highlands) and the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa). The International Food Policy Research Institute leads an associated project on monitoring, evaluation, and impact assessment.



This document is licensed for use under a Creative Commons Attribution-Noncommercial-Share Alike 3.0 Unported License

This document was made possible with support from the American people delivered through the United States Agency for International Development (USAID) as part of the US Government’s Feed the Future Initiative. The contents are the responsibility of the producing organization and do not necessarily reflect the opinion of USAID or the U.S. Government.

# Contents

Introduction .....	1
Training and capacity development.....	7
Training of Lemo Woreda experts and relevant partners .....	7
Training of Basona Worena Woreda experts and relevant partners.....	13
Experience sharing visit in Tigray.....	18
Conclusions .....	21
References .....	22
Annex 1: Workshop program.....	24
Annex 2: Participants .....	25

# Introduction

Land degradation is increasing in severity and extent in many parts of the world, seriously affecting more than 20% of all cultivated areas, 30% of forests and 10% of grasslands (Bai et al., 2008). Land degradation is especially widespread in Sub-Saharan Africa (SSA), affecting 20-50% of the land and some 200 million people (Scherr, 2000; Snel and Bot, 2003; Nkonya et al., 2008; Obalum et al. 2012)). An estimated 65% of Africa's agricultural land is degraded due to erosion and/or chemical and physical damage (FAO, 2005; UNEP, 2008). Within the SSA sub-region, the highland of Ethiopia is believed to experience one of the highest levels of land degradation (FAO, 1986; Hurni, 1988; Bojo and Cassels, 1995, Sonneveld, 2002; Jolejole-Foreman, 2012). Deforestation, soil erosion, and nutrient mining are the major forms of land degradation in the country (Girma, 2001; Sonneveld, 2002).

Some analysis based on historical evidences show that a deforestation rate of over 160,000 ha a year has resulted in a dramatic decline in forest cover from 40% to less than 3%, turning the majority of Ethiopian into barren land (Bishaw, 2001; World Bank, 2001; Berry et al. 2003). This has resulted in high erosion, nutrient depletion, firewood scarcity, and increasing use of animal dung and crop residues for household fuel rather than added to the soil to improve fertility (Bishaw and Abdelkadir, 2003). Soil erosion due to steep slope, poor surface cover and intensive rainfall is the most serious form of land degradation in Ethiopia. Soil erosion rate in the highlands of Ethiopia reaches over 130 t ha<sup>-1</sup> year<sup>-1</sup> (Sutcliffe, 1993; Berry, 2003). The direct cost of soil loss and its essential nutrients due to unsustainable land management reaches at \$106 million a year (Bojo and Cossells, 1995; Berry, 2009). Due to severity of soil loss from upslope and rapid siltation, the water harvesting schemes developed for supplemental irrigation have brought little success (Haregeweyn et al. 2005; Tamene & Vlek 2007). Erosion has also caused sedimentation of hydropower dams resulting in significant economic loss due to frequent power cut. These high erosion and sedimentation processes will also have huge implication on the various hydropower plants recently completed and those under construction including the Renaissance Dam planned to provide power for local use and export. Population pressure and climate change will likely intensify the land degradation process and further reduce resilience. Ethiopia is thus generally locked in a disturbing cycle of land degradation-poverty-land degradation syndrome. As a result there is an urgent need to prevent further degradation and retain the multiple values of productivity through capitalizing on the natural recovery and restoration strategies such as area closures, re-afforestation, soil and water conservation as well as other sustainable land management programs.

Against this background, huge landscape restoration effort has been underway in Ethiopia since the 1970s with the assistance of different international organizations. Currently, it is generally claimed that billions of trees have been planted, and millions of hectares of land treated through the construction of terraces, deep trenches, percolation ponds, etc. across the different parts of the country. However, there are still many areas untreated, some of the efforts have not succeeded and in many instances failures are believed to be due to inadequate capacity to implement relevant technologies at appropriate places. Cognizant of these challenges, the Africa RISING project in the highlands of Ethiopia took an initiative to develop protocol around "Integrated Natural Resources Management". Though the project in collaboration with CGIAR centers and national partners has been working very closely with the national partner institutions and farmers at farm/household scale

since 2012, it has identified integrated land and water resources management at landscape scale as key interventions to promote sustainable intensification at farm/plot level. To achieve this model watersheds were identified where ‘research and development’ efforts will be married to strengthen partnerships, scale the technologies and management practices from farm to landscapes/watersheds and enable farmers realize the benefits of various interventions.

Based on one of the seven research themes of the AR Ethiopian highlands project: “Integrated Land and Water Management to Enhance Sustainable Intensification and Improve Food Security”, CIAT took the initiative to lead a protocol under the title “Enhancing food security and environmental stability through landscape based integrated water and land management”. The research protocol including approaches and outputs were developed in collaboration with ILRI, ICRAF, IWMI, ICRISAT and Mekelle University. One of the propositions of the protocol is that sustainable intensification at farm scale cannot be achieved unless land improvement measures are taken through sustainable water and land management at landscape scale. The main aim of the protocol is thus to ‘create climate-smart landscapes’ that not only promote intensification and diversification but also are more resilient to climate shocks and human impacts – thus are suited to enhance food security through sustainable intensification.

Considering that participatory landscape based integrated natural resources management (soil, water, biological resources) is useful approach to reduce resources degradation and improve agricultural productivity, the protocol was designed in such a way that the community will play the major role in designing and implementing land and water management options with AR leading several components mainly: (a) capacity building, (b) experience sharing, and (c) exposing the communities and local level leadership to different packages of suitable technologies that are suitable for different landscape positions and resource bases. Because different potentials and constraints exist across the landscape continuum, it will be essential to design and implement targeted interventions geared to specific landscape and socio-economic conditions. In this protocol it was emphasized that community based participatory approach will form the basis for improving food security through targeted interventions such as soil and water conservation, afforestation, enclosures, agroforestry, water storage and recharging options (percolation systems, check dams, ditches, deep trenches, etc.), water harvesting structures (stream/river diversion, borehole, check-dams, ponds, cisterns, etc.), and promoting horticulture and home-gardens across different landscape positions. The first step of implementation was awareness creation followed by experience sharing, community mobilization, capacity building, partnerships and multidisciplinary approaches to enhance technology adoption and sustainable use.

Since ‘improved land and water management’ needs to follow an integrated approach to bring the desired change and be sustainable to local condition, the protocol identifies that improved agroforestry practices (trees, fruit trees, vegetables) and livestock feed and pasture management are key components. That means that the physical and biological conservation practices need to be designed to include ‘agroforestry and pasture’ related practices – solely in appropriate locations or integrated with the soil and water conservation options. In addition, crop and soil fertility management practices will be included to understand the role of improved land and water management in improving land productivity and enhancing food security.

In its first phase, the protocol will be implemented in two AR sites: Basona (Debre Birhan) and Lemo

(Hossana) with the aim of creating “climate-smart Africa RISING landscapes” where integrated land and water management technologies will be demonstrated and implemented. Watershed inventory, Hydrological modelling and community evaluation approaches will be used to establish baseline and assess the impacts of interventions and facilitate out-/up-scaling of technologies to other areas. To achieve this, the protocol has identified different steps the first of which was ‘problem and constraint analysis’ followed by training and capacity building. Below we report some of the major activities thus far focusing on baseline assessment, constraint analysis, training and capacity building components.

## **Work plan towards protocol implementation**

To plan and implement suitable and sustainable landscape management options, it is first important to conduct detailed situation analysis. This helps understand the major problems existing in the target areas, the opportunities prevalent in the areas and identify the major biophysical and socio-economic constraints that may impede implementing technologies. To achieve this, two steps were followed in this protocol: field visit and focus group discussion.

### *Problem, opportunity and constraint analysis based on field visits*

Repeated field visits were conducted in the Basona site during the months of July, August and September 2014 while two separate visits were made at the Lemo site (months of July and September 2014). The main goal was to observe the landscape conditions, identify major land and water related problems, identify opportunities as well as understand constraints. The visits also helped observe and characterize some of the key intervention efforts in the sites. The baseline assessment also serves to monitor trend by comparing changes over time.

As observed in the Basona site (Debre Birhan), it can be seen that Gudo Beret Kebele has serious land degradation problems specifically in the form of soil erosion (gully) and landslide (photo 1a & b). Due to gully development (photo 1a) farmlands have been damaged and previously existing springs disappeared. Based on communication with local farmers, in some cases flow direction had changed (due to severe erosion) which lead to the abandonment of irrigation practices. In addition, gully erosion coupled with the presence of sub-surface water resulted in the initiation of landslides in the area (photo 1b). It is also observed that there is high water harvesting potential in the form of shallow wells. This means that integrated landscape management will not only help arrest land degradation but also enhance water availability/ harvesting and promote irrigation.



Photo 1 (a) Gully erosion and (b) associated landslide causing damage on farm lands in Gudo Beret Kebele, Debre Berhan area, Ethiopia

To tackle the above degradation problems, enhance moisture and harvest water, different efforts have been undertaken in the Kebele. Few of the examples include soil and water conservation and natural resource management practices (Photo 2a and 2b), gully treatment measures Photo 2c and 2d), and water harvesting practices and construction of ponds.

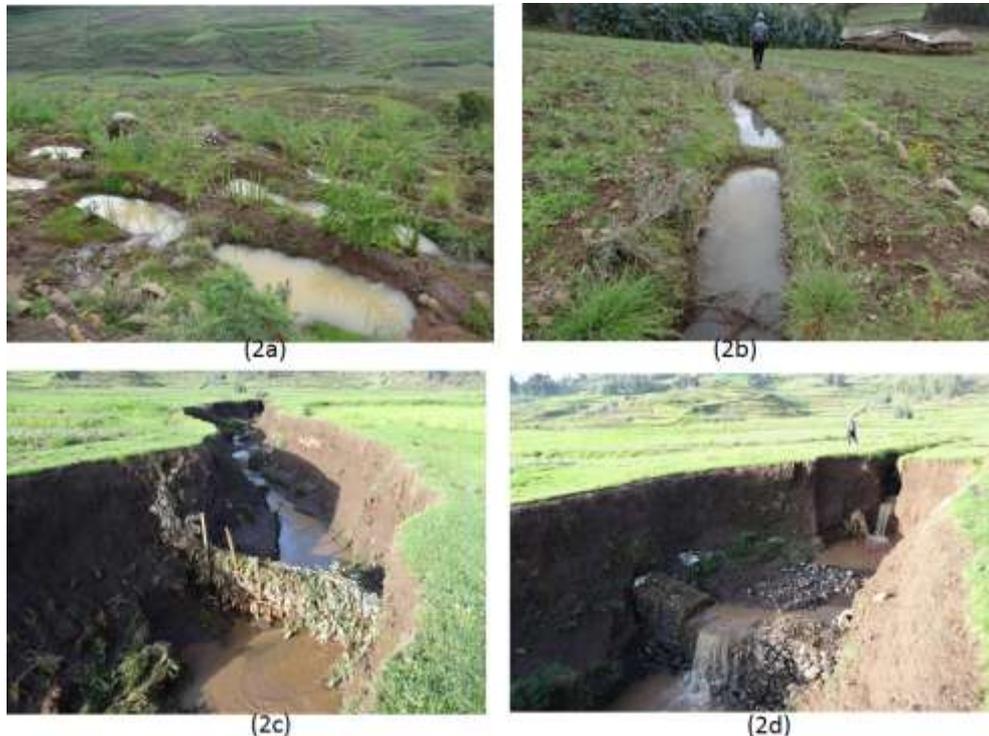


Photo 2 (a) Example of deep trenches, (b) stone faced soil bunds with deep trenches and biological measures (c) Brush check-dam, and (d) gabion check-dam constructed as gully treatment options in Gudo Beret Kebele, Debre Birhan area, Ethiopia

Observation of some of the interventions made in the site and discussion with community members and local experts clearly show that there are challenges in the implementation of the interventions.

For instance, the gully treatment measures are not properly executed because of technical capacity limitations and also biological measures are not integrated to stabilize gullies and their banks. In addition, most of the interventions are implemented in 'isolated pieces' and no integrated approaches are employed to address land and water degradation issues across the whole landscape. These indicate that training and capacity building which includes experience sharing to sites with best practices are needed to make sure that appropriate technologies are identified and properly implemented in an integrated manner. Discussion with Woreda level administration bodies as well as experts also showed the need to train local experts on different SLM and water harvesting techniques.

In both Basona and Lemo sites the experts indicated the following key areas where they would like to have training and experience sharing: (i) how to determine and identify the kinds of interventions to be placed in a landscape in such a way that they could provide the optimum benefit for both upslope and downslope landscape and communities; (ii) understand the design and construction of different water harvesting and erosion control measures like check-dams of different types and sizes; (iii) understand how to design and construct series of percolation ponds at a landscape level,

(iv) learn about the identification and execution of different agroforestry practices across different landscape positions; (v) understand the integration of physical and biological conservation options specifically feed and forage as well as fruit trees and vegetables . As a result, training and capacity development is considered one of the priority interventions under the protocol.

*Problem and constraint mapping based on focus group discussion*

In addition to the various field surveys and expert consultations, it was necessary to conduct discussion with the local community about the major problems observed in the sites and possible interventions they think should be implemented. Accordingly, focus group discussions were conducted at Gudo Beret kebele involving 22 farmers of 16 male and 6 female group. An effort was made such that the participants come from different parts of the kebele and are knowledgeable of the surroundings.

The focused group discussion resumed by highlighting the goal of the exercise and the processes to be followed. The goal was to discuss with local communities and understand the major constraints and opportunities they have. It also included discussing the potential solutions communities think to be implemented to tackle the constraints. The process started with identification of relevant stakeholders (farmers who know the areas and development agents) followed by discussion with them *to identify locations of existing and scheduled SLM interventions as well as the hotspots and distribution of degradation features in the kebele landscape and to understand how the community views various SLM options with which they are familiar.* To facilitate the discussion, high resolution satellite image was shown to the participants and asked to identify key places within their community. Once things have become clear farmers were asked to mark features, changes and areas of degradation hotspots. These were then concurrently digitized into GIS for later analysis.

Table 1.Pair wise comparison matrix

No.	Major Constraints	1	2	3	4	5	6	7	8	9	Score	Rank
1	Gully erosion	x	2	3	4	5	1	1	1	1	4	5
2	Faba bean and field pea disease		x	2	2	2	2	2	2	2	8	1
3	Wheat rust			x	4	5	3	3	3	3	5	4
4	Seasonal water scarcity				x	4	4	4	4	4	7	2
5	Land slide					x	5	5	5	5	6	3
6	Irrigation canal seepage						x	6	6	6	3	6
7	Climate change							x	8	9	0	9
8	Introduction of technologies without adaptation study								x	9	1	8
9	Seed quality									x	2	7

Once the major constraints of Gudo Beret Kebele were identified based on group discussion, they were prioritized using pair-wise comparison matrix. Results showed that farmers consider crop disease, seasonal water scarcity, landslide, wheat rust and gully erosion as very serious problems in the Kebele (Table 1). Table 2 shows the potential interventions required to tackle some of the problems based on the perceptions of local farmers. As can be seen in this table farmers have identified both physical and biological options to tackle land degradation in the form of soil erosion and landslide while they recommended changing variety to counter bean and wheat diseases.

Table 2. Possible solutions to tackle the constraints

No.	Major Constraints	Proposed solutions by the farmers
1	Gully erosion	Check dams using different materials (gabions, brush, etc.) with proper design (spillway, , side key, apron, depth), gully reshaping
2	Faba bean and field pea disease	Changing crop variety, timely delivery of chemicals, changing the chemicals
3	Wheat rust	Changing crop variety
4	Seasonal water scarcity	Water harvesting, spring development
5	Landslide	Stabilization with check-dams
6	Irrigation cannel seepage	Repair/maintain the irrigation cannel
7	Climate change	Tree planting
8	Introduction of technologies without adaptation study	Local specific adaptation study and soil test based technology recommendation
9	Seed quality	Change the seeds

# Training and capacity development

## Components and objectives of the training events

Based on our observation of the landscapes and some of the interventions as well as discussion with Woreda level experts at both Debre Birhan and Hossana, consensus was reached for a need to train local experts and farmers on SLM and water harvesting as well as overall integrated watershed management options. The themes of the training were identified based on field observation and request from Woreda and Kebele level experts as well as local administration bodies. Accordingly the main objectives of the training were:

- To support the extension and government effort on IWM - One of the activities planned under the project during 2014 is providing training for extension officers, researchers, University instructors, NGOs and local government bodies) on implementation modalities of various approaches and technologies.
- Scaling-up/out of technologies and practices which emerge as promising and accepted by the community from past and ongoing experiments.

Considering the theme of training requested by partners and the focus of the protocol which is to implement integrated landscape management practices and ultimately create 'climate-smart' landscapes, team of experts from CIAT, ILRI, Mekelle University and ICRAF were involved in designing and executing the first round of training at Lemo (Hossana) and Basona (Debre Birhan). The experts who conducted the training include Dr. Lulseged Tamene (CIAT), Dr. Kindu Mekonnen (ILRI), Dr. Kifle Woldearegay (Mekelle University), Mr. Aberra Adie (ILRI), Mr. Nigussie Hagazi (ICRAF). The training was conducted in the period 14-15 December, 2014 at Lemo Woreda (Hossana) and 18 December, 2014 at Basona Worana (Debre Birhan). At both places the training was accompanied by field visit to on-going/existing soil and water management practices and gap identification for potential intervention in the selected watersheds at the respective Kebeles. The training program at each site has been concluded with development of action plan for immediate activities during the current year of watershed and moisture conservation movement (January –June 2015) and sharing of responsibilities. Below we discuss details of the training and experience sharing events at the two Kebeles.

## Training of Lemo Woreda experts and relevant partners

The training and experience sharing in the Lemo Woreda was conducted on the afternoon of 14 December and morning (up to 1:00 PM) of 15 December 2014. A total of 20 participants from Areka and Worabe Research Centers, Lemo Woreda Administration (including the Woreda Administrator), Lemo Woreda Office of Agriculture (including sector offices), staff members from Wachemo University and extension staff from Upper Gana and Jawe kebeles participated in the training. The training was conducted as per the program shown in Annex 1.

Brief introductions about the general concepts and principles of integrated watershed management has been made by the trainers followed by sharing of lessons related to the Lemo Woreda land and water degradation problems, watershed management efforts and major constraints of effective implementation of watershed management technologies. Power point presentations composed of mainly illustration of various soil and water management problems and remedial practices from various areas in Ethiopia created great deal inspiration for the participants. The different

components of integrated watershed management (water, soil, crop, livestock, and trees) and their interactions have also been explained by the trainers. A great deal of discussion around the major challenges, intervention efforts, achievements and constraints that hindered achieving expected results has been made by the participants.

The major issues/problems raised by the Woreda and Kebele stakeholders include:

Poor soil fertility	Water inaccessibility	Fragile soil	Free grazing
Soil erosion	High population pressure	Land fragmentation	Livestock feed shortage
Wind erosion	Human and livestock diseases	Deforestation	Barren lands due to soil degradation
Siltation			

In addition to the above, the participants indicated shortage of capacity and technology options, and lack of awareness on the management and utilization of econ-system resources as additional challenges. The discussion also highlighted that the problems are interrelated one feeding to the other. For instance, due to population pressure there is land scarcity, which leads to inappropriate land use including cultivation of steep slope areas. This further leads to erosion and further degradation as well as downstream siltation. It was also mentioned that in some cases the main issue is the level of awareness within the society regarding integrated watershed management. For instance, there is a huge water potential and water is generally available but because of unwise use and/or lack of knowledge to exploit the existing potential people often mention water shortage as a big problem. Considering that land degradation especially soil erosion and nutrient depletion are silent problems (their temporal degradation level is not visible) awareness creation and capacity development are crucial interventions.

After identifying the major problems/issues, the next step was discussion of the key land and water management interventions implemented in the Woreda to tackle the observed problems. The discussion highlighted key past and existing watershed management initiatives including:

- Physical SWC practices were implemented to tackle soil degradation. About 30-35 watersheds with land area of 200-500 ha each have been covered by the physical SWC campaign (through projects and mass mobilization mainly during the off season).
- In recent times some (mainly in the next three years) efforts were made to include biological SWC practices; the previous interventions however did not give much attention to biological measures and area closures.
- Area closures were implemented in some selected watersheds in the recent interventions.
- Fodder trees were introduced in the new interventions (Photo 3a) particularly those implemented in the last three years.
- Spring rehabilitation and shallow well development were implemented in limited cases to enhance water availability for irrigation and drinking.

With implementation of some of the above interventions, the following key achievements were made:

- Recovery of forest (tree cover) is emerging – with some photo evidences available to compare.
- Areas closures, natural grass recovery, improved forage are observable in some areas.
- SWC measures led to recovery of springs and improvements in discharge of existing ones.
- Cut- and carry is implemented in some areas which reduces pressure on land and enhances the fertility of the soil.
- Some wildlife have re-appeared in areas with treated watersheds.
- Regrowth/regeneration of indigenous trees: due to the implementation of area closures regrowth of indigenous tree is emerging.



Photo 3. Example SWC interventions and fodder introduced in Lemo Woreda AR project site

Despite the observed success stories in some isolated cases there are still challenges facing the successful implementation of integrated soil, land and water management interventions. Some of the major challenges of past and present watershed management efforts include:

- Past watershed management practices which were done by safety net program were merely physical SWC practices which were not able to protect the soil and water.
- Efforts to include biological SWC practices at the initial stage was not considered.
- Most of the efforts were not integrated (crop-livestock-agroforestry) and did not consider holistic approach thus overall success is low.
- There was unequal participation of gender (men and women) where the involvement of women was less. This reduced inclusiveness and participation of all stakeholders.
- Insufficient technology options both for physical and biological SWC: most of the implemented physical measures had technical problems and limited biological options were implemented.
- There was no proper documentation of impacts of past and present practices to justify the feasibility of the technologies and practices as well as approaches.
- Youth were not effectively linked to the watershed management efforts and to benefit sharing: many of the watershed interventions did not aim at making the land productive and youth and women were not considered as priority.

- SWC efforts were not linked with livelihood/biophysical/social/environmental benefits; the package of SWC was not targeting benefits at different stages of the interventions.
- Rural road construction works create gully erosion, flooding of downstream areas and water logging; this is mainly with the creation of concentrated flow (from road sides and culverts) and options of managing water from roads was not considered.
- Despite enclosure, free grazing still cause's degradation: though area enclosures are implemented in some places, communities still are not able to fully implement zero grazing and this is causing problem on land and water management.
- Despite the majority of interventions were done through mass mobilization, there was no adequate awareness – thus the people didn't internalize the potential benefits of technologies and implemented interventions.
- There is still shortage of forage thus farmers send their cattle to graze on cultivated fields. Forage quality is also poor creating pressure on productivity.
- There is still focus on physical SWC with no adequate emphasis on biological measures including agroforestry and forage.
- Though water is a key issue, emphasis on water development and management was poor and still remains a challenge.

Considering the above challenges, further discussion was made related to “what should be done” to tackle the challenges and enhance tangible impacts on the ground. The participants identified the following options to be implemented with the objective of improving the condition of the selected watershed so as to realize its sustainable benefit to the society.

- Restrict free grazing: through such interventions the communities believe that the land can be reclaimed and productivity be enhanced.
- Provide feed and fodder option as part of the package of SWC and other NRM interventions so that grazing can be restricted.
- Integrate biological SWC technologies: this includes introduce/strengthen nurseries to raise planting materials and implement biological SWC options.
- Delineate land for different purposes according to its potentials which includes for crops, trees, livestock etc. and implement watershed development accordingly.
- Increase community participation, awareness creation and capacity building: farmers should own the interventions, have awareness on the short-term and long-term benefits of SWC and NRM management, and have the capacity on the technologies to implement the interventions.
- Strengthen local bylaws and create if they don't exist: this includes bylaws on watershed management, water harvesting and management of communal resources.
- Improve livestock breeds and reduce livestock number: the communities have many but less productive livestock; better to improve livestock breeds and not focus on numbers.
- Introduce improved livestock production system including milk processing: as part of the market linkage it is necessary to focus on agro-processing for livestock products.
- Work on youth empowerment: the participants have stressed the need for implementing interventions that could create jobs to youth and women.
- Focus on water developments and management for multiple use including drinking, livestock and irrigation purposes.

The major challenge as repeatedly mentioned during the discussion was lack of awareness of the local community about the SWC as well as land and water management interventions. Especially when community work is implemented as mass mobilization following top-down approach the community will have less awareness about the ultimate benefit of the intervention at household level and thus bear less level of responsibility in maintaining the structures and revitalizing the landscape. This project aims to work closely with the community at the selected mini-watershed so as to increase level of awareness and create responsibility within the community in implementing, managing and maintaining.

#### *Field visit to Jawe kebele*

On the morning of day 2 (December 15, 2014), all participants traveled to Jawe kebele (Shelala sub kebele) to visit the model watershed where different management practices are implemented by the community. The Gombora river watershed consisting of 60 household situated on a steep slope land is one of the watersheds covered by the woreda's plan for SWC campaign in 2015. Some biological effort with Desho grass planted on soil bunds of the lands of 15 households is becoming a showcase for the woreda to demonstrate the INRM efforts. Desho grass is well maintained, protected from free grazing – the local bylaw penalizes any free grazer Birr 50 and 100 for each head of sheep/calf and mature cattle respectively. The extension staff mentioned that farmers witness the increase in crop yield since the SWC practice was implemented (two years old) due to reduction of leaching of chemical fertilizer and seed due to the soil erosion. However, it has been noticed that the farmers could benefit more if they could include Multi-Purpose-Trees/Agroforestry trees, fruit trees or fodder trees in to the system. Suggestion was made to include these in future interventions. Agreement has been reached to pilot the AR INRM intervention following the Woreda's SWC plots in the Gombora watershed instead of starting very far so as to facilitate experience sharing and demonstrations. Farmers witness three-fold increase in crop yield since the physical and biological interventions were implemented on Gombora watershed. It was suggested that detailed impact assessment needs to be done in order to justify the change in crop yield.

Another issue discussed during the field visit was the issue of water accessibility (harvesting) for small scale irrigation, livestock and other household uses. It has been noticed that there is a huge potential to harvest surface and ground water for various purposes in the area. In the lower landscapes, excess water becomes a problem while the upper hills suffer from soil erosion and water shortage. During the discussion, the CGIAR team highlighted that there are many options of water harvesting which can be demonstrated to the farmers to collect water at the different landscape levels in order to alleviate the problems of both the excess and shortage of water. After discussing with some farmers, it has been understood that ponds (around homesteads) and wells on the lower slopes can be constructed to harvest water for irrigation and other purposes. The ponds can be used to harvest rainfall and even for roof water harvesting while surface and groundwater can be exploited using wells. Finally it was agreed that selected farmers who can volunteer and have the capacity to implement such interventions can be used to demonstrate the technologies for further upscaling. One local farmer called Haji Hamid has volunteered to implement water harvesting technologies and he has also indicated that there are others who will be interested to implement. Most however suggested that they will be happy if they can get access to purchase plastic linings for pond construction. Since some farmers who have hand dug shallow wells complained that the wells collapsed during excavations, there is a need to build capacity of farmers on well construction

methods especially when the groundwater is shallow. Experiences from other sites (especially Tigray) can be used to train local farmers.

### *Round up discussions*

After the field visit, participants met for reflections of observations on the field visit, overall training process and future project plan. Dr. Kifle presented options of water harvesting and gully treatment methods from Tigray's experience. He mentioned in his presentation that road side gullies which were mentioned by the local stakeholders as a challenge can be turned to an opportunity for irrigation and other uses of water if proper water harvesting structures are used. He expressed his bold optimism that the currently degrading watersheds can be recovered (reclaimed) soon if all concerned bodies are serious and committed to the INRM efforts.

The next activity during the round up session was development of action plan, sharing of responsibilities and resource mobilization for the intended activities. Ato Wondimu Anise, the Lemo Woreda administrator, expressed his appreciation for the project and the training program which he said has come at the right time when they are about to begin the year's (January 2015) SWC campaign. He also said that he will take responsibility of mobilizing the community and arousing the farmers' interest and even to the extent of requesting the community to contribute money for the intervention if there are no other funding options. He further committed himself to take up the project's issue to the Woreda political bureau (cabinet) level so that the plan becomes part of the Woreda's own plan. Dr. Kindu, on behalf of the AR project explained that the project doesn't have financial budget for the expanded water harvesting technologies but can provide services like identifying suitable technologies, training, and demonstration of selected interventions when necessary and conduct research support including impact assessment. He also mentioned that some modest interventions can be funded by the project to demonstrate selected technologies so that the community can adopt and out-scale.

### *Action plan*

Finally, the action plan (Table 3) for the initial activities during the current year has been developed and participants who will take part in the experience sharing visit to Abrehawa Atsbeha community integrated watershed management practices in Tigray have been selected by the woreda and kebele staff. Comments and reflections from few representatives regarding the training process and overall impressions were received. Two members (Ato Belayneh Osire and Ato Tamirat Erjino) from the woreda office of agriculture have been assigned by the participants to be focal persons for the project.

Table 3 Lemo Woreda Integrated Watershed Management Action Plan

S/N	Activity	Duration	Responsible Institution
1	Discussion with communities	Up to Dec 28/2014	Andualem??
2	Farmers Selection	Up to 13/12/2014	Lemo Woreda Office of Agriculture(Belayneh Osire and Tamirat Erjeno)
3	Experience Sharing to Tigray Region	19-25/12/2014	ILRI/Africa RISING Project
4	Community Discussion	Up to 28/12/2014	Kebele Agric. office head (Andualem Bezabih) and Woreda Office of Agric. experts
5	Identify Technology options(Inputs)	Up to 28/12/2014	CGIAR Centers, Research Centers, Universities and Woreda Administration
6	Water Harvesting Options	Up to 28/12/2014	Mekelle University, CIAT
7	Community mobilization and fund raising	Up to January 9,2015	Lemo Woreda Administration

### **Training of Basona Worena Woreda experts and relevant partners**

Like the case of Lemo, the training in Basona started with the basics of integrated landscape planning. This was followed by discussion of the problems, interventions, benefits and constraints observed in the area. The following are some of the major experiences, lessons and challenges raised by the participants:

- Lack of integrated planning of watershed management: the previous intervention efforts tried in the area did not implement integrated and participatory watershed management.
- Knowledge gap in watershed management planning: there was limited capacity to develop integrated watershed management plan.
- Lack of model site visit for experience sharing: one of the very important issues raised by the communities is that there was no properly planned and implemented watershed which could be used as model for experience sharing and trainings of communities.
- Forage shortage: on the major issues raised by farmers is shortage of forage especially during the dry season.
- Water shortage: despite the high rainfall of the area, water shortage (especially during dry season) is a major constraint.
- Lack of integration with the Debre Birhan University: participants have stressed the need to integrate research with development and hence stressed to have stronger collaboration with universities and research institutions.
- Few farmers create problems by using free grazing: though there is a positive development on the awareness of the communities to have zero grazing, still few farmers do not implement these bylaws and hence there is a need to work more on community awareness creation.
- Some NGOs did not follow formal procedure to approach the local community: in order to bring change there is a need to approach communities in a proper manner following formal

procedures.

- Lack of know how to manage and use the forage crops: though farmers have access to different forage crops they have limitations in managing and using the forage crops properly.
- Lack of integration with the extension in watershed development activities: full integration with extension agents, local administration and the communities is important to have effective implementation of watershed management and water harvesting.
- Some farmers cultivate the terrace: despite the agreements among the communities some farmers are cultivating the terraces in need of additional income.

Opportunities/Benefits of the interventions:

- As an opportunity experts enthusiasm increased, guideline developed in order to assist the local byelaw development, and IP created at different level.
- Responsibility of farmers increased: this is because of the fact that farmers are able to realize the importance of the interventions and hence taking the responsibility to implement the interventions.
- Implementation guidelines ready to prepare byelaws.
- 30 years' experience of watershed management research and development in AnditTid watershed. As a result integrated technologies are introduced and scale out and used as learning site. This need to be strengthened and scaled-out to other areas.
- The watershed management intervention increased from mini to micro-watershed level: the approach and scale of intervention in watershed management has changed from mini to micro-watershed levels.

Constraints to sustain benefits:

- Unable to scale-out the experience of AnditTid watershed to other areas: the experience and technologies implemented in AnditTid was not tried to be implemented in other areas.

Future plans to rectify constraints and improve technology adoption as well as increase benefits:

- Debre Birhan University's efforts: the Debre Birhan University has mentioned that it is planning and ready to develop model site inside the University campus.
- Woreda level plans: there are proposals in watershed management in other Woredas as mentioned by the Woreda administration office.

After the above discussions were made by partners on technology implementation efforts, benefits, challenges and future steps, they have inquired about the success stories in Tigray. One key question raised was about how it was possible to implement integrated watershed management in Tigray and what the secret behind the success was. Dr. Kifle explained some of the opportunities as below:

- First and for most the top leadership takes the front lead; this includes the leadership at all levels starting from Kebele to Woreda and regional offices.
- There was strong evaluation and resistance was faced from experts in using 60 day free labor but because of the great political commitment played by the region everybody has to support the development.
- Through implementing feasible technologies and experience sharing to sites with best

practices, farmers and experts managed to be more aware on the importance of the interventions and finally got strong commitment towards implementation of the interventions.

- Strong commitment of the local leadership and full support of the government bodies at all levels: this is one of the most important components for successful implementations of interventions.
- The NGOs are guided by the leadership of the government to integrate with the extension: all the NGO's operating in watershed management and water harvesting operate under full assistance of the government bodies.
- Higher education institutions being involved in applied research that supports the interventions: one of the reasons for the success of interventions in Tigray has been the involvement of higher education institutions and research centers in research, capacity building and dissemination of the interventions in the region.
- NRM and SWC interventions became key solutions to the food insecurity problem in the region: the Tigray regional state and all the political system as well as the communities have made strong case that watershed management is the key solution to the water and food insecurity in Tigray.

#### *Field visit*

The participants have visited the on-going intervention site where a number of activities are going-on which include: construction of deep trenches with soil bunds, percolation ponds/pits, check-dams, and afforestation activities. Endale Lemma (head of the Basona Woreda Office of Agriculture and Rural Development) has explained the on-going efforts of implementations (photo 4).

Participants, especially those coming from the Debre Birhan University have mentioned that they were not aware of these on-going developments and appreciated the Woreda for the great efforts and thanked Africa RISING project for creating such a forum that tries to link all the partners for this highly important activities. Participants have visited successful interventions started by the Woreda which need to be scaled-up in the next watershed movement in the Woreda. The Woreda, participants and Africa RISING project team have all agreed to work together to make a model site for the area in terms of SWC, agroforestry and other eco-system related interventions in which all the partners will have their own roles.

In addition, a number of research areas on existing interventions and practices were identified. Some of them are management and utilization of already introduced forages and existing feed sources (private and communal grazing lands, crop residues and locally available fodder trees); identification of niches where to harvest water and how to use the existing water sources; and identification of tree and shrub species and management practices that can support restoration of upstream parts of the model watersheds and bridge the gap on energy demands.



Photo 4: Stakeholders discussing at Debre Birhan AR site.

### *Feedback*

At the end of the workshop there was a feedback session and the main points raised by the participants include:

- The training was very good and gave participants insight to use the site as learning watershed: this is mainly for the watershed where interventions have started last year and which will be done in the 2015 watershed movement.
- It would be good if more participants from different department of the Universities would have joined the training.
- The Tigray experience gave us a good insight of watershed management and if this was done in a region with less resource base (more degraded land, less and more erratic rainfall) there will have a great opportunity to do better in the Woreda through better training and experience sharing.
- Participants highly appreciated AR project and the CGIAR centers involved in the IWM exercise for the quick response to the capacity building request on a very important issue in a very critical time as the Woreda is preparing massive watershed movement program starting Dec. 24.
- The technical backstopping and experience sharing is highly valuable and there will be a need for such support to continue in the due course of the implementation of the planned interventions.
- The Tigray experience indicated that the region has learned from mistakes and failure. With proper training and experience sharing the Woreda can benefit from the lessons learnt in Tigray and avoid repeating mistakes.
- The innovation platform (IP) should be strengthened and the University and other research institutions should come on-board and even to the forefront to support the on-going interventions through research and capacity building.
- The participants identified the training to be very interesting and highly relevant.
- Unlike other partners good move is taken by AR: the participants have stressed the key role

that AR project has played in coordinating the stakeholders, organizing this training and experience sharing in a topic which is very critical for the implementation of the SWC and other NRM interventions.

- The participants promised to implement SLM options and create a learning site for others.

#### *Action plan*

After detailed discussion and deliberations on the way forward, some critical action points were identified and responsibilities assigned. In addition, tentative time plan was suggested for the execution of each plan (Table 5).

Table 5 Basona Worena Woreda Integrated Watershed Management Action Plan

No	Activities/ Tasks	Responsibility	Time line
1	Water development (technology niche)	Office of Agriculture and AR	Jan. 3, 2015
2	Generation of evidences for active initiatives	AR and DB research	On-going
3	Revision of current SWC work (Gully, water harvesting, biophysical SWC)	Office of Agriculture, DB research, AR and DB University	Jan. 3, 2015
4	Identifying tree	ICRAF (AR), Office of Agriculture and DB research	Feb. 8, 2015
5	Fodder option	DB research, AR and Office of Agriculture	Feb. 8, 2015
6	Crop option	AR and DB research	March 8,2015
7	Market linkage of interventions	Office of trade and transport, Office of Agriculture and AR	
8	Linkage with IP at woreda and kebele level	AR	Feb.8, 2015
9	Capacity building	AR	On-going
10	Community engagement	Office of Agriculture and AR	March8,2015
11	Community mobilization	Woreda administration	Jan.9, 2015
12	Material mobilization	Office of Agriculture and Individual farmers	On-going
13	Identification of model farmers for water development	Office of Agriculture	Feb. 8, 2015

## Experience sharing visit in Tigray

Once presentations were made and field visits (where integrated watershed management will be implemented) are conducted the next step was field visit for experience sharing in Tigray region, Ethiopia. This was decided because it will help partners see what kinds of interventions were implemented in which position of the landscape, how each intervention was implemented, what benefits are secured, what kinds of challenge can be expected and what approaches can be made to rectify those. The visit was conducted between Dec. 22-23 in the Tigray region, in Abraha WeAtsbeha and Maichew watersheds. The two areas have been selected because they are model watersheds in the region, especially Abraha WeaAtsbaha being one of the most successful areas of watershed management in Ethiopia as well as Africa.

### Field visit to Abreha Weatsbeha area

The participants have started their field visit from Mekelle and on their way to Abreha Weatsbeha they have stopped on a very interesting representative site where a number of interventions like area closures, afforestation, and check-dam and micro-dam constructions have been implemented with bee keeping activities at various levels of the landscape (Fig. 5).



(a)



(b)



(c)



(d)

Photo 5: (a) Irrigation development with water from check-dams, (b) fruit trees managed by women and youth, (c) check-dam ponds and (d) Shallow hand-dug wells used for irrigation development in Abreha Wetasbeha area, Tigray. The shallow wells are downstream of series of percolation ponds.

After reaching Abreha Weatsbeha the community leader called by his nick name “Abahawi” welcomed the participants and explained how the Kebele has turned from a completely food and water insecure condition to water and secured area. He mentioned that a number of efforts have been made through the integration of local communities, local authorities and the regional government to change the barren and food insecure area into a beautiful landscape as can be seen now. He indicated that extensive soil and water conservation measures and natural resources management has been made in the last 20 years to reach a level it is now. The interventions made, which are fully community owned include: construction of different soil and water conservation measures like check-dams, percolation ponds, deep trenches, stone/soil bunds etc.; area closures; and afforestation at upstream areas of the watershed. Upstream soil and water conservation measures have recharged the groundwater systems and the local communities have constructed a number of alternative water harvesting technologies at downstream areas which include check-dams, ponds and hand-dug wells for water supply as well for irrigation purposes. The leader of the Kebele mentioned that in the Kebele more than 270 ponds and over 500 hand dug wells have been constructed over the years and are used for irrigation, water supply and livestock watering purposes. He mentioned that the Kebele is now fully food secured.

#### *Discussions at Abreha Weatsbeha after the field visit*

After the field visit participants have asked the local leader “Abahawi” a number of questions including how the community managed to change the landscapes and ensured food security.

The local leader “Abahawi” on his side mentioned the following:

- Any development at local level can only be achieved not through talking but showing the communities practical achievements. He encouraged all local leaders to be models by themselves first and then mobilize communities.
- Watershed management needs strong commitment of the local leadership and the communities and hence the need to be determined to change the landscape.
- The local leadership should make sure that the communities fully trust the leadership in development related initiatives so that communities can fully participate in implementing various initiatives. This can be achieved by showing leadership in the implementation of good practices.

Appreciating all the lessons learned from the field and discussions the kebele leaders of both woredas (DebreBirhan and Hossana) have promised to invite Abahawi in the next Ethiopian year (2007 E.C.) so that he will visit their respective best achievements. He promised to visit to the sites with his own expenses and created a great inspiration and energy to the participants.

Moreover, the participants mentioned the following:

- They appreciated the AR project for bringing them to this area and witness the huge achievements that seem impossible to achieve but attained by the local communities in which they created water, conserved the landscapes and finally ensured food security in an area with very low soil fertility, low rainfall and highly degraded landscapes.
- Participants have also mentioned that they learned not only on the different technologies implemented but also on the commitments of all parties and overall implementation challenges and solutions in watershed management efforts which could help them in their

respective localities.

### **Field visit to Maichew site**

The next day (Dec. 23), a field visit was organized to Maichew site (photo 6), where a number of interventions were visited along the landscape: (a) upstream SWC efforts including deep trenches and afforestation activities, (b) construction deep trenches and soil bunds at farm levels, (c) constructions of shallow groundwater wells, spring development and above ground reservoirs for irrigation development, (d) development of bench terraces coupled with water storage systems (with water from a spring) and multi-level crop development within the benches (from carrots, pepper etc. to apple and other fruit trees). During the field visit participants were not able to believe that it is possible to create land in such landscapes, harvest water in such difficult terrain and distribute it to landless youth such that the youth are able to benefit from such interventions. One farmer said this is the most remarkable achievement that he have ever seen in land restoration efforts in which great benefits are obtained in a short time (which is less than two years effort).



Photo 6. Group photo of participants around Maichew watershed (background is some of the bench terraces developed in the area).

### **Round-up discussions in Maichew**

The participants were given the chance to reflect their impressions about the two days field visit in Tigray and mentioned the following:

- They expressed that they do not have proper word that can express their feelings about the observations they made and lessons learn. They have seen how it can be possible to: (a) create water where there was no water for irrigation, and (b) create land where there was no land for cultivation. They compared the land and water condition in Tigray with their areas and they said that despite the great resource base (soil, land and water in their areas) they were not benefitting much so far. With the experience and training they received with the experience sharing, they vowed to implement best practices of watershed management and water harvesting in their respective areas.
- One farmer from the participant said “our eyes are opened now and we will demonstrate great work/achievements next year”.

- They have thanked and appreciated AR and the whole team for all the training and experience sharing they got and requested AR to continue supporting the implementations of the planned interventions (in research, capacity building and technology options) in their respective areas.
- They mentioned that AR is the first ever project to support the full implementation of watershed management and water resources development interventions at grass root level linking all the stakeholders and they urged the project to continue supporting them in the years ahead.

Finally all the participants, AR team and especially local leaders of the sites made commitments that once they are back to their places they will implement what they have learned in Tigray.

## Conclusions

The training and experience sharing made was very successful for a number of reasons:

- The training and the experience sharing helped fill the gap in the implementation of watershed management and water harvesting practices in the two woredas which is part of the AR protocol. The participants have expressed their great satisfaction on the visits and trainings made. These gave them knowledge, skill and even energy for implementation of their planned interventions.
- They have visited the Tigray region in which tremendous efforts have been made to reverse completely degraded landscapes in a successful manner. Since they observed the possibility of restoring degraded areas in a difficult environment they understood that they can achieve even better in short period of time (as their areas have better potential). They promised to implement INRM in selected AR watersheds (in both Debre Berhan and Hossana areas).
- For AR project it was a great lesson for the fact that many issues and ideas on how to work with community, how to mobilize different stakeholders and how to bring impacts at grass roots levels were learned. Moreover, the AR project team learned that there is huge resources at Woreda and Kebele levels to implement interventions and what is often lacking is the capacity, knowledge and technology options in which AR could play an important role. The AR team plans to write a paper on this topic which could be used for further up-scaling.
- The AR project team appreciated the importance of experience sharing and farmer-to-farmer discussions held during the field visits in Abreha Weatsbeha.
- One of the major achievements in Tigray which is also an instrument for effective land and water management is the awareness of the local communities, the leadership role played by local leaders and the strong political commitment at all levels of the government.

## References

- Bai ZG, Dent DL, Olsson L, Schaepman ME. 2008. Global assessment of land degradation and improvement 1. Identification by remote sensing. Report 2008/01, ISRIC, Wageningen.
- Berry, L. 2003. Land Degradation in Ethiopia: its extent and Impact, Commissioned by the GM with WB support.
- Berry, L., Olson, J. & Campbell, D., 2003. Land degradation in Ethiopia. Assessing the extent, cost, and impact at the national level: findings and lessons learned from seven plot case studies. World Bank Report.
- Bishaw, B. and Abdelkadir, A. (2003). Agroforestry and Community Forestry for Rehabilitation of Degraded Watersheds on the Ethiopian Highlands. International Symposium on Contemporary Development Issues in Ethiopia, July 11-12, 2003, Addis Ababa, Ethiopia.
- Bishaw, B., 2001 Deforestation and Land Degradation in the Ethiopian highlands: Strategy for Physical Recovery, *Journal of Northeast African Studies*, Vol. 8 (1):7-26.
- Bojö, J. and D. Cassells 1995. Land degradation and rehabilitation in Ethiopia: a reassessment. AFTES Working Paper No. 17, World Bank.
- FAO. (1986). Highlands Reclamation Study: Ethiopia. Final Report. Volume I.
- FAO. 2005. Agro-Ecological Zoning and GIS application in Asia with special emphasis on land degradation assessment in drylands (LADA). Proceedings of a Regional Workshop, Bangkok, Thailand 10–14 November 2003. FAO, internet website: <ftp://ftp.fao.org/agl/agll/docs/misc38e.pdf>, accessed July 1, 2008.
- Girma, T. (2001). Land Degradation: A Challenge to Ethiopia . *Environmental Management*, Vol. 27 Issue 6, p815.
- Haregeweyn, N. et al., 2005. Specific sediment yield in Tigray-Northern Ethiopia : Assessment and semi-quantitative modelling. *Geomorphology*, 69, pp.315 – 331.
- Hurni, H., 2000. Assessing sustainable land management (SLM). *Agriculture, Ecosystems & Environment*, 81(2), pp.83–92. Available at: <http://linkinghub.elsevier.com/retrieve/pii/S0167880900001821>.
- Hurni, H. 1988. Degradation and conservation of the resources in the Ethiopian highlands. *Mountain Research and Development* 8(2/3): 123-130.
- Nkonya, E., Pender, J., Kaizzi, K.C., Kato, E., Mugarura, S., Ssali, H., and Muwonge, J. (2008). Linkages between Land Management, Land Degradation, and Poverty in Sub-Saharan Africa The Case of Uganda. International Food Policy Research Institute, Research Report 159.
- Scheffer, M., S. Carpenter, J. A. Foley, C. Folke, and B. Walker. 2001. Catastrophic shifts in ecosystems. *Nature* 413:591–96.
- Scherr, S. 2000. A downward spiral? Research evidence on the relationship between poverty and

natural resource degradation. *Food Policy* 25(4): 479–498.

Snel M, Bot A. 2003. Draft Paper: Suggested indicators for Land Degradation Assessment of Drylands. FAO, Rome.

Sonneveld, B. G. J. S. 2002. Land Under pressure: The Impact of Water Erosion on Food Production in Ethiopia. Shaker Publishing (PhD dissertation). Netherlands.

Sutcliffe JP (1993) Economic assessment of land degradation in the Ethiopian highlands: a case study. National Conservation Strategy Secretariat, Ministry of Planning and Economic development, Addis Ababa.

Tamene, L. & Vlek, P.L.G., 2007. Assessing the potential of changing land use for reducing soil erosion and sediment yield of catchments : a case study in the highlands of northern Ethiopia. *Society*, (March), pp.82–91.

UNEP (2008). Africa: Atlas of Our Changing Environment. Division of Early Warning and Assessment (DEWA) United Nations Environment Programme (UNEP). Nairobi 00100, Kenya.

World Bank (2001). African Development Indicators. Washington, DC, USA.

World Bank. 2007. The Cost of Land Degradation in Ethiopia: A Review of Past Studies. Washington, DC, USA. <https://openknowledge.worldbank.org/handle/10986/7939> License: CC BY 3.0 Unported.

## Annex 1: Workshop program

Time	Session	Responsible
<b>14.12.2014 (Sunday)</b>		
6:00 AM –	Addis to Hossana	
2:00 – 2:10	Welcome and introduction	Participants (Kindu leads)
2:10 – 2:30	Why Watershed and Integrated Watershed Management	Lulseged/Kindu
2:30 – 3:15	Partners' watershed management experiences, lessons, challenges	Participants (Lulseged leads)
3:15-3:45	Livestock management at landscape level	Kindu/Abera
3:45 – 4:10	Refreshment (tea-break)	
4:10 – 4:30	Agroforestry at landscape level	Nigussie/Kindu
4:30 – 4:45	Soil and Crop Management: efforts and gaps	Lulseged/Kindu/Participants
4:45 – 5:00	Principles and basics of surface water harvesting	Kifle
5:00 – 5:45	Gully erosion and approaches to rehabilitation	Kifle/Lulseged
5:45 – 6:15	Discussion	Participants (Kindu leads)
<b>15.12.2014 (Monday)</b>		
8:00 – 9:45	Visit the intervention watershed	Participants – Mr. Kassa leads
9:45 – 10:10	Refreshment (tea break)	
10:10 – 11:00	Ground water development and management	Kifle
11:00 – 11:30	Landscape restoration and water creation	Kifle/Nigussie
11:30 – 12:00	Basics of map reading ...	Lulseged/Kifle
12:00 – 1:00	Discussion – Way forward and future plan	Lulseged/Kindu
1:00 – 1:45	Lunch	
2:00 -	Back to Addis	

Time	Session	Responsible
<b>18.12.2014 (Thursday)</b>		
8:30 – 8:45	Welcome and introduction	Participants (Kindu leads)
8:45 – 9:00	Integrated Watershed Management	Kindu/Abera/Lulseged
9:00 – 9:45	Partners' watershed management experiences, lessons, challenges	Participants (Abera leads)
9:45-10:30	Livestock management at landscape level	Kindu/Abera
10:30 – 10:50	Refreshment (tea-break)	
10:50– 11:30	Best practices of watershed management and water harvesting in Ethiopia	Kifle
11:30 – 11:50	Agroforestry at landscape level	Kindu
11:50 –12:10	Soil and Crop Management: efforts and gaps	Temesgen
12:10 – 13:20	Lunch	
13:20 –15:30	Visit the intervention watershed	Participants – Mr. Endale leads
15:30 – 15:45	Refreshment (tea break)	
15:45 –16:15	Gully erosion and approaches to rehabilitation	Kifle/Lulseged
16:15 – 16:30	Practices and issues: water and land development in DB	Kifle/Lulseged
16:30 – 17:30	Discussion - Way forward and future plan	Abera/Kindu

## Annex 2: Participants

Name of Participant	Institution/Organization	Position
Wondimu Anise	Lemo Woreda Administration	Woreda Administration Head
Kassa Hansawo	Lemo Woreda Agricultural Office	Head of Agriculture Office
Solomon Kifle	Lemo Woreda Agricultural Office	NRM Coordinator
Girma Aba	Lemo Woreda Agricultural Office	Crop Extension Coordinator
Tadele Ermecho	Lemo Woreda Agricultural Office	Livestock Development office Coordinator
Belay Osire	Lemo Woreda Agricultural Office	Crop Expert
Andualem Bezabih	Jawe Kebele	Jawe Kebele Agri office Coordinator
Tamirat Erjeno	Lemo Woreda Agricultural Office	Crop Expert
Lobe Haile	Lemo Woreda Agricultural Office	Livestock Expert
Tefera Ergeno	Lemo Woreda Agricultural Office	NRM Expert
Birhanu Erwaro	Lemo Woreda Agricultural Office	Irrigation Expert
Misgano Haile	Lemo Woreda Agricultural Office	Irrigation Engineer
Tariku Habite	Jawe Kebele	Livestock DA
Mulatu Basha	Jawe Kebele	Crop DA
Adinew Erwaro	Jawe Kebele	NRM DA
Alemayehu Anza	Worabe Agricultural Research Center	Researcher
Yohanis Heramo	Wachemo University	Department Head and Lecturer
Aleamar Seid	Areka Agricultural Research Center	Researcher
Aklilu Fikre	Lemo Woreda Agricultural Office	Land use management
Zerihun Yemataw	Areka Agricultural Research Center	Researcher

Full name	Organization
Endale Lemma	Basona Worena Woreda Office of Agriculture
Shewangizaw H/Michael	Basona Worena Woreda Office of Agriculture
BeyeneBitew	Debre Birhan Agricultural Research Center
WulitaWondwosen	Debre Birhan Agricultural Research Center
Rebeka G/Tsadiq	Debre Birhan Agricultural Research Center
Asfaw Bisrat	Debre Birhan Agricultural Research Center
Kebede Yitena	Basona Worena Woreda Office of Agriculture
RetaWorku	Debre Birhan University
ZebenayGebbru	Basona Worena Woreda Office of Agriculture
Fekadu Sime	Basona Worena Woreda Office of Agriculture
Anteneh Birhanu	Basona Worena Woreda Office of Agriculture
Behailu Amare	Basona Worena Woreda Office of Agriculture
Abdu Ebrahim	Basona Worena Woreda Office of Agriculture
Yeshewatsehay Hailu	Basona Worena Woreda Office of Agriculture
Jemal Mohammed	Basona Worena Woreda Office of Agriculture
Eshete Kebede	Gudo Beret Kebele Office of Agriculture
Engidasew Abebe	Gudo Beret Kebele Office of Agriculture
Melkamu Dagne	Gudo Beret Kebele Office of Agriculture
ZerihunPawlos	Adisgae Kebele Office of Agriculture
Wondimayehu Tefera	Adisgae Kebele Office of Agriculture
Mekonnen Mengistu	Adisgae Kebele Office of Agriculture
Samuel G/Kidan	Adisgae Kebele Office of Agriculture
TsigemariamBashe	Debre Birhan university
HamereYohannes	Debre Birhan University
Teferi Assefa	Basona Worena Woreda Office of Agriculture

Kindu Mekonnen (PhD)	ILRI
Abera Adie	ILRI
Kifle Woldearegay (PhD)	Mekelle University
Tesfaye tesfamichael	Addis Ababa University
Shimelis Mengistu	ILRI
Temesgen Alene	ILRI

Endale Lemma	Male	Basona Worena Office of Agriculture	Head
Jamal Mohammed	Male	Basona Worena Office of Agriculture	Expert
TeferiAsefa	Male	Basona Worena Office of Agriculture	Expert
Kebede Yitena	Male	Basona Worena Office of Agriculture	Expert
Temesgen Alene	Male	ILRI	Site coordinator
Engedasew Abebe	Male	Gudo Beret kebele office of Agriculture	DA
Melkamu Dagne	Male	Gudo Beret kebele office of Agriculture	DA
Wondye Desta	Male	Gudo Beret Kebele Administration	Administrator
TegeneKidane	Male	Gudo Beret Kebele	Farmer
BeletWondeaferew	Female	Gudo Beret Kebele	Farmer
Samuel G/Kidane	Male	Adisgae office of Agriculture	DA
Mekonnen Mengistu	Male	Adisgae office of Agriculture	DA
Teklemariam W/Aregay	Male	Adisgae Kebele Admin.	Administrator
BeteShawel	Male	Adisgae Kebele	Farmer
HaregwaBirhane	Female	Adisgae Kebele	Farmer
Gebbru Mulatu	Male	Adisgae Kebele	Farmer
ManazeBegashaw	Male	Adisgae Kebele	Farmer

Name	Sex	Office / PA/Organization	Job Title
Adnew Ayele	M	Jawe	Farmer and chairman of the KA
Abebe Jala	M	Jawe	farmer
Beyen Hadiso	M	Jawe	farmer
Alemitu Abiyo	F	Jawe	farmer
Abera Mekengo	M	Jawe	Farmer
Bekelech Belachewe	F	Jawe	Farmer
Andualeme Bezabeh	M	Jawe	Head of the KA agr. office
Tamirat Ergino	M	Lemo of agr	Crop expert
Belay osier	M	Lemo of agr	Crop expert
Kassa Hansewo	M	Lemo of agr	Head of lemo office of agr.
Solomon Kefile	M	Lemo of agr	NRM expert
Tadel Ermecho	M	Lemo of agr	Livestock expert
Girma Aba	M	Lemo of agr	Head of extension
Yohannes Horama	M	WcU	Researcher/lecturer
Wondimu Anise	M	Lemo	Administrator
Workneh Dubale	M	ILRI	RS – coordinator