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SOCIOECONOMIC CONSTRAINTS AFFECTING THE IMPLEMENTATION OF LAND REHABILITATION PROGRAMS IN THE HIGHLANDS OF ETHIOPIA

A CASE STUDY OF ABBA GERIMA AND DEBRE YAKOB LEARNING WATERSHEDS

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ABSTRACT

Subsistence agriculture is the main stay of Ethiopian smallholder farmers and the country's economy at large. Land degradation and frequent drought are posing a big threat on this sector. To reverse this phenomenon, different land rehabilitation programs have been designed and implemented in the last three decades. This study evaluated the effectiveness of the interventions from the government mobilization program and the Water and Land Resource Centre (WLRC) by using the Driver-Pressure-State-Impact-Response (DPSIR) framework in two learning watersheds in the highlands of Ethiopia.

The literature review and a survey undertaken among farmers and officials in the study areas indicated that the WLRC project watersheds development approach was effective in sustaining watershed development efforts through addressing the root causes of land degradation. Even though the project had limited community participation and inadequate involvement of women in decision making of benefit sharing, its activities were integrated in addressing the drivers and pressures of land degradation. Apart from soil and water conservation measures, the project introduced home garden development, technologies that increase land and labour productivity, fodder development, and the cut and carry system. This ultimately reduced the pressure on natural resources and provided an incentive for the local communities. As a result, development now better fits with the DPSIR framework.

On the other hand, the government program was highly focused on addressing the symptoms of land degradation and the lack of in-depth understanding of socioeconomic constraints that are affecting the effectiveness of land rehabilitation program. The program fails to address the main drivers and pressures of land degradation. As a result, rehabilitated lands are frequently destructed by free grazing, ploughing and intensification of agriculture and forest clearing. This study identified several socioeconomic issues that should be included in the national policy of land rehabilitation. The first is the consideration of alternative livelihoods to reduce poverty and pressure on natural resources. The second is genuine participation of the communities in all processes of watershed development. The third is provision of an equal chance for both genders in the decision making of sharing benefits from the rehabilitated watersheds.

Keywords: Socioeconomic constraints, watershed, land degradation, government program and learning watersheds.

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1. INTRODUCTION

Of Ethiopia's population about 84% live in rural areas. Most of their livelihood is derived from agriculture and local environmental resources such as annual crops and forest products. Agriculture practice is mainly based on a small scale rain-fed production system which accounts for over 90% of the total cultivated land in the country. Given the importance of agriculture in Ethiopia's economy, most of the cultivated land has been seriously eroded. Land degradation and soil erosion coupled with erratic rainfall and extreme droughts remain the main challenges of Ethiopian smallholder agriculture (Lulseged & Vlek 2008).

Annually, Ethiopia loses over 1.5 billion tons of topsoil from the highlands of Ethiopia which have been intensively cultivated and settled by people for a long time. Soil erosion is considered the main factor that contributes to the current food insecurity and poverty in the rural communities (Lulseged & Vlek 2008). This rate of land degradation poses another pressure on the remnant forests as farmers seek new fertile agricultural land for cultivation.

The scale and magnitude of anthropogenic induced land degradation is increasing in the highlands of Ethiopia (Feoli et al. 2002). To reduce the intensity of the problem, efforts towards the rehabilitation of degraded lands through soil and water conservation measures like construction of terraces, check dams, and water harvesting structures have been practiced for the past 30 years. The intervention towards soil and water conservation was started through the different schemes of food for work (FFW) and cash for work (CFW) programs. After 2005 a national guideline on integrated watershed development was introduced (Desta et al. 2005). This document marked the concept of integrated watershed management and participatory planning at the community watershed level. Even though watershed development is a priority of the current government of Ethiopia, the benefits derived from the development effort are limited and there exists frequent destruction of rehabilitated areas through free grazing and farming practices. To improve sustainability and the benefits derived from the natural resources management different projects and programs are under implementation in the highlands of Ethiopia. Among these projects and programs, WLRC projects learning watersheds are implemented in six catchments (Water and Land Resource Centre 2014).

Changing traditional practices and the adoption and dissemination of sustainable agricultural practices' (SAPs) are becoming important policy directions. Sustainable agricultural practices such as use of technologies (fertilizer and selected seed) moisture harvesting structures, minimum tillage, intercropping and crop rotation are introduced as packages of the agricultural extension system of Ethiopia. The logic behind the promotion of SAPs has been to increase agricultural productivity and at the same time reduce land use change from forest to crop land (Teklewold et al. 2013).

Despite the introduction of technologies and promotion of different soil and water conservation measures, the main socioeconomic constraints that are limiting the rehabilitation of degraded land are not properly addressed. In order to make conservation practices sustainable, there is a need to consider socioeconomic benefits apart from the biophysical performance of the interventions (Amsalu & de Graaff 2007). Even though there are a great deal of studies on the adoption and effectiveness of the watershed development intervention (Asrat et al. 2004; Gebreselassie 2006; Nyssen et al. 2009), there are limited studies on success stories in terms of addressing socioeconomic factors in nearby watersheds to convince policy makers.

To halt this problem the current government has designed a program with the aim of rehabilitating degraded lands and conserving natural resources. The program approach is

mainly based on the mobilization of communities for the construction of physical soil and water conservation such as terraces, check dams, moisture harvesting and drainage structures. After the construction of these structures, the area will be closed from free grazing and human interference until rehabilitation is well established (Amhara Region Bureau of Agriculture 2013).

In addition to this government program, there are other projects and programs with the aim of rehabilitating degraded watersheds and are based on a slightly different approach. Among many projects, the Land and Water Resource Centre (WLRC) is implementing watershed development in six community watersheds. These watersheds are located in the highlands of Ethiopia. The project is designed to help stakeholders learn from the different approaches of watershed development and are called learning watersheds. This research project assessed the practices in the learning watersheds of Abba Gerima and Debre Yakob in the highlands of Ethiopia.

The main goal of this paper is to review the main efforts of watershed developments in the highlands of Ethiopia, which have the aim of halting land degradation and improving the ecological functioning in the areas and livelihood of the rural community. Also the purpose is to analyse the main constraints that affect the effectiveness of these efforts, including socioeconomic factors. Through this the research may contribute towards improved socioeconomic policy variables for the sustainable natural resource management of the country. The specific objectives of this study were:

- To demonstrate the existing experiences, including communities' perception, from integrated natural resource management programs using WLRC learning watersheds in the north-western part of Ethiopia as case study areas.
- To identify whether specific constraints affect the effectiveness of the program.
- To suggest alternative policy variables that could improve the effectiveness and the sustainability of natural resources management interventions for the maximum benefit of the society and ecosystems.

2. METHODOLOGY AND DATA COLLECTION

2.1. Description of the study area

For this case study the two community watersheds of Abba Gerima and Debre Yakob were considered. The study area is located in the north-west of Ethiopia in the current Amhara National Regional State (Fig. 1). The area is characterized by high summer rainfall with high intensity which causes serious runoff and soil erosion (Water and Land Resource Centre 2014). The area is densely populated and livestock numbers are significantly high. As a result, land degradation fuelwood, farm and grazing land scarcity are common problems in the watersheds. Apart from these problems the watersheds have immense potential to use groundwater to promote small scale irrigation, streams, human labour to tackle land degradation and favourable conditions for the promotion of off-farm activities. Even though these watersheds have diversified potential for other livelihood alternatives, the communities limit their livelihood to crop production. This may be due to the lack of focus and attention by the extension system on

homestead development, animal fattening and energy saving technologies (Water and Land Resource Centre 2014).

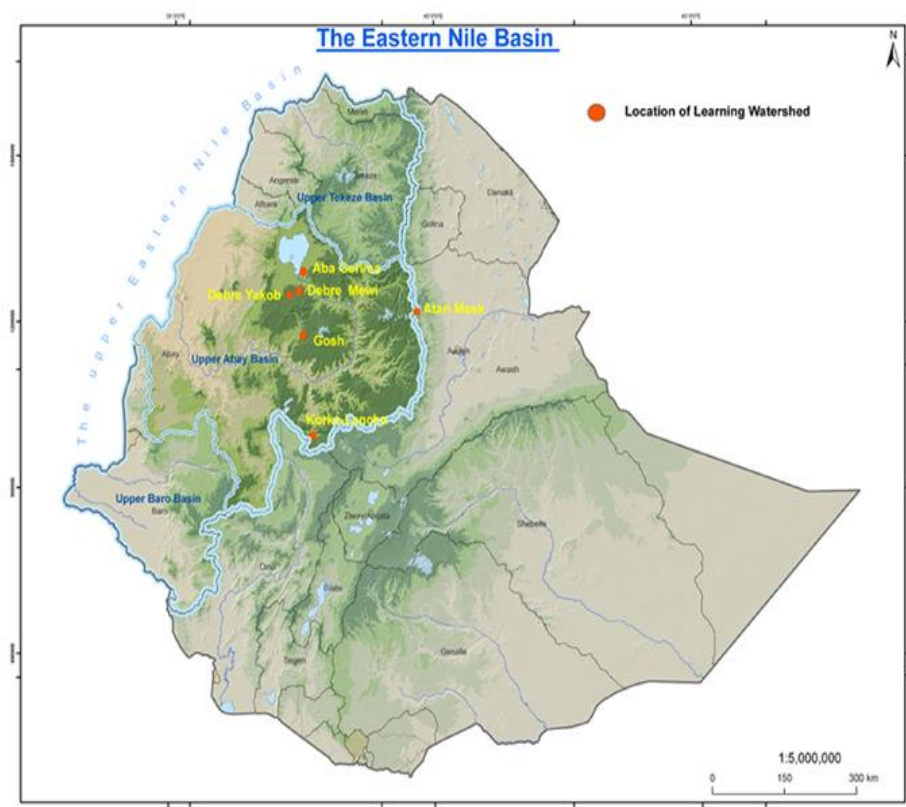


Figure 1. Location map of the six learning watersheds in the highlands of Ethiopia. Red dots with yellow text show the location of learning watersheds and red circles show location of study areas (Map adapted from WLRC 2014).

The Abba Gerima watershed is located in Bahir Dar zuria woreda¹ 15 km from the capital city of the Amhara region, Bahir Dar. This watershed is part of the Lake Tana sub-basin, whose proper management is important on a large scale that encompasses the whole of the region, as Lake Tana is the biggest lake in the country and is threatened by siltation from the surrounding catchments. In the Abba Gerima watershed, heterogeneity of the landscape is observed as a result of diverse land use. The watershed is severely degraded by sheet erosion as the land cover is poor (Fig. 2).

On the other hand, the Debre Yakob watershed is located in Mecha woreda at around 90 km from Bahir Dar. Unlike the Abba Gerima watershed it is characterized by undulating topography. This characteristic of the watershed makes it vulnerable to soil erosion and difficult for crop production without soil and water conservation intervention (Fig. 3). These two watersheds are taken to represent the north-western highlands of Ethiopia in topographic features as well as socioeconomic aspects.

¹ Woreda is the second lowest political administration unit in Ethiopia. This administration unit is equivalent to district.

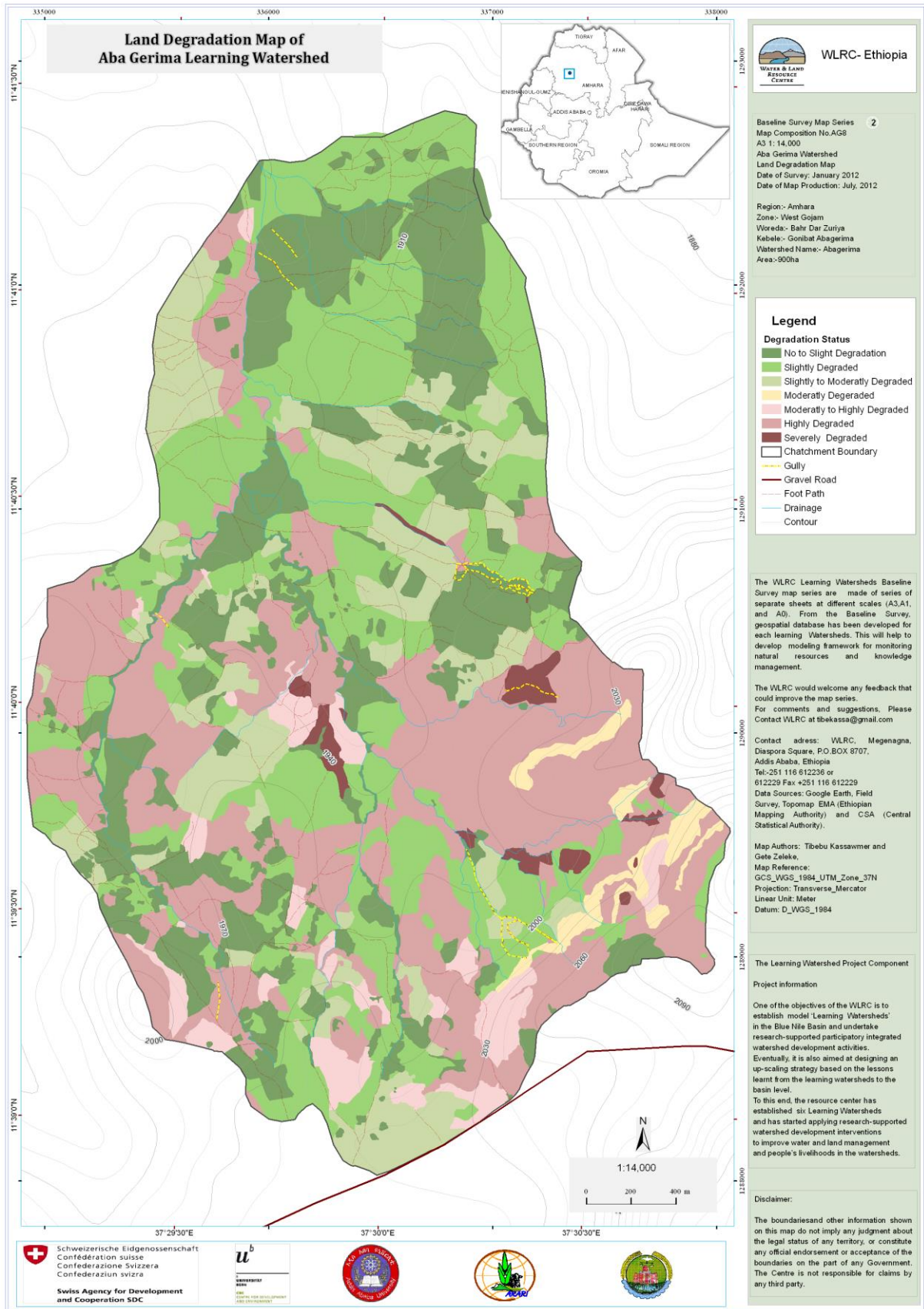


Figure 2. Land degradation map of the Abba Gerima watershed, in the highlands of Ethiopia (Map: WLRRC 2014).

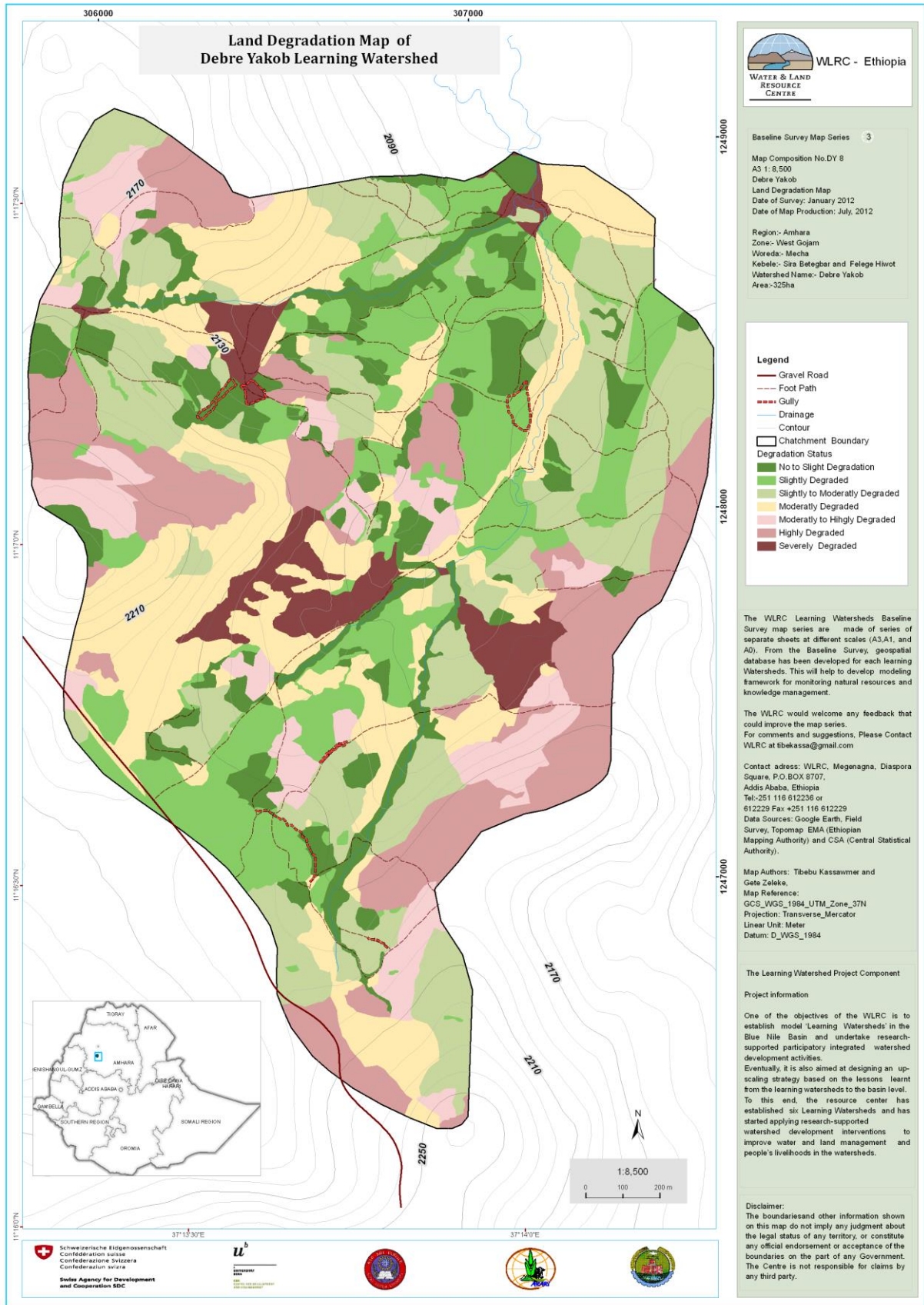


Figure 3. Land degradation map of the Debre Yakob watershed, in the highlands of Ethiopia (Map: WLRRC 2014).

2.2. Data collection

2.2.1. Review of policy documents, plans, reports, best practices and articles

The literature review was based on the assessment of policy framework for sustainable management of watersheds through reports, strategic directions and the experience reported from other projects. At all levels of the government structures, the implementation modality of watershed development has been reviewed and compared to actual implementation. Also the policy framework was reviewed in light of international policy and agreements, e.g. the United Nations Sustainable Development Goals, the World Bank Group Strategy, and the UN Convention to Combat Desertification.

2.2.2. Survey with users, policy makers, experts and other decision makers

A survey was conducted to support the literature review and to better understand the views of users in finding alternative pathways to ensure the sustainability of the ongoing natural resources management practices. A questionnaire was developed and sent to the Amhara Region Bureau of Agriculture in Ethiopia (Appendices 1 and 2). Four experts from the Bureau were assigned to collect the data. The interviewees were selected purposefully to include all segments of the communities and government officers. For communities, a total of 15 questions were used in the survey, covering views towards the effectiveness of the government program and the WLRC project in terms of socioeconomic and environmental aspects. From each of the two watershed communities, 10 farmers from different segments of the society (youths, women, rich or poor farmers) were selected for completing the survey (Appendix 2). The assumption is that communities in the learning watersheds also participate in other public mobilization program watersheds. The questionnaires prepared for the farmers and government officers were different except for the three issues which dealt with perception of the level of land degradation, community participation and sustainability of efforts (Appendices 1 and 2). Most of the questions were different for government officials and communities since their roles in the process of watershed development are different. A few questions were kept the same both for communities and government officers and the answers were compared.

This was to support the comparison of the different approaches exercised by the WLRC project and the government program so that best practices could be scaled up. In addition, a survey of 18 questions was used to interview 10 government office heads, experts (4) and development agents (2) to better understand the level of the problem and potential future considerations of the socioeconomic policy variables (Appendix 1). The results from the survey are summarized in tables and graphs. To analyse the data obtained from the survey simple statistical tools like percentage and ranking were used. In questionnaires which had more than one answer, the sum of the percentage for all answers exceeded 100% and in this case both percentage and ranking were used. The questionnaire for farmers was translated into the local language (Amharic). The translation was done by experts in the Bureau of Agriculture and then reviewed again to insure the correct comprehension of the questions as differences in interpretation can affect the result and quality of the survey.

2.2.3. *Photography and mapping*

Photographs and maps were used to support the research with visual evidence. Regarding the learning watersheds, baseline photographs are available which show changes in a time sequence. This reflects further on the response of the area to watershed development intervention.

3. FINDINGS FROM THE LITERATURE

3.1. Conceptual framework

According to Tefera (2002), the root causes of land degradation in the highlands of Ethiopia are population pressure, animal overstocking, poverty, backward agricultural practices, the nature and type of soil and rainfall. To assess the sustainability of watershed intervention it can be helpful to identify a framework that considers both biophysical and socioeconomic aspects of land degradation. The Driving force–Pressure–State–Impact–Response (DPSIR) Model is an information system for sustainable environmental management that must occur within a framework (Odermatt 2004, see fig. 4). This framework has been commonly used for organizing the development and selection of criteria and indicators. The DPSIR framework was widely proposed by the European Union Environment Agency (Odermatt 2004) and was used in this research project to evaluate watershed development efforts in the case of the Ethiopian highlands. Here the DPSIR framework model was used to classify variables and to evaluate the performance of watershed development efforts of the government program in the highlands of Ethiopia. Using this model, it can be assessed whether the interventions fit the framework to ensure sustainable environmental rehabilitation efforts.

According to this framework socioeconomic factors like population pressure, land use change, overgrazing, poverty and a high demand for energy (driving forces) generate stress related to environmental, social, and economic issues (pressures), which brought about the current land degradation and influenced the sustainability of the rehabilitation efforts (states). The effects of changes of state (impacts) require efforts by communities, local governments, researchers and policy makers to move towards sustainable natural resources management in the highlands of Ethiopia (responses). These responses (like policy formulation, development of guidelines and an integrated management approach to solve problems) are expected to be sustainable watershed management variables which were identified in this study (Fig. 4).

3.2. Policies, strategies and directions towards natural resources management

Ethiopia is a signatory to a number of international conventions that have positive implications on the sustainable development efforts of the country through combating desertification and climate change (César & Ekbom 2013). Ethiopia has ratified the United Nations Framework Convention on Climate Change, the Convention on Biological Diversity and the United Nations Convention to Combat Desertification. The Environmental Policy of Ethiopia was issued in 1997 and this document was the first key document that captured environmental sustainable development principles. Ethiopia's Programme of Adaptation to Climate Change (EPACC) is a programme of action to build a climate resilient economy through adaptation at sectoral, regional and local community levels (César & Ekbom, 2013). The EPACC updates and replaces Ethiopia's National Adaptation Programme of Action (NAPA) which was formulated and submitted it to the UNFCCC Secretariat. Ethiopia has also developed a framework and national

strategy towards a green economy, the “Climate Resilient Green Economy” (César & Ekbom 2013).

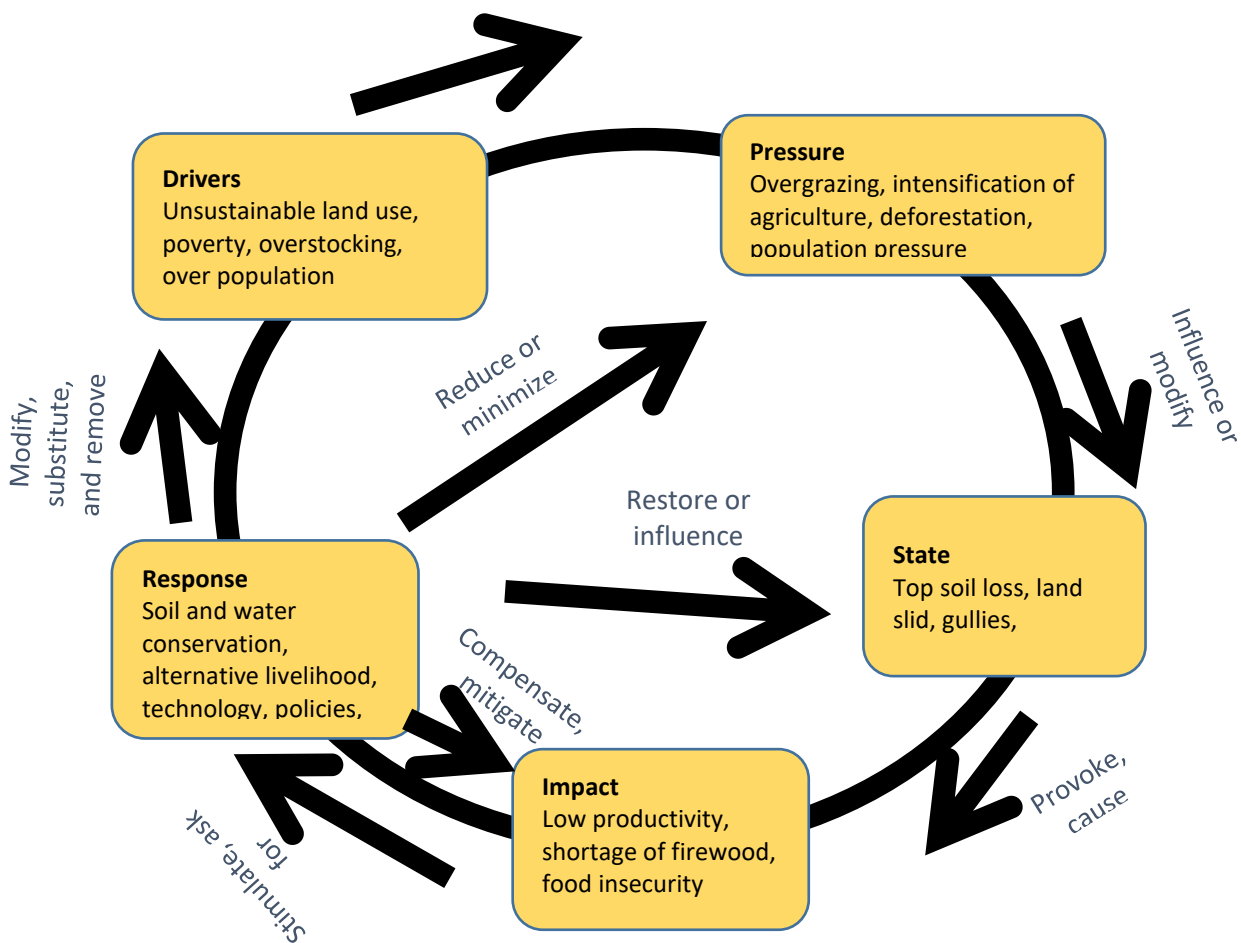


Figure 4. Conceptual Framework Map to evaluate the effectiveness of watershed development interventions in the highlands of Ethiopia (Odermatt 2004).

With these policy documents in hand, environmental rehabilitation effort date back to the eve of the 1985 famine in northern Ethiopia. To challenge the problem of land degradation, the government launched food for work (FFW) and cash for work (CFW) programs towards addressing environmental problems through the support of international donors (Hoben 1995). Over the last 30 years, Ethiopian smallholder farmers have constructed millions of hectares of terraces and moisture harvesting structures. The current development strategy and policy of Ethiopia also gives priority to the proper management and utilization of natural resources. The policy also states that soil conservation is directly related to water resources utilization. Furthermore, it underlines watershed development as the main tool to maintain the livelihood bases of the rural community as land degradation and soil erosion are threatening farming practices. Through proper land management practices, it is possible to significantly increase proper exploitation of the land (Desta et al. 2005).

The Ministry of Agriculture and its respective Regional Bureaus of Agriculture and Rural Development are in charge of promoting Soil and Water Conservation (SWC) extension programmes into different parts of the country. For the proper implementation of watershed development, the Ministry, together with different donor agencies developed community-based

participatory watershed development guidelines in 2005 (Desta et al. 2005). These guidelines were supposed to ensure the community-based problem identification, planning, implementation and governance of the SWC activities (Tefera & Sterk 2010). Given these guidelines and policy frameworks, some scholars argue that the process of the implementation of policies lack an in-depth understanding and inclusion of socioeconomic drivers of land degradation like alternative livelihoods, genuine participation of communities and population dynamics (Keeley & Scoones 2000).

Even though soil and water conservation measures were introduced a long time ago, the farmer's attitudes towards using them in a sustainable way is not at the expected level. Based on a survey from 147 smallholder farmers in the highlands of Ethiopia, Aklilu Amsalu, and Jan de Graaff (2007) argue that the adoption of soil and water conservation measures are determined by family size, other sources of income, wealth status and extension services. The results revealed that older age of the farmer means a higher rate of adoption of terraces. perception of the technology return, increase in farm size and increase in livestock number. However, the continued use of stone terraces is lower with increase in farm size as a result of diminishing marginal returns. In addition farmers' participation in non-agricultural activities negatively affects their continued use (Amsalu & de Graaff 2007). The reason associated with the problem of the continuous use of terraces is that the introduced SWC technologies were not suitable to the farmers' requirements and farming system conditions. The conservation strategy pursued was not truly farmer participatory, implying that a sustainable adoption of the technologies was unlikely. These findings have two broad important policy implications for future SWC intervention in the country: the need for in-depth understanding of the sociocultural setting of the local community and the need to adequately involve local farmers in the process of watershed development (Bewket 2007).

3.3. Efforts towards tackling land degradation

As stated in the introduction, there is a considerable loss of topsoil in the highlands of Ethiopia due to water erosion. Preventing this could add about 1.5 million tons of grain to the country's annual harvest (Lulseged & Vlek 2008). This shows that soil erosion is a determinant factor contributing to food insecurity and poverty in the rural community. This rate of land degradation also poses pressure on the remnant forests as farmers seek new fertile agricultural land for cultivation (Lulseged & Vlek 2008).

In order to break the vicious circle of poverty-degradation, government and donors together designed cash-for-work (CFW) and food-for-work programs (FFW). The focus of these programs was mainly in moisture deficit and food insecure areas of the country. On the other hand, the country-wide (both moisture deficit and moisture sufficient areas) public mobilization based on natural resource management practices was started in 2011. According to this program's implementation guideline, communities are mobilized to provide 30 to 40 days of free labour each year as a contribution to the rehabilitation of watersheds (Fig. 5). This government program is undertaken in the form of a campaign taking place mostly in the dry seasons of January to the end of March (Amhara Region Bureau of Agriculture 2013).

Even though, in the last 30 years, most of the hillsides have received some soil and watershed development measures, most of the rehabilitated land has been destroyed by ploughing, free grazing and lack of maintenance, and each year farmers are obliged to perform soil and water conservation measures on the same watershed (Amhara Region Bureau of Agriculture 2013). Furthermore, the interventions, which mainly focus on physical structures to halt erosion, seem

to fall short of addressing the main causes of land degradation. The program seems to need further incorporation of socioeconomic aspects to be successful.

According to a report from the Bureau of Agriculture, the main causes for the destruction of rehabilitated land are free grazing, search for new farm land, absence of maintenance and low quality of physical structures (Amhara Region Bureau of Agriculture 2013). The report also emphasizes that the destruction of rehabilitated land is more severe in the highlands and moisture sufficient areas of the region. This is because this area is characterized by high rainfall and intensive crop production. The farming system also requires a higher input of animal labour. As a result, the area is characterized by overstocking of animals, especially cattle (Fig. 6).



Figure 5. Land rehabilitation efforts of the government program in the highlands of Ethiopia. Left photo shows community effort on the construction of a bench terrace in Meket Woreda, North Wollo Zone. Photo on the right shows rehabilitated watershed using both physical and biological measures, Habru Woreda, North Wollo Zone (Photos: Aytnew E. Tatek 2012).



Figure 6. Destruction of rehabilitated lands through free grazing of animals. Photo on the left shows the physical conservation structures constructed in dry season being destroyed by livestock grazing in rainy season, Dessie Zuria Woreda, South Wollo Zone. Photo on the right from Gozamen Woreda, East Gojjam Zone shows that communities are engaged in the

construction of SWC measures but at the same time livestock free grazing brings another threat of destruction (Photo: Aytnew E. Tatek 2012).

On the other hand, there are some success stories from the intervention of different projects and programs which have been successful in ensuring sustainability of rehabilitated watersheds. The WLRC project has been implemented during the last four years and has showed some improvement in this regard (Fig. 7). The impact assessment report from the project watershed of Abba Gerima shows that because of the intervention of the project in a wide range of socioeconomic aspects, free grazing has been reduced by 57% and fodder supply has been increased 46% (Water and Land Resource Centre 2015).

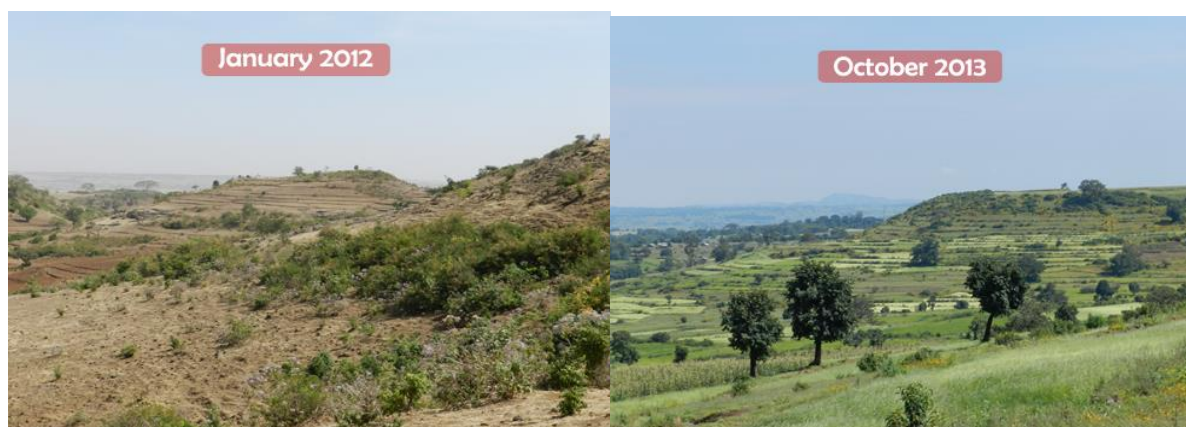


Figure 7. Land rehabilitation efforts by WLRC project, Abba Gerima learning watershed. Photo on the left is baseline photo and photo on the right a year and half after rehabilitation (Photo: WLRC).

3.4. WLRC projects and its watershed development approach

The upper Blue Nile basin is characterized by extensive erosion and land degradation. To halt this problem a range of actors are involved in watershed development activities. Among them WLRC is actively involved in the establishment of six learning watersheds in the Eastern Nile basin. The intervention of the project is set to reduce the pressures (creating alternative livelihoods, increase production and productivity of small plots of land and technologies that reduce the required animal and human power for production) on natural resources and to tackle the symptoms of soil erosion. The main objective for the establishment of learning watershed in the highlands of Ethiopia is to undertake research based participatory integrated watershed development activities. Furthermore, the project has aimed at designing a scaled up strategy which will facilitate other government programs to learn from the learning watersheds. Apart from soil and water conservation measures, livelihood improvement and research are the integral part of the project activities. The project approach is based on bringing different stakeholders together to enable them to play their own roles in the learning watersheds. The project is thereby able to bring together researchers, development sectors and the local communities for the sustainable management and transformation of the landscape (Water and Land Resource Centre 2014).

Physical and biological soil and water conservation

The erosion mitigation measures are also well integrated following the watershed logic. Hillsides and grazing lands are treated by hillside terraces and other moisture harvesting structures. When it comes to the farm lands the technologies to control erosion and increase infiltration are preferred to be soil/stone bunds. In addition, different soil fertility management practices like composting and intercropping are practiced. After construction of the physical measures, during the start of the rainy season, revegetation of the physical structures with multipurpose plants has been undertaken (Fig. 8). The main objectives of the revegetation program are to increase fodder for animals and increase the fertility of the land (Water and Land Resource Centre 2014).



Figure 8. Rehabilitated landscape in Debre Yacob watershed. Photo on the left is a baseline photo just after the construction of physical SWC measures. Photo on the right is taken one and a half years later, after the physical structure was reinforced with biological measures (Photo: WLRC).

In addition to farm land and hillside treatment, the rehabilitation of gullies downstream of the watershed was considered a prime agenda. Figure 9 shows a gully formed as a result of inappropriate land use upstream of the watershed, which was reclaimed within one year. The rehabilitation of big gullies was an important lesson for the local communities that degraded land can be changed into productive land (Fig. 9). Communities from the surrounding districts and across the region are also facing the ever-growing gully erosion in the region (Water and Land Resource Centre 2014). A study on onsite costs of gully erosion and cost benefits of gully rehabilitation in the north-western highlands of Ethiopia shows that mean yield loss per hectare of gully erosion per annum is estimated to be 2744ETB which is equivalent to \$137.20 (Yitbarek et al. 2012). Land degradation inventory from the Bureau of Agriculture in the Amhara region alone shows that out of 2,165,604 ha of the degraded land, 182,080 ha are affected by gully erosion as the most serious form of water erosion. From these data, the region annually loses \$24,981,376, which is equivalent to 500 million ETB². The majority of this gully affected land mass is found in the moisture sufficient area of the north-western part of the region. The role of the project intervention in effective rehabilitation of big gullies reaches far beyond land reclamation if the attitude change brought about by local communities and policy makers is considered (Amhara Region Bureau of Agriculture 2013).

² ETB (Ethiopian Birr), Ethiopian currency. 1ETB is equivalent to 20.50USD.



Figure 9: Gully rehabilitation in the Debre Yakob watershed. Gully on the left side is baseline photo before any intervention. Photo on the right shows the same gully after rehabilitation less than a year later (Photo: WLRC).

Homestead development as livelihood alternative

The other intervention through integrated watershed development approach of the project is homestead development. This intervention consists of agricultural practices and includes vegetable, fruit, small chicken farms and animal fattening. Homestead development in the Ethiopian context is an untapped livelihood diversification alternative that can improve the lives of poor rural farmers, especially women (Water and Land Resource Centre 2014). In the highlands of Ethiopia the landholdings of smallholder farmers is gradually shrinking as a result of young farmers emerging from the family. The average land holding in the Amhara region is 0.75-1ha from which farmers must produce their annual food needs. Farm fragmentation is also emerging as the main problem in the highlands of Ethiopia as a result of farmers voluntarily sharing their land with their children as they reach working age and form their own families (Gebreselassie 2006). This pressing problem is pushing the search for marginal lands for cultivation and increases the rate of land degradation. In response WLRC has put homestead development as a means of diversifying livelihood options and consequently minimizing the pressure on natural resources (Fig. 10). This has helped farmers to produce more diversified products in the very small area of land found around their home (Fig. 10).



Figure 10: Homestead development as a livelihood alternative. Photo on the left shows a project beneficiary with his multi-storey homestead farm and photo on the right shows farmers, government officials and researchers examining the field level (Photo: WLRC).

Technology introduction to facilitate the agricultural production system

The smallholder agricultural system is labour intensive and all the practices are based on traditional knowledge. Technology has therefore been introduced with the aim of increasing the efficiency of the smallholder farmer's agricultural production system as an integral part of the project intervention (Fig. 11). The reason for keeping a high number of cattle among smallholder farmers is mainly that the farming system requires considerable animal and human labour. Tillage is practiced by using oxen and the traditional *teff*³ crop production, for example, requires repeated tillage and compaction during seeding. The highlands of Ethiopia are a major *teff* producing part of the country. Research in one of the learning watersheds shows that between 8t/ha and 32t/ha per annum of soil are lost from a *teff* field in the form of sheet erosion, which is much greater than from other crop fields because of repeated tillage and compaction (Zegeye et al. 2010). In addition, smallholder farmers keep as many animals as they can as a source of income and assets to cope with crop failure. The resilience of smallholder farmers for crop failure is limited unless they have animals to be sold when there is a shortage of food.

³ Teff is an annual grass, a species of love grass native to Ethiopia. Teff is an important food grain in Ethiopia, where it is used to make injera (local bread) (Wikipedia)



Figure 11: Photo on the left shows traditional threshing which changes into mechanized threshing in the right, Abba Gerima watershed (Photo: WLRC)

To reduce the animal labour required for threshing cereal crops, the project introduced a threshing machine. As indicated in figure 11, to thresh *teff* with cattle (in the left photo) requires a considerable number of cattle. In contrast machine threshing shortens the number of days and amount of labour required to thresh the same amount of crops for a reasonable running cost. This will further reduce the pressure of overgrazing resulting from the overstocking of cattle.

The cut and carry system to reduce the pressure of free grazing

The highlands of Ethiopia are dominated by a crop-livestock mixed agricultural system. Livestock is the main component of the farming system as well as providing a coping mechanism in case of crop failure. The traditional animal production system is based on free grazing of animals on hillsides in the rainy season and on farm lands in the dry season. This system creates compaction of soil through trampling and increases water runoff because of the low infiltration rate. Furthermore, grasses and crop residues are destroyed by overstocking which leaves the animals with a shortage of feed and results in the death of livestock in the dry seasons. The cut and carry system or zero grazing involves confining livestock in a stall and the development of a cut & carry feeding system. The livestock are kept in a stable all year round to prevent diseases, soil trampling and feed wastage (Costa S 2014; Meul et al 2012). With the intervention of the WLRC, farmers started to use the cut and carry system, which increases the productivity of livestock and reduces the contribution of free grazing to soil erosion (Fig. 12).



Figure 12. Cut and carry system integrated with animal fattening in the learning watersheds. The photo on the left shows women collecting the grass harvested from the watershed to feed livestock kept in homestead for fattening, as shown in the right photo (photo: WLRC).

Introduction of new crop varieties to increase production and productivity

The main issue leading to cultivation of marginal lands and intensification of agriculture is the ever-growing threat of the low productivity of land (Amsalu & de Graaff 2007). Land fragmentation has increased as a result of the gradually increasing number of households. The introduction of new crop varieties and improved agronomic practices can play a role in reducing the pressure on land and subsequently reduce land degradation (Gebreselassie 2006). In the WLRC project this has been an integral part of the watershed development effort and has enabled the increased production and productivity of land (Fig. 13). Apart from the benefit derived from the introduction of new crop technologies, it has also increased institutional integration among research and development agencies (Water and Land Resource Centre 2014).



Figure 13. New crop varieties introduced by research to increase productivity of land. Photo on the left shows newly introduced pea variety. A photo on the right shows new disease resistant and high yielding wheat crop variety. A photo on field visit by farmers, development agencies and research and project staff (photo: WLRC).

3.5. Natural resources management and gender

Gender being one of the socioeconomic factors affecting the rehabilitation practice of degraded land makes its proper consideration pertinent. The understanding of the links between gender inequality, poverty and land degradation and potential negative effects, and taking appropriate measures will help to ensure sustainable development. Even though the government policy encourages the participation of women in any development intervention (Amhara Region Bureau of Agriculture 2013), it is unlikely to find women deciding on the type of interventions or benefit distribution.

Ethiopian women are mostly responsible for collecting fuel wood, fetching water and taking care of homestead activities (Desta et al. 2005). The involvement of both men and women equally in the decision making process for both planning and sharing of the benefits derived

from the rehabilitation effort is important. Unless both women and men have equal opportunities in deciding on the technology selection for land rehabilitation and benefit sharing then the sustainability of the efforts will remain a challenge.

4. RESULTS FROM THE SURVEY

According to the interviews farmers rated lack of follow-up by the implementing agency as the first problem for the unsustainability of watershed development efforts. Whereas both farmers and government officials agreed that unless livestock management is properly addressed in the watershed development approach, it is very difficult to ensure its sustainability (Table 1 and 2). Results from the survey are presented in tables 1 and 2.

4.1. Perceptions of the level of land degradation

Both communities and government officials acknowledged the seriousness of land degradation in the area (Fig. 14).

4.2. Community participation

Results from the survey indicate that the role of the community was more focused on the construction of soil and water conservation measures (Fig. 15). Even though 36% of government officers argued that communities were participating in technology selection, farmers responded that their role in technology selection is zero.

4.3. Comparison of the government program and the WLRC project

As was stated in the introduction, apart from the government mobilization based watershed development program, there are projects and programs which are supporting the rehabilitation of watersheds in different parts of the region. The communities and the government officials in the learning watersheds of the WLRC project are participating both in the project activities and the government program. A total of 90% of the respondents agreed that the WLRC project watersheds were better in terms of enhancing sustainability (Table 1, question no.12 and Table 2, question no.13). All the respondents from the government offices agreed that the current guideline and approach of the government watershed development need improvement. In the government program, the respondents ranked technology selection and quality of work as the approaches that needed to be improved the most or 55% (ranked as 1st), then the creation of sense of ownership by the community 36% (2nd), community participation 36% (2nd) and livestock management 27% (3rd) (Table 2, question no. 4).

Table 1 Farmers response to the level of degradation and effectiveness of the solutions, participation, and sustainability of WSD efforts (N=20), in ranking the 1st means highly rated and 4th the lowest rated.

Ques- tion	Farmers response to	Options	Percentage	Rank
1	Land degradation problem	Severe	30	
		Moderate	45	
		Low	25	
3	Participation both in project and government program	Yes	100	
		No	0	
		I do not know	0	

4	The role of farmers in watershed development	Planning & problem identification	31	2
		Technology selection	0	0
		Construction of SWC measures	41	1
		Monitoring and Supervision	25	3
		Others	3	4
7	The role of women in WSD in the project compared with government program	Best	13	
		Better	87	
		No difference	0	
8	Area of women participation	Planning & problem identification	25	
		Construction of SWC measures	64	
		Monitoring and Supervision	4	
		Decision on benefit sharing	7	
		Others	0	
9	Any negative impact of mass mobilization	Yes	40	
		No	55	
		I do not know	5	
10	Livelihood impacted by mass mobilization	Labour migration	0	4
		Shortage of grazing land	67	1
		Shortage of farm land	0	4
		Shortage of fuelwood	33	2
		Others (social relation, petty trade)	11	3
11	Is there any difference in magnitude of the problem in social status and gender	Yes	73	
		No	9	
		I do not know	18	
12	Which segment of the community most affected	Women	40	1
		Youths	20	2
		Poor farmers	10	3
		Rich farmers	10	3
		Others	20	2
13	How do you rate the sustainability of WLRC watersheds	Very good	58	
		Good	42	
		Bad	0	
		I do not know	0	
15	Problems in sustainability of WSD activities in government program	Low Participation	13	3
		Lack of alternative livelihood	25	2
		Lack of follow-up	38	1
		Free grazing	25	2
		Others	0	0

Table 2 Government offices response to the level of degradation and effectiveness of the solutions, community participation, and comparison of different programs and sustainability of WSD efforts (N=10); in ranking the 1st means highly rated and 4th the lowest rated.

Question	Government offices response to	Options	Percentage	Rank
1	On the level of land degradation	Severe	63	
		Moderate	36	
		Low	0	
3	Is that necessary to improve the government program	Yes	100	
		No	0	
		I do not have any idea	0	
4		Community participation	36	2

	Which approach of the program needs to be improved	technology selection & quality	55	1
		Creation of sense of ownership	36	2
		Livestock management	27	3
		Others	0	0
6	The role of communities in WSD	Planning and problem identification	55	2
		Technology selection	36	3
		Construction of SWC measures	73	1
		Monitoring and supervision	18	4
		Others	0	0
8	Area of women's participation	Planning & problem identification	27	
		Construction of SWC measures	61	
		Monitoring and supervision	0	
		Decision on benefit sharing	11	
9	The level of women's participation in decision making of benefit sharing	Actively involved	27	
		Only few are involved	55	
		Mostly men decide	18	
10	Is there any missing approach in the government WSD program	Yes	90	
		No	10	
11	Which approach of the program needs to be improved to increase women's participation in decision making	Awareness creation	43	1
		Home garden intervention	29	2
		Alternative energy source	14	3
		Improvement of infrastructure	14	3
12	Which program better enhances sustainability of WSD interventions	Government program	10	
		WLRC project	90	
13	Is there any strategy to incorporate the best practices of the WLRC project approach	Yes	91	
		No	9	
14	Which approach needs to be included in the government program	Participatory planning	36	3
		Integration of technologies	64	1
		Follow up and supervision	55	2
		Alternative livelihood	55	2
18	Main problems associated with sustainability of WSD interventions in the government program	Low Participation	19	3
		Lack of alternative livelihood	23	2
		Lack of follow up	19	3
		Free grazing	38	1

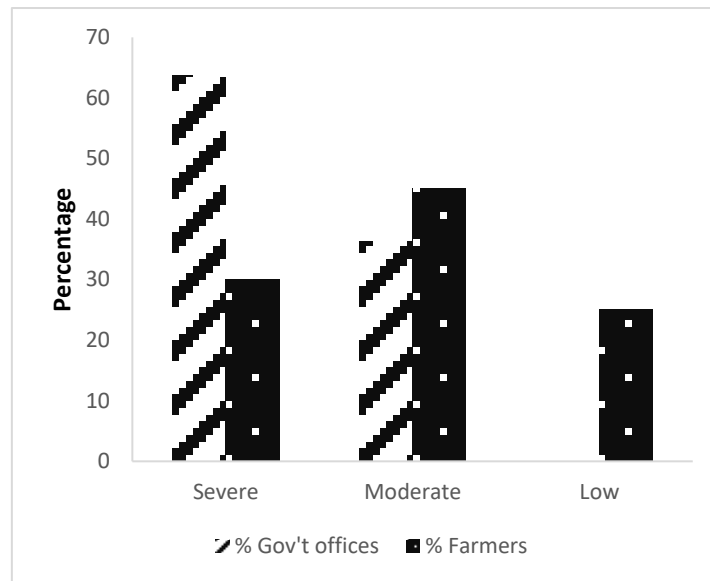


Figure 14. Perceptions of government offices and farmers on the severity of land degradation in the highlands of Ethiopia.

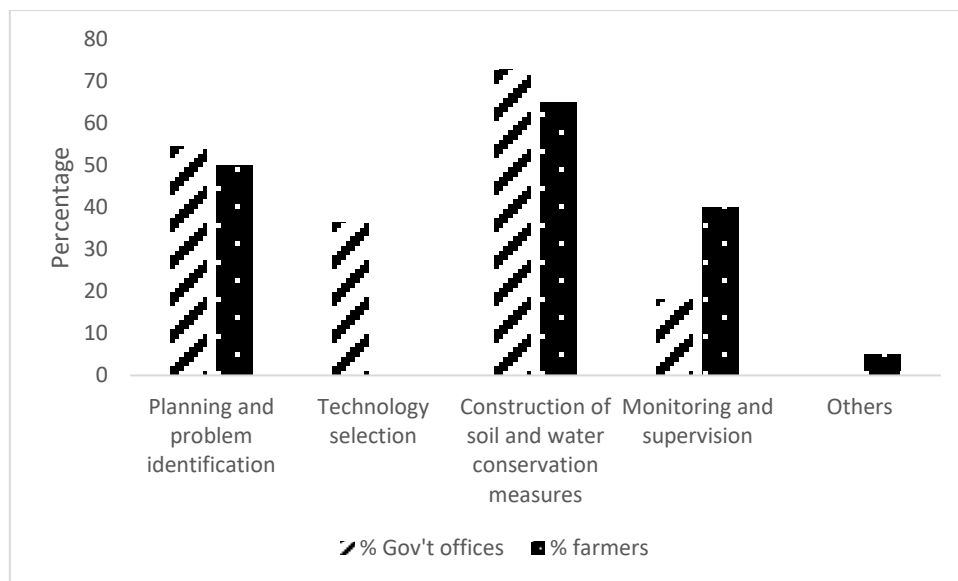


Figure 15. Perceptions of government offices and farmers on the role of communities in the process of watershed development in the highlands of Ethiopia.

4.4. Perceptions of the sustainability of watershed development efforts

The farmers as well as government officials acknowledged the issue of unsustainability of watershed development interventions. The problems of sustainability in the government program were considered to be associated with free grazing, lack of follow-up, lack of alternative livelihoods and low participation of communities in the process (Fig. 16). The ranking of the problem varied between farmers and government institutions. Free grazing was ranked first by government officers whereas farmers argued that the priority problem was associated with lack of follow-up (Fig. 16).

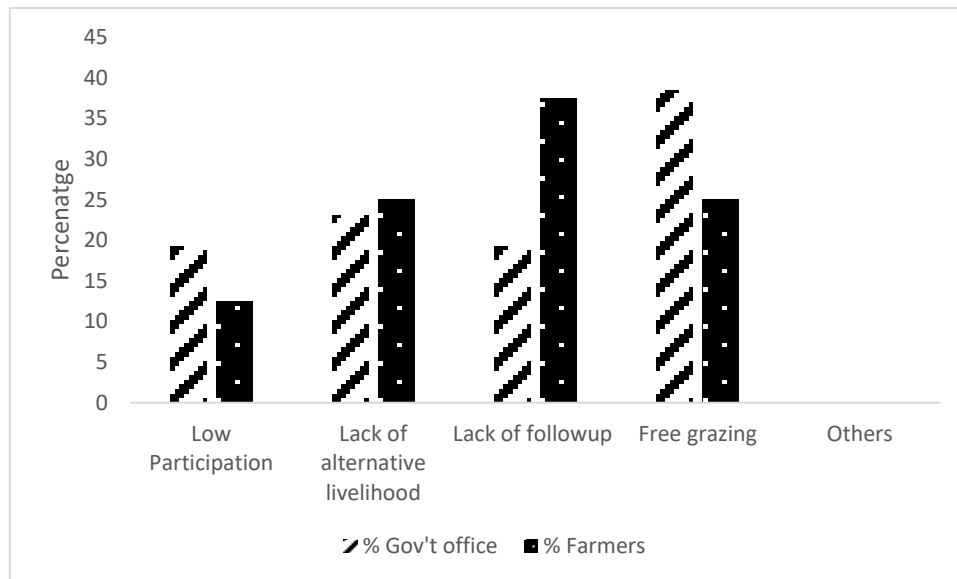


Figure 16. Perceptions of government offices and farmers on the problems associated with sustainability of watershed development efforts in the highlands of Ethiopia.

5. DISCUSSION

5.1. Current approaches towards watershed development

5.1.1. Government program

Starting in 2002 the Ethiopian government has developed comprehensive policy frameworks and guidelines for the proper management and utilization of the country's natural resources (Asrat et al. 2004; Gebreselassie 2006; Nyssen et al. 2009; Teshome 2006), including the Agricultural and Rural Development, Ethiopian Water Sector Strategy, National Community Based Watershed Development Guideline and Conservation Action Plan. These policies and strategies highly emphasise the conservation of natural resources and at the same time aim to improve the livelihood of the rural community. The Agricultural and Rural Development Policy and Strategy stresses the importance of natural resources management in drought prone (moisture stress) areas (Teshome 2006). The policy puts forth natural resources management as a means that should be undertaken in a manner that will maximize the benefits to the rural population whose livelihoods depend on these resources. This case study applies to the moisture sufficient area of the north-western part of the country where it can be reasoned that natural resources management has been overlooked for a long time. As a result, drought prone areas of the country have long experience in watershed development as compared to the moisture sufficient areas. Only during the last five years has there been mobilization of communities towards watershed development activities. In addition, projects and programs like Sustainable Land Management (SLM) supported by the World Bank and GIZ, Community Based Natural Resources Management (CBNRM) supported by IFAD and WLRC, have been introduced in these areas (Amhara Region Bureau of Agriculture 2013).

During the last five years there has been a mass mobilization of communities towards rehabilitation of degraded land across the country. With this public mobilization based program millions of hectares of land have been covered by soil and water conservation measures. The participation of rural communities in the process of land rehabilitation has also increased. In

the public mobilization based watershed development, local government officials initiate farmers' interest in new technologies and participation in development programs by using three strategies. First this is initiated through promotion of the benefits of introduced technologies and natural resource management. The second is through rewarding access to the food for work program in food insecure areas. The third strategy is through the articulation of the historically strong alliances between farmers and the current ruling party. Predominantly to mobilize the farmers, local politicians use the position of the current ruling party in tackling development constraints and the party's alliance with farmers. By using this strong alliance local development brokers try to facilitate communication between government institutions and farmers to implement watershed development agendas (Segers et al. 2009). Farmers rarely participate in development programs with the expectation of new benefits; rather they participate because of the hegemonic party-farmers historical relation and because of the top-down pressure that government agencies put on local politicians. This leads farmers to accept technologies and mobilization programs even when knowing that they are not suitable for them (Segers et al. 2009).

Even though attention on watershed management is improving in the moisture sufficient areas of the region, still implementation is far behind in considering the sustainability dimensions of natural resources management (Amhara Region Bureau of Agriculture 2013). The report from the Bureau of Agriculture concludes that the main problems associated with these issues are lack of experience, technology selection and integration of activities (Amhara Region Bureau of Agriculture 2013). Some argue that the problem goes far beyond these issues and the process of the implementation of watershed activities lacks in-depth understanding of the social set-up of the communities (Keeley & Scoones 2000; Asrat et al. 2004; Amsalu & de Graaff 2007). The WLRC project is established to draw a lesson to the highlands of Ethiopia through the approach of integrated watershed development. The project intervention includes participatory planning, documentation of baseline data, incorporation of research, home garden development and other off-farm activities (Water and Land Resource Centre 2014).

The government program of watershed management in the Amhara region is based on the mobilization of communities for soil and water conservation during the dry seasons. According to a report from the Bureau of Agriculture, each year watershed rehabilitation is practiced in 1500 to 2000 community watersheds⁴ across the region (Amhara Region Bureau of Agriculture 2014). The main focus of the mobilization process is the number of communities which participated each day and the area covered by soil and water conservation measures. Even though some training and supply of hand tools are provided for better accomplishment of the activity in the preparation phase of the campaign, little is done to address socioeconomic issues. The survey showed that 40% of the farmers interviewed believed that the mobilization process affected their livelihood. Nearly 67% of the communities agreed that the construction of soil and water conservation brings a shortage of grazing land as a result of increased area closure. Alternative livelihoods like home garden development, off-farm activities and introduction of improved agricultural technologies are limited.

As was introduced in section two, DPSIR is a framework that can be used to evaluate the sustainability of environmental management systems (Odermatt 2004). In line with this it can be concluded that the government program does not fit with the DPSIR model which is developed as a basis for the sustainable environmental management (see 3.1.3). Mostly the

⁴ According to the watershed development guideline of Ethiopia a community watershed is the smallest planning unit of a watershed development intervention. The maximum size of the watershed that should be taken as a planning unit is suggested to range from 200 to 500 ha.

actions of environmental management are focused on the symptoms of land degradation. The measures then are prescribed as soil and water conservation measures, which are based on physical structures. The watershed development strategy lacks the modification of drivers (unsustainable land management, poverty, and livestock overstocking) and pressures (overgrazing, intensification of agriculture, deforestation and population pressure). The responses then fail to modify drivers and reduce pressure on natural resources (Fig. 17). As a result the rehabilitation efforts of the government remain unsustainable. The findings from the literature review and the results of the survey are in line with the assumptions of this paper.

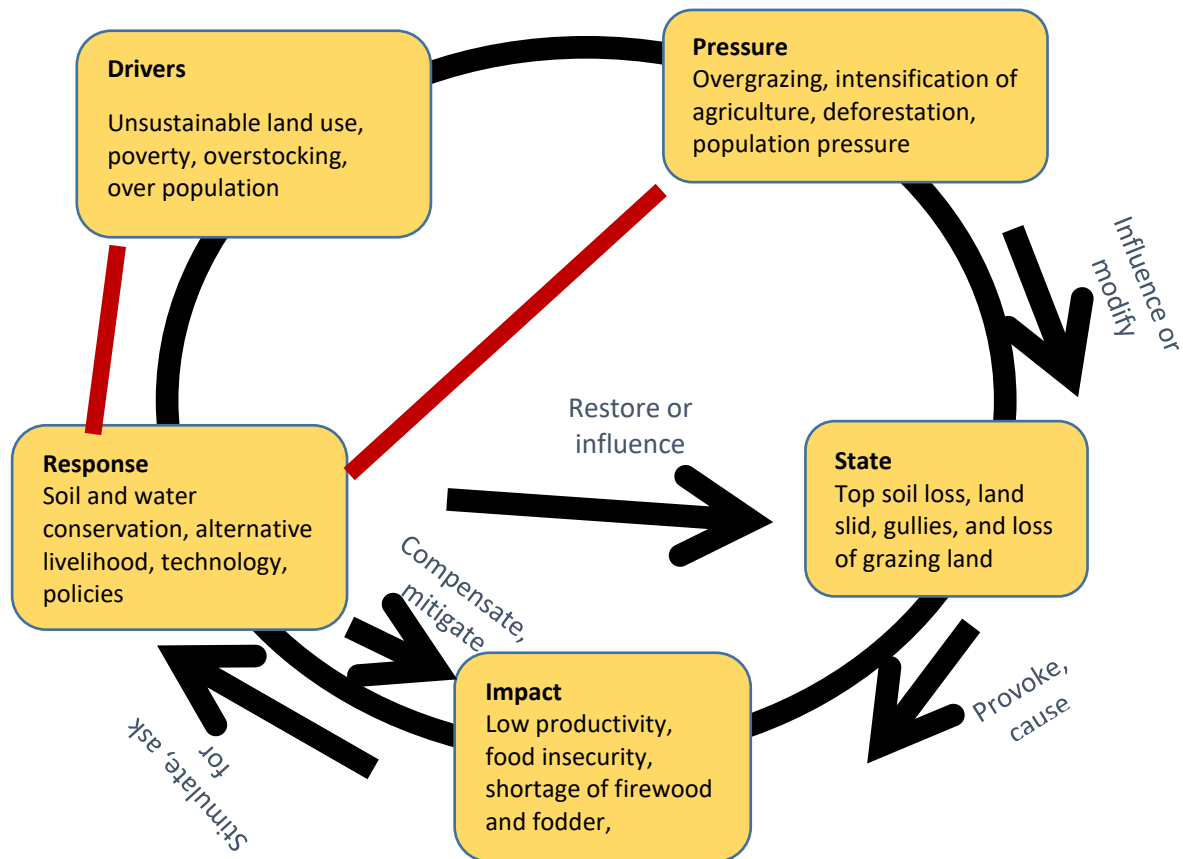


Figure 17. DPSIR framework tested with the government mobilization based watershed development. The link between the response and both drivers and pressures seems to be lacking. The red lines show the missing links from responses to drivers and pressures (adapted from Odermatt 2004).

5.1.2. WLRC watershed development approach

The main issues leading to cultivation of marginal lands and intensification of agriculture are the ever-growing threats of low productivity of the land, population pressure and the lack of alternative livelihoods (Amsalu & de Graaff 2007). Furthermore, in the case of the highlands of Ethiopia the size of the landholdings of smallholder farmers is gradually shrinking. Farm fragmentation is also emerging as the main problem (Gebreselassie 2006). This pressing problem is pushing the search for marginal lands for cultivation and increases the rate of land degradation. As was indicated in section two on the practices of the WLRC project, the intervention of the project includes physical SWC, home garden development, and introduction of new technologies that increase agricultural productivity per unit area of land. The comparison

of both the WLRC project and the government programs was undertaken based on the DPSIR model.

The results from the literature review (Amsalu & de Graaff 2007; Gebreselassie 2006; Water and Land Resource Centre 2015) and the survey show that there is a significant difference in the approaches to tackle the ever increasing land degradation problem in the study area. One of the success stories behind the approach of the WLRC project is their commitment to forage development and in adopting the cut and carry system, creation of alternative livelihoods to reduce the burden on natural resources, and the introduction of technologies that increase productivity and reduce the requirement of human and animal labour for the farming system (Figs. 7, 8, 9, 10, 11, 12 & 13). The interventions of watershed development are mainly targeted towards tackling drivers and pressures that accelerate the rate of land degradation. The activities of soil and water conservation to improve the state and to mitigate the impact also modify the drivers and pressures posed on natural resources (see 3.4).

The impact assessment document from the Abba Gerima watershed also shows that before the intervention of the watershed project 43% of the households used fruit and 30% vegetables as a source of income. However, after the project intervention 81% and 51% of the households used fruit and vegetable production as a source of income, respectively. The document also indicates that out of the total number of sampled households 30% used forage production as a source of income before the intervention while 51% of the households used forage production as a source of income after the intervention (Water and Land Resource Centre 2015). In support of this, 90% of the interviewed government officers agreed that the WLRC watershed development approach better enhances sustainability than does the government program (Table 2, question no.12).

The findings from the literature review and the interviews were in line with the assumption of this paper in the problem statement and the objectives. However, the results from interviews showed that the WLRC project is still lacking in addressing gender issues, like that of the government. Even though 87% of the interviewed communities believed that the role of women in the watershed development of the project is better, still women's participation in decisions on sharing benefits remains low. Among interviewed government officers 55% of the respondents agreed that only a few women were involved, 27% said women were actively involved, and 18% said that mostly the men decide.

5.2. Alternative policy variables in watershed development

To reverse the problem of land degradation, watershed rehabilitation has been practiced for the last 30 years through different schemes of the FFW and CFW programs in the highlands of Ethiopia. The programs have put special emphasis on the drought prone areas of the country. Starting in 2010 these programs have been extended to a wider region and there is a mass mobilization of communities contributing free labour for the construction of SWC (Amhara Region Bureau of Agriculture 2013). Each year thousands of hectares of land have been rehabilitated. Every householder living in rural areas has an obligation to participate 30 to 40 days in each year in this soil and water conservation campaign. The attention given to the rehabilitation of degraded lands by policy makers has remarkably increased. With this focus a lot of success stories are achieved in terms of rehabilitation of degraded land (Fig. 5). The commitment of communities and government has attracted many of the international donors to support sustainable land management.

Even though a lot of success stories can be traced back from the public mobilization based watershed development approach, there are issues that need to be addressed to ensure the sustainability of these efforts.

The first is lack of a clear understanding of the return of soil and water conservation measures. Obviously SWC efforts have a long term return which is derived from the rehabilitated farm and grazing land. But the Ethiopian subsistence farmers need some form of livelihood option that can support their current needs. In the interviews, 40% of the farmers responded that the mass mobilization affected their livelihood and 67% agreed that it affected them through creating a shortage of grazing land. Of the respondents 38% agreed that it affected their livelihood indirectly through taking their time from social networking, labour rent and collection of wood for fuel. On the magnitude of this problem 40% responded that women are most affected and 20% agreed that youths are affected. This entails the need for consideration of the current needs of communities to cope with the problem of shortage of grazing, fuel wood and other forms of livelihood alternatives that the communities deal with.

The second problem is lack of an integrated approach. The watershed development program lacks integration of homestead development, introduction of technologies that increase productivity, a clear strategy on forage development and other off-farm activities. These issues are better addressed in the WLRC project intervention areas and the government needs to scale up to the region-wide program. The ever-increasing population in the highlands of Ethiopia needs alternatives other than farming, especially the youths. The intensification of off-farm activities and other non-farm livelihood options will reduce the pressure on intensification of agriculture that is practiced at the expense of forest clearing. In addition appropriate livestock management practices will reduce the pressure of free grazing, consequently minimizing the destruction of rehabilitated land.

The third problem is associated with the participation of communities in all the processes of watershed development. The public mobilization based watershed development approach is mostly addressed in a top-down manner and gives little room for the communities to decide. The government officers ranked the role of the communities differently than did the communities themselves (see section 4). From both the interviews of communities, government officials and literature review, it is clear that the process of watershed development lacks adequate involvement of the communities in all processes of watershed development.

The fourth problem is the issue of gender imbalance in the process of decision making of sharing benefits from the rehabilitated land. The report from the Bureau of Agriculture acknowledges the problem of little women's participation in development programs (Amhara Region Bureau of Agriculture 2013). In Ethiopia women are mainly dependent on natural resources, as fetching water, collection of fuel wood and collecting fodder for livestock that are around the home garden are the workloads assigned to women by the society (Desta et al. 2005). Therefore the participation of women in the process of decision making and of benefit sharing in the rehabilitated land is pertinent. In the interviews, 64% and 61% of both communities and government officers responded that the role of women in watershed development is limited to the construction of SWC structures. In addition, 55% of government officers agree that women rarely participated in decision on benefit sharing. As a result, to take care of their family's day to day needs women illegally access rehabilitated lands. This must be taken into account in the assessment of the sustainability of rehabilitation efforts.

6. CONCLUSION AND RECOMMENDATIONS

Land degradation, coupled with backward agricultural practices, threatens the livelihood of smallholder farmers in the highlands of Ethiopia. By using a literature review and conducting a survey in two watersheds the approach of the government program and WLRC projects were evaluated based on the DPSIR conceptual framework. The findings from the literature review and other data indicate that the watershed development practices of the learning watershed of the WLRC project are successful in terms of addressing the multifaceted issues of land degradation. Through an analysis of the practices in the WLRC project learning watersheds of Abba Gerima and Debre Yakob, this paper reveals several socioeconomic issues and best practices that should be addressed in the policy framework of natural resources management of the country:

- i. The proper consideration of alternative livelihoods. Since the return from soil and water conservation is long term, it is very important to consider short term benefits so that farmers can obtain a livelihood and consequently reduce the pressure on natural resources. The introduction of homestead development, technology and improved livestock management practices can significantly improve the livelihood of communities and reduce the root causes of land degradation.
- ii. The genuine participation of the communities in all processes of watershed development. The public mobilization based watershed development is based on a top down approach. The results from the interviews suggest that the role of the communities, both in the government and WLRC projects, is predominantly the construction of soil and water conservation measures. Additionally, their role in technology selection is low and that they have a very limited role in planning and problem identification, monitoring and supervision. With this limited and narrow participation of the local communities, it is very difficult to expect the watershed development efforts to be sustainable.
- iii. The provision of an equal chance for both genders in the decision making on sharing of benefits. The results from the survey suggest that both in the government and the WLRC project women rarely participate in the decision on sharing benefits from the rehabilitated watersheds. The participation of women is limited to the construction of soil and water conservation measures. Given the dependency of Ethiopian women on natural resources to fulfil their family's daily needs, it is important to properly consider their role in deciding on benefit sharing. This will help to ensure the sustainability of watershed development efforts.

Generally the findings indicate that the WLRC project watershed development approach has a good performance in addressing the drivers and pressures of land degradation and is in better harmony with the DPSIR model. The government program is focused on tackling the symptoms of land degradation and seems to neglect issues that reduce the pressures and drivers of land degradation in its intervention. On the other hand, both programs fail to ensure the genuine participation of communities, especially in involving women in the process of decision making regarding the sharing of benefits.

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APPENDICES

Appendix 1. Questionnaire for government officials, Experts and Development Agents at all level

I. Background information

i.	Name	
ii.	Work place	
iii.	Work position	

II. The level of land degradation and effectiveness of solutions

1. How do you define the level of land degradation in the highlands of Ethiopia
A) Sever B) Moderate C) Low
2. The last five year there has been a mass mobilization towards natural resources management initiated by the government, in your opinion how do you find the program in improving natural resources management?
A) Very effective B) Moderately effective C) ineffective D) Not sure
3. In your opinion can the program be improved to increase its effectiveness?
A) Yes B) No D) I do not have any idea
4. If yes, then which element of the program stated below should be improved? (Rank with regard to importance, 1 as most important, 2 as second and etc.
A) Community participation B) technology selection and quality of work C) Lack of ownership by the community D) Livestock management practice E) Others

III. Community participation

5. How do you rate the level of participation of the community in the government watershed development program?
A) Very good B) Good D) Bad E) I do not have any idea
6. What was the role of the community in the process of watershed development
A) Planning and problem identification B) Technology selection C) Construction of soil and water conservation measures D) Monitoring and supervision E) Others---
7. How do you compare the level of participation of women in all aspects of watershed development in the project as compared to the government program
A) Best B) Better C) No difference D) I do not have any idea
8. In which area do women participate in the project watershed development practice? (more than one answer is possible)
A) Planning and problem identification B) Construction of soil and water conservation measures C) monitoring and supervision D) Decision on benefit sharing E) Others-----

9. How do you see women decision making in the process of benefit sharing in the project supported watershed after rehabilitation?
A) Actively involved B) only few are involved C) Mostly men decide D) Not yet known
10. In your opinion is there any missing approach that should be scaled up to the government program in relation to women's decision making in benefit sharing
A) Yes B) No C) I do not have any idea
11. If yes, what alternative approach do you think should be included in the government watershed development to increase the decision making of women in benefit sharing?
A) Awareness creation B) Integration of home garden development C) Supply of alternative energy sources D) Improvement of local infrastructure to improve their access E) Others-----

IV. *Comparison of the programs and guideline improvement*

12. If you compare the intervention of the government program with the WLRC project watershed development intervention, which of the two would you consider better enhances sustainability?
A) Government program B) WLRC project) C) No difference
13. Do you have any strategy to incorporate the best practices of other projects on the ongoing government program?
A Yes B) No C) Not yet decided
14. If your answer is yes, which approach do you think should be included in the watershed development strategy of the government? (more than one answer is possible)
A) Participatory planning B) Integration of technology B) Follow up and supervision D) Creation of alternative livelihood E) others-----
15. Do you think the current guidelines and policies of natural resources management need some improvement?
A) Yes B) No C) I am not sure
16. If yes, what is your recommendation on its improvement? (more than one answer is possible)
A) Planning approach B) Technology selection D) Follow up and supervision C) Integration of off-farm activities E) Others

V. *Sustainability of watershed development efforts*

17. How do you evaluate the sustainability of watershed development in the government mobilization program?
A) Very good B) good C) Intermediate D) Bad E) Not yet known
18. If there is a problem in sustaining the rehabilitated watershed, what do you think the main problems associated with it? (more than one answer is possible)

- A) Absence of alternative livelihood B) Free grazing C) Lack of maintenance D) Lack of follow up and supervision E) Others-----

Appendix 2. Questionnaire for farmer interview

I. Background Information

i.	Interviewer's Name	
ii.	Age	
iii.	Sex	
iv.	Social status	Rich Medium Poor
v.	Name of the household head (respondent)	
vi.	Name of Village	
vii.	Name of Watershed	
viii.	Name of <i>Kebele</i> (PA)	
ix.	Name of <i>District</i>	

II. The level of land degradation and effectiveness of solutions

- How do you define the level of land degradation problem in your locality?
A) Sever B) Moderate C) Low D) I don't know
- Can you trace back when watershed development practice was started in your area?
A) 3-5 years B) 5-8 years C) Before 8 years ago

III. Participation

- Have you ever participated in the government's watershed development program?
A) Yes B) No C) I do not know
- If your answer is yes, then what was your role in watershed development practice? (more than one answer is possible)
A) Planning and problem identification B) Construction of soil and water conservation measures C) Monitoring and supervision D) Technology selection E) others-----

- Have you ever participated in other watershed programs of the government a part from the project watershed?
A) Yes B) No C) I do not know
- If your answer is yes, then what difference do you observe between the two programs in terms of approach? (more than one answer is possible)
A) Participation in planning and problem identification B) Creation of alternative livelihood C) Supervision and monitoring D) Technology selection E) Others-----

7. How do you compare the level of participation of women in all aspects of watershed development in the project as compared to the government program
A) Best B) Better C) No difference D) I have no idea
8. In which area do women participate in watershed development practice? (more than one answer is possible)
A) Planning and problem identification B) Construction of soil and water conservation measures C) monitoring and supervision D) Decision on benefit sharing E) Others---

IV. Sustainability of efforts

9. Do you think there is negative impact associated with the mass mobilization towards rehabilitation of degraded lands?
A) Yes B) No C) I do not have any idea
10. If yes, which livelihood option was impacted with this intervention (more than one answer is possible and rank them in the order of seriousness, 1 as most seriously affected and 2 as second and etc.)
A) Labour migration and labour rent income B) shortage of grazing land as a result of area closure C) Shortage of farm land due to terraces D) Shortage of fuel wood E) Others....
11. Do you think the magnitude of the problem differ based on social status and gender?
A) Yes B) No C) I do not have any idea
12. If yes, in your opinion which segment of the community is most affected? Put your answer in order of severity of the problem, 1 as most seriously affected and 2 as second and etc.)
A) Women B) Youths C) Poor farmers D) Rich farmers E) Others-----
13. How do you rate the sustainability of WLRC watershed?
A) Very good B) Good C) Bad D) I do not have any idea
14. In your opinion is there any problem in sustainability of rehabilitated watersheds in the government program
A) Yes B) No C) I do not have any idea
15. If yes, what are the problems associated with the destruction of rehabilitated watersheds in the government program? (more than one answer is possible)
A) Low level of participation in planning, problem identification and technology selection
B) Low follow up and supervision C) Absence of alternative livelihood D) Absence of maintenance and sense of ownership E) Others-----