

# Land Degradation Causes, Consequences and Sustainability of the Restoration Efforts: The Case of Soro Wereda, Hadiya Zone, Southern Ethiopia

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**Abstract:** Land degradation is a global issue and it is more severe in developing countries like Ethiopia. To address the problems of land degradation in Ethiopia, many efforts have been made since 1970s. From then onwards many attempts have been made and integrated watershed management in one among these. The study was undertaken in Soro Wereda, Hadiya Zone, and SNNPR with the objective of examining land degradation causes, consequences and sustainability of the restoration efforts. In order to achieve the stated objectives, both primary and secondary data were generated by employing qualitative and quantitative methods. Systematic sampling technique was used to select 97 representative households from three kebeles. The quantitative data was analyzed by using frequency, percentage, mean and standard deviation. The qualitative data was analyzed through narration. The findings of the study showed that gully formation, stoniness of land, absence of grasses and vegetation cover, decline in crop productivity and change in soil color are the main symptoms of land degradation. The major extent of land degradation as perceived by the local people was severe. Only very few of the households opted that highly severe regarding the extent of land degradation. The major causes of land degradation in the study were soil erosion, deforestation and over cultivation. In addition, topography, overgrazing, lack of conservation methods and cultivation of marginal land were the other important causes with the certain degree of variation. The core impacts of land degradation were the declining of yield year after year, food insecurity| poverty and drought and famine. The remaining increases of inputs, malnutrition, desertification and displacement of people ranked two up to five followed by the above mentioned impacts. It is very difficult to restore the degraded land without the full participation of relevant stakeholders. The main stakeholders that participate in the restoration process include government, NGOs, farmers and DAs and each of these stakeholders have its own roles. Adopting of the participatory approach, promoting the awareness of rural communities as well as other stakeholders, management of restored land, and combining of the restoration efforts with local knowledge are core issues to the sustainability of the restoration process. In order to run the restoration efforts in sustainable way strengthening of community participation, capacity building of stakeholders, providing of incentives for those achieve the restoration process and scale up of the best practices are needed.

**Keywords:** Restoration Efforts, Land Degradation, Causes, Consequences, Sustainability, Stakeholders

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## 1. Introduction

Land degradation is a global issue and it is more severe in developing countries [17]. Land degradation remains an important global agenda in the 21<sup>st</sup> century because of its advance on agronomic productivity, the environment and its effect on food security and the quality of life [2]. The 2008

report of FAO indicated that during the period 1981-2003 the total land degraded in Ethiopia is estimated to be 297Km<sup>2</sup> [4]. In response to increasing concerns about degradation of the natural resources and the sustainability of agricultural production potentials in many poor regions of the world, many national and international organizations have initiated research and development programmes for natural resource

management (NRM) [5]. Recognizing land degradation as a major environmental and socio-economic problem, the government of Ethiopia has made several interventions. As a result large areas have been converted to terraces, covered by soil bunds, closed by area closures and planted with millions of tree seedlings [11].

Soro wereda is one of the most densely populated highland areas in Ethiopia. Population pressure is the main triggering factor for land degradation problem in the study area. In the study area a number of the efforts have been taken by the joint-efforts of government, agricultural office, local farmers, DAs and with the minimum role of the NGO's that began in 2010 to restore the degraded land. Land degradation has severe socio-economic problem in study area which resulted in reduced production and productivity of land, loss of natural vegetation and poverty. These conditions create a desire on the researcher to conduct the research on it. Therefore, this study is going to examine land degradation causes, consequences and sustainability of the restoration efforts in Soro Wereda.

### ***1.1. Statement of the Problem***

Land degradation is a serious growing problem in Ethiopia as well as study area. As the result of these different measures are taken to restore the degraded land and there are a number of factors that hinder the restoration efforts to the degraded land. Because land degradation is a critical problem, many efforts by both local groups and the government are now being focused on promoting SLM practices. The first phase of the SLMP was launched in 2008 and it has successfully introduced land management practices and rehabilitated thousands of hectares of degraded lands using physical and biological measures in 45 selected woredas and watersheds [9].

Agriculture is the mainstay of the Ethiopian economy. The government's priority to fight widespread poverty and food insecurity is also directed towards this sector. The Agricultural Development Led Industrialization (ADLI), which has been adopted as development strategy since 1994/95, is believed to have put the agriculture sector in its proper place in the Ethiopia Economy [10]. Land degradation in general and soil erosion in particular still remain the major challenges that are adversely affecting the agricultural performance of the country; hence the call for improved land management practices. Some of the outcomes include reduced run off, soil erosion, and associated downstream siltation, increased vegetation cover and surface roughness, increased soil depth, increased recharge of ground water table, increased crop production and productivity and improvement in fodder availability [25].

It would be unthinkable to attain sustainable land management without the full participation of relevant stakeholders. In Ethiopia, there are a number of stakeholders who are directly or indirectly involved in these activities. They fall into the following categories; government, development agencies, research institutes, farmers and NGO's [13, 19]. Recently government has taken initiative to run the restoration programmers on degraded lands through integrated community participation.

Due to the government political structure, power and resource are decentralized and restoration programme is supposed to be integrated in development plans of each administration level to contribute to the goal of the government on environmental conservation [22].

Restoration results encourage the stakeholders to involve in the programme in sustainable ways. Lack of awareness and attention of farmers, continuous training by government, low capital and support of NGOs in large number to restore the degraded land become the challenges to run the programme. The main cause of land degradation in Ethiopia is soil erosion. Erosion in Ethiopian highlands, nearly one billion tons of soil is lost each year due to natural causes exacerbated by human activities, particularly overgrazing, over cultivation, deforestation, topography and high intensity of rainfall. The effects includes reduce outputs (crop yield, livestock yields), siltation, food insecurity, desertification, displacement of people, poverty and malnutrition and the like. Through the proper understanding of the real causes and impacts of land degradation, the stakeholders are easily involved in the restoration program with the active participation and understanding of the causes and impacts of land degradation increases the interest of stakeholders about the restoration process. Also once the causes and the impacts are known, this opens the door to restore the degraded land. Reclaiming of a degraded land is not an easy task and requires a lot of energy, capital, material, and skilled man power. There are a number of challenges that constraint the sustainability of the restoration process. It is obvious any restoration effort bears its own challenges. Generally both are go side by side and are highly interlinked.

### ***1.2. Objectives of the Study***

The general objective of the study was to examine the causes, consequences of land degradation and its sustainability of the restoration processes in the study area.

The study attempted to address the following specific objectives:

- 1) To assess the extent and symptoms of the land degradation;
- 2) To assess perceived causes and consequences of land degradation;
- 3) To examine the role of stakeholders in the restoration efforts;
- 4) To assess the sustainability of the restoration process.

### ***1.3. Research Questions***

The following research questions were used to guide the research:

- 1) How do farmers perceive the extent and symptoms of land degradation?
- 2) What are the major causes of land degradation and how about its outcomes?
- 3) What are the roles of stakeholders that engage in the restoration efforts?
- 4) How about the sustainability of the restoration efforts?

## 2. Materials and Methods

### 2.1. Description of the Study Area

Soro is one of the weredas in the Southern Nations, Nationalities and Peoples Region of Ethiopia and part of the Hadiya Zone which is located at 7° 30'-7° 43' North latitude and 37° 35'-38° 05' East longitude. Soro is bordered in the South by the Kembata Tembaro Zone, on the Southwest by the Dawro Zone, on the West by the Omo River which separates it from the Oromia Region, on the North by Gomibora, on the Northeast by Limo, and on the Southeast by Duna. The administrative center of this wereda is Gimbichu.

The Soro Wereda is a typical of the moist weyna-dega agro-ecological zone (8% dega, 55% weyna-dega and 37% kola). The mean annual total rainfall is about 1260 mm and has average temperature of 19°C. Accordingly, it has two rainy seasons, Belg and Kiremt. Belg is the short rainy seasons and lasts between March and May. The kiremt season, which is the longest rainy season, lasts between June and September. The highest rainfall occurs in July and August. In terms of water resources in the study area, there are three main streams namely, Lintala stream (meaning the clean), Ajacho and Gamunna streams. Lintala stream originates from the foot of the Mount Shonkola. It is the tallest mountain in the Soro wereda.

### 2.2. Agricultural Activities of the Study Area

According to the information of Soro Wereda Agricultural and Rural Development Office, major crops cultivated in the study area are: cereals as teff, maize, wheat, sorghum; pulses such as haricot bean; horticultural crops like enset, coffee, different vegetables, etc. and different types of livestock like cattle, goat, sheep, donkey, mule, etc. Soro Wereda Agricultural and Rural Development Office is the main government institution working with farmers in the study area. The office has a structure that extends down to the development centers by assigning DAs who are graduated from different discipline of agriculture. To meet its objective, different agricultural extension system has been tried in the Wereda for decades, new participatory, Agricultural Demonstration and Training Extension system underway [8].

## 3. Research Methodology

### 3.1. Research Design

The research design used in this research was mixed, a concurrent type. Both qualitative and quantitative data were employed as the research demands both.

### 3.2. Sample Size Determination and Sampling Techniques

Soro wereda has got 46 kebeles among which three of them were selected. The selection was based on the contact with Agricultural and Rural Development office especially with the Natural Resource Development and Conservation Work. The

three kebeles are Harche uyaya, Shara and 1<sup>st</sup> Hankota.

The number of the households for Harche uyaya, Shara and 1<sup>st</sup> Hankota were 1275, 782 and 855 respectively. Accordingly, the total households residing in the study area was 2912 [21], out of which, 97 Sample respondents were selected by using the following formula.  $n = \frac{N}{1+N(e)^2}$  Where, n=sample size N=population size e=level of precision, i.e. 0.1. The above formula is used to calculate the sample size with a 90% confidence level and 0.1 errors [14]. For the triangulation of information 27 respondents were involved in focus group discussion and key informant interviews. Generally the total sample size of the researcher for this research was 124.

The sample size for each kebele was determined according to the total number of households. The kebeles households were selected after the arranging of households in alphabetical order by using the following formula  $K = \frac{N}{n}$ . The researcher then asked the head of each kebele agricultural offices to facilitate the condition to contact with the sampled households at the farmer training center and finally the interview was conducted.

### 3.3. Data Sources and Methods of Data Collection

Data for this research was collected or gathered from two sources. These are primary and secondary sources. The primary sources are farmers, kebeles Administrators, Agricultural experts and DAs. In addition, secondary sources of information was used as other tools for acquiring the relevant information to the study which includes journal, books, census, research works, project reports and seminar paper. The instruments of data collection that used were field observation, structured interviews, focus group discussion and key-informants interview.

### 3.4. Methods of Data Analysis

The quantitative data was tabulated and analyzed. Statistical Package for Social Scientists (SPSS) version 20 software was employed to analyze data gathered from interviewed households. Descriptive statistics such as frequency, percentage, mean and standard deviation were used. The data was presented in tables, graphs, plates and figures. Qualitative data was gathered through focus group discussion, field observation and key informant interviews was analyzed by narration for description and first discussion was made with the experts who work at natural resource development and conservation work and land management office and development agents and then during the discussion the important points were taken through writing on issues. Pictures were also used as evidence and to support the qualitative data where necessary.

## 4. Results and Discussion

### 4.1. Background Information of the Households

Concerning age composition, majority of them were

categorized above the age of 35. 36 – 46 (48.5%); 47-57 (24.7%) and above 58 (12.4%). About 14 (14.4%) of them were found between 25 and 35 years. The maximum and minimum ages of the households were 70 and 25 respectively and the average was 44 years. The existence of productive age groups is crucial in areas where there is a shortage of finance and the work that requires labor, like the restoration of degraded land. In the study area based on field survey the productive age group has a positive impact for the restoration of degraded land.

#### 4.2. Household Size

According to field survey the total family sizes of sample household were found to be 570 out of which 290 (50.9%) were males and 280 (49.1%) were females. The households with one to four members constitute 25.8 percent, households with 5-7 members make up 54.6 percent: with 8-10 constitute 17.5 percent and above 10 contain the remaining 2.1 percent. The minimum and maximum size of households was 2 and 17 respectively, the mean being 6 with a standard deviation of 2.26. This is by far greater than what has been reported for the Region and the Zone (5.1 and 5.7 respectively) [7].

#### 4.3. Extents and Symptoms of Land Degradation

As it is mentioned above, land degradation is a common environmental problem in Ethiopia and remains an important global agenda in the 21<sup>st</sup> century. Loss of soil productivity leads to reduced farm income and food insecurity, particularly among the rural poor and thus continuing or worsening poverty. Land degradation can contribute directly to poverty separately from its impact on agricultural productivity, by reducing the availability of other goods and services important to poor households [20].

The study showed that in the study area almost all sampled households (100%) perceived the presence of land degradation problem. Gully formation, stoniness of land, absence of grasses and vegetation cover, decline in crop productivity, change in soil color, drying up of streams and springs, presence of bare land, land itself requiring high fertilizer, decreasing of biodiversity, lack of soil fertility, climate change, food insecurity, drought and famine are among the symptoms of land degradation perceived by the local people. As indicated by Amare *et al.*, [1] land degradation manifests itself in many different ways: vegetation becomes increasingly scarce, water courses dry up, thorny weeds predominate in once rich pastures, footpaths grow into gullies, and soils become thin and stony. Based on field observation in the study area, there is the existence of land degradation and this is created because of lack of soil and water conservation at the top of land and resulted in the formation of gully, reduces soil fertility and gradually the land cover with stone at the bottom of land (See figure 1).



Figure 1. Symptoms of land degradation, (Photo by Researcher, 2015).

Table 1 shows that 7 (7.2%) of interviewed households mentioned the presence of land degradation in their kebeles have highly severe and about 87 (89.7%) of the interviewed households opted that there is moderate to severe extent of land degradation problem in their kebeles. Only about 3 (3.1%) of respondents indicated that there is slight land degradation in their kebeles. According to survey, most of the farmers confirmed that the land degradation is occurred more at the summer season because of; at this season there is high amount of soil erosion, lack of conservation measures and high intensity of the rainfall. At the study area the major forms of land degradation is soil erosion by water. Some of sampled households confirmed that degradation is occurred at the winter season as the result of the soil erosion by wind and other forms.

Table 1. Extent of Land Degradation as Perceived by the Local People.

Extent of Land Degradation	Frequency	Percent
Highly Severe	7	7.2
Severe	47	48.5
Moderate	40	41.2
Slight	3	3.1
Total	97	100

Source: Field Survey, 2015

#### 4.4. Household's Perception About Soil Erosion Problem

Soil erosion is recognized as one of the world's most serious environmental problems [3]. Perception of soil erosion as a hazard to agricultural production and sustainable agriculture is the most important determinant of effort in adoption of conservation measures [11]. According to survey, the majority of the farmers (96.9%) acknowledged that soil erosion is a problem on their farmland and the remaining (3.1%) respondents replied that there is no soil erosion problem. Concerning degree of soil erosion problem the study showed that most of the interviewed households perceived that there is moderate to severe extent of soil erosion problem on their farmland. This is supported by Kibemo [16] 29.8% of interviewed

farmers mentioned erosion on their farm-field is minor and about 55 (65.5%) of the farmers interviewed opted that there is moderate to severe degree of soil erosion problem on their lands. Only about 4.8% of farmers indicated that there is no erosion problem on their farms. Only 2.1% of farmers acknowledged that there is slight soil erosion problem on their farmland and the rest 5.2% perceived that there is highly severe soil erosion problem on their farmland (See Table 2). As compared to the number of respondents who stated the degree of the problem of soil erosion on farmland as slight is smaller

than those who stated the intensity of soil erosion as severe and moderate. During FGD, the selected respondents raised the point of view about it again and again about the extent of the problem and the problem is severe as the result of topography, low coverage of land with vegetation, gully development and due to the fast growing of population had the low habit of fallowing of land and cultivating of more marginal land, these conditions exacerbate the problem more in the study area. In general terms, the households were well aware of the problems of soil erosion on their farmland.

**Table 2.** Households perception of soil erosion (in degree of problem).

Soil Erosion	Frequency	Percent	Degree of problem	Frequency	Percent
Yes	94	96.9	Highly Severe	5	5.2
No	3	3.1	Severe	50	51.5
			Moderate	40	41.2
Total	97	100	Slight	2	2.1
			Total	97	100

Source: Field Survey, 2015

#### 4.5. Major Causes for Land Degradation

Ethiopia is believed to be one of the Sub-Saharan African countries most seriously affected by land degradation. It has been reported that land degradation in Ethiopia accounts for 8% of the global total [24]. As it is indicated in Table 3, most of interviewed households were aware about the causes of land degradation in the study area. On the basis of survey, the major causes of land degradation mentioned by 100% sampled households were soil erosion, deforestation and over cultivation. This finding is moreover supported by Anteneh [2] the result indicates that all of the respondents were aware of soil erosion and deforestation as causes of land degradation. In addition, a considerable number of households showed that topography, overgrazing, lack of conservation methods and cultivation of marginal land are the other important causes of land degradation that consisted of 94.8%, 87.6%, 89.6%, 87.6% and 77.3% respectively with the certain degree of variation.

**Table 3.** The Major Causes for Land Degradation.

Major causes for land degradation	Frequency	Percent
Soil erosion	97	100
Deforestation	97	100
Overgrazing	85	87.6
Over cultivation	97	100
Rapid population growth	87	89.6
Topography	92	94.8
Cultivation of marginal land	75	77.3
Lack of conservation methods	90	87.6

Source: Field Survey, 2015

Based on the information gathered from key informants from Soro wereda Agricultural and Rural Developments office, field observation and focus group discussion, the study area is found at the steep slope and this relief is vulnerable to land degradation due to the continues existence

of soil erosion in this area.

#### 4.6. Impacts of Land Degradation as Perceived by the Local People

According to survey, all interviewed farmers 97 (100%) perceived that there are a number of consequences occur followed by the degradation of land in the study area. Among these the core are the declining of yield year after year, food insecurity| poverty and drought and famine because of 100% farmers opted these impacts. This finding is supported by the view of Getachew [12] that the rise agricultural development in Ethiopia is hampered by many factors, among which land degradation which is threatening the overall sustainability of agricultural production of the country and as it is reported by Mesfin [18] land degradation is seriously affecting the livelihood of the local community. Due to land degradation problem, the agricultural lands currently used for cultivation requires the application of more chemical fertilizers over time. Unless it is difficult to obtain yields and such degraded lands remains out of use. Besides of that, the remaining increases of inputs, malnutrition, desertification and displacement of people ranked two up to five followed by the above mentioned impacts respectively (see table 4).

**Table 4.** Impacts of Land Degradation.

Impacts of land degradation	Frequency	Percent
Declining of yield	97	100
Drought and famine	97	100
Displacement of people	50	51.5
Increases inputs	93	95.8
Food insecurity  poverty	97	100
Malnutrition	86	88.6
Desertification	60	61.8

Source: Field Survey, 2015



#### 4.7. Participation of the Local People in the Restoration Efforts

Participation of the local people is one of steppingstone to achieve the restoration program and one hand can never clamp, this shows that every person at community level should play a great role for success of program. Concerning the participation of family members in restoration program, most of sampled households acknowledged all are participating in the program (See figure 2). The local people are the key stakeholder that engaged in restoration process from the very beginning and has played an important role for the sustainability of the program. Developing experience and need for genuine participation of rural communities at the all phases of decision making contributes for management of land resource. The key to the success of any watershed project and its sustainability depends on people's participation. For achieving the desired participation of people, the roles of community organizations, groups, and other stakeholders are crucial. Local people must play an active role starting from project design, moving to implementation and the project maintenance. In this context, a participatory watershed management approach is considered as the ideal for achieving food security and sustainability [23].



**Figure 2.** Restoration campaign by the local community at 1<sup>st</sup> Hankota Kebele (Photo by Researcher 2015).

#### 4.8. The Role of Stakeholders in the Restoration of Degraded Land

It would be unthinkable to restore the degraded land without the full participation of relevant stakeholders. In Ethiopia, there are a number of stakeholders that are directly or indirectly involved and play significant roles for the promotion of rehabilitating of degraded land. The same is true about study area, based on survey the whole interviewed households confirmed that there are a number of stakeholders that involve in the program. These mainly include government, NGOs, farmers and DAs and each of these stakeholders have its own roles for the restoration process.

Government as one of the main stakeholder in the study area performed the following activities, coordinating the all stakeholders for the success of the programme, follow up the work, creating the conducive environment for the stakeholders to take a part in program through formulating of the participatory approach, encouraging and asking the

NGOs to participate in the restoration process, giving material support and mobilizing the farmers, creating field day for the different stakeholders to share the best practices among the selected kebeles. Government institutions have also been involved in planning and implementing practices for the management of land resources at different levels including the setting up of institutions, designing relevant policies and strategies, giving agricultural education, technology generation and dissemination [13, 19]. Most importantly, the government has instituted a decentralization policy in which the lowest levels of administration are to be engaged, with communities, in planning and implementation. In addition, policies and strategies have been formulated to enhance wise use of natural resources.

NGOs are giving training to farmers as well as to the other stakeholders, providing the financial and material support and the selected seedlings that are favorable to the local environment. During field observation currently the SLMP began work with the selected kebeles through paying of monthly salary to the local farmers for preparing of nursery sites to produce favorable seedlings to the environment for rehabilitating of degraded land (See figure 3).



**Figure 3.** Farmers participating in nursery management A, B in 1<sup>st</sup> Hankota and Hirche uyaya Kebeles respectively (Photo by Researcher 2015).

Farmers are also one of major stakeholders that are participating in the programme actively by protecting the rehabilitated land, giving free labor and their time during restoration process, exercising frequent maintenance and stabilize the structures with vegetative measures and adequately maintained and managed what has been done for many years, shows great initiatives in soil and water conservation measures, area closure and afforestation programme, are able to solve the land degradation problems.

Development agents as stakeholders have been playing the following roles, giving training at kebele level about community based participatory watershed program, follow up and guidance at home to home, community to community and FTC levels, planning and implementing the programme and finally evaluate the success of the restoration process with kebele farmers and administrative office, coordinating and facilitating the different stakeholders to participate, creating access to farmers to attain different training, encouraging the sharing of experience farmer to farmer and transferring the progress of the restoration programme to the agricultural and rural development office and opening access to the rural

community to take the best practices from other kebeles.

The land users are involved in the restoration process according to survey. Most of interviewed farmers 69 (71.1%) acknowledged that high about the extent of land users

participation in the programme. The remaining of 7 (7.2%) and 21 (21.7%) acknowledged that low and medium about the degree of participation of land users in the restoration process (See table 5).

**Table 5.** The stakeholders that play role in the Restoration Process and the Extent of Land Users.

Stakeholders	Frequency	Percent	The extent of land users in the program	Frequency	Percent
Government	70	72.1	Low	7	7.2
NGOs	30	31	Medium	21	21.7
Farmers	97	100	High	69	71.1
DAs	97	100	Total	97	100

Source: Field Survey, 2015

Based on the gathered data from sampled households and key informants, the major actors and driving forces to run the restoration process are farmers, development agents and government. The government is a pioneer by formulating the policy at the country level and then implement and evaluate the activities up to grass root level and the farmers are a direct beneficiaries of land resource and their livelihood is mainly depend up on it and the nearest stakeholder to rehabilitate the degraded land and protect the restored land. So, they are expected to give more emphasis for the programme.

#### 4.9. The Sustainability of the Restoration Efforts

Including the idea of sustainability is a base to run the restoration process and it is steppingstone for the success of the program. Based on survey the sampled households, participants of focus group discussion and the key informants have stated the following core points with regard to sustainability of restoration efforts. These are encouraging all stakeholders to involve in the restoration programme from the very beginning of the community based participatory watershed development plan, promoting the awareness of rural community as well as other stakeholders on land degradation problem and organizes and initiates them to participate in the restoration process, running and adopting of the participatory approach. This approach boosts and increases the sense of ownership among the rural community. A participatory approach builds more trust among communities involved in soil and water conservation development programs. The participation induces decision sharing and has the potential to increase farmers' ownership of the existing and future SWC measures as well as ensuring their future sustainability [6].

In addition, Management of restored land by a local association and benefiting of the rural community through the income generating activities are key one for the sustainability of restoration efforts at the local level where there is a shortage of land during the restoration process. In parallel, a study by Kaba *et al.*, [15] in order to ensure the sustainable maintenance of SWC measures, communities need to receive economic benefits as soon as possible.

Initiates the farmers to support the structural soil and water conservation measures with biological measures, apply area closure and other conservation measures, construct the

structural soil and water conservation measures in scientific ways and equip the experts with training to fulfill the skill gap, maintenance activities for structural measures and create awareness to the beneficiaries, so that they carry out the maintenance by themselves, empowering the households to develop the saving habits and to save money in traditional and modern saving institutions that have own role for sustainability of restoration process.

Motivate the farmers to adopt sustainable land management practices on communal and individual land to enhance the tenure security. In addition, the government develops policy based on country context and then implements and finally offer incentives for areas that showed the great progress in restoring of severely degraded land and scale up these best practices to the other areas, providing support and updated information for development agents and farmers in continuous ways by taking account of quality, combining of the restoration efforts with the local knowledge and balancing the number of population with the economic level of a country.

## 5. Conclusions

This study has attempted to assess land degradation causes, consequences and sustainability of the restoration efforts in Soro wereda. The main source of income of farmers in the study area relies on farming. 95.9% of households confirmed that the main source of income as on- farm activities. However, there is a shortage of farmland. This area is one of area that is found in the highland of Ethiopia and densely populated. The mean of household land holding size is 0.83 hectare. The source of income of households in study area has a positive impact for the restoration process because those farmers who engaged in on-farm activities spent much time on their farmland and are more involved in soil and water conservation measures, afforestation, and reforestation and in protecting of restored land than that of farmers that engaged in off- farm activities.

The findings show that there is a land degradation problem and its extent is mainly found moderate to severe in the study area and the same is true about degree of soil erosion problem. The indicators of land degradation are gully formation, stoniness of land, absence of grasses and vegetation cover, declining of crop productivity, change in

soil color, drying up of streams and springs, presence of bare land, climate change, land itself requires high fertilizer, drought and famine.

Concerning to major causes of land degradation in the study area almost all households responded that soil erosion, deforestation and over cultivation. Rapid population growth, over grazing and cultivation of marginal land occupies the second, third and fourth position about the causes of land degradation. The major impacts of land degradation are declining of yield year to year, food insecurity |poverty and drought and famine. Some of the most important consequences of land degradation like displacement of people, desertification, malnutrition and increases inputs.

In order to avert land degradation in the study area there has been undertaking a number of restoration efforts by the joint efforts of rural communities, government and non-governmental organizations. The major activities that are undertaking to restore degraded land are physical (structural) soil and water conservation measures and area closure. In addition, in order to speed up the restoration process the biological soil and water conservation measures, agroforestry and agronomic measures have been practicing. The most practiced structural conservation measures are soil bund and cut off drain. Grass strip and wind breaks are the major biological soil and water conservation measures that are practicing in the study area to reclaim degraded land. In terms of agronomic measure the most widely practiced measure is contour cultivation and followed by this there are application of manures, chemicals and cover crops respectively.

The more effective measure about the restoring of degraded land in study area is physical soil and water conservation measure because of the rural communities is aware about the importance of this measure. Currently the government running the community based participatory watershed development program and as the result of this all men, women and the youth are participating to tackle the problem of land degradation. One of finding indicates that most of the restoration efforts in the Soro wereda based on survey, it is undertaking areas with severe land degradation problems. Restoration should be practiced in areas with severe natural resources degradation where there is lack of balance between the resource, which is confined, and the demand which is ever increasing on account of population pressure.

The main goals of the restoration efforts are increasing of the production and productivity of agricultural land, achieve the food security of the rural community by fighting against poverty, to change the stoniness of land to soil or grass coverage of land. Regarding extension services to restore degraded land, development agents are the major source of information. Besides of that the neighboring farmers, mass media, field training, and NGOs are also served as additional sources of information.

It is unthinkable to restore the degraded land without the full participation of relevant stakeholders. In the study area, the government, farmers, development agents and NGOs are

the stakeholders that involved in restoration process. The main challenges that hinder the sustainability of restoration process are lack of community awareness and sense of ownership, unwillingness from some farmers to work in group, lack of experts skill regarding to soil and water conservation engineering works, lack of capital and material support, poverty, lack of training by government and considering the application of restoration process reduces their cultivating land. The finding also indicates there are a number of progresses through the restoration process. These includes increasing the production and productivity of land, reducing of soil erosion, cover of degraded land with grass and vegetation's reduce the prevalent of drought and famine, poverty and prevent climate change.

The crucial issues to run the restoration efforts in sustainable ways are developing the awareness of rural community as well as other stakeholders about restoring of degraded land, running and adopting of the participatory approach, initiates the farmers to support the structural soil and water conservation measures with biological measures and managing the rehabilitated land by a local association and benefits the rural community through the income generating activities and motivate the farmers to adopt sustainable land management practices on their land as well as on communal land.

## 6. Recommendations

Based on the finding of the study, the following practical suggestions are forwarded to the restoration efforts of degraded land in the study area.

- 1) The researcher recommends that strengthening of community participation and capacity building of the community play an important to increase the participation of community in the restoration process. Land is one of natural resources, in the case of developing countries like Ethiopia the back bone of economy is agriculture and losing of this resources has great damage on the life of human being. Therefore, in order to develop the sustainable land management, the rural communities should involve in the programme and expected to play their roles.
- 2) Develop and implement more participatory approach to grow the sense of ownership, since it is difficult to achieve the restoration goals without the full participation of all stakeholders.
- 3) Strengthening of the extension services at the wereda level should play a great role for the success of the restoration efforts.
- 4) The wereda agricultural and rural development office has great duties to facilitate the conditions for non-governmental organizations should involve in the programme because there are low in number in the study area.
- 5) Showing the ways how to the rural community to benefit from the programme that should have a positive impact for restoration efforts of degraded land and



currently integrated watershed management is focused up on the conservation and development.

- 6) The government is one of the major actors to run the restoration process like farmers, has a great role should prepare policy regarding to how to manage the restored land and implement and check success of the policy at the country level.
- 7) The wereda agricultural and rural development has roles to achieve and ensure sustainability of the programme and one of the big issues about the restoration process is its sustainability.
- 8) At kebele level head of kebele agricultural office, developments agents and kebele administration office should select the surveyor farmers who have capacity and skill to measure degraded land and then to divide this areas for different groups for the rehabilitation purpose.
- 9) In order to foster the skill gap of experts regarding soil and water conservation engineering works at the wereda level especial attention should be given to capacity building.
- 10) Currently rural population is growing at fast rate, but there is a shortage of agricultural land. This factor is a challenge for the restoration efforts because the fast growing of population leads the rural communities to deforestation and this area is vulnerable to soil erosion. Therefore, creating of income generating activities, facilitating resettlement program with their interest, encouraging the rural community to use family planning and opening employment access to rural community should play an important role to the sustainability of the restoration process.
- 11) Encourage kebele agricultural office head, kebele administrative leaders, developments agents and farmers should draw laws that govern them protect restored land and to punish criminals and to use resources wisely.
- 12) The sustainable land management measures it should be introduced and implemented with getting the farmers and communities willingness and consent.
- 13) Providing incentives for those who showed great efforts and progresses in restoring of degraded land at wereda level and then scale up the best practices among the kebeles through the sharing of experience.

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