COLLEGE OF SOCIAL SCIENCE AND HUMANITIES

DEPARTMENT OF GEOGRAPHY AND ENVIRONMETAL STUDIES

IMPACTS OF SOIL EROSION ON AGRICULTURAL PRODUCTIVITY AND FARMERS LIVELIHOOD

OF SIRE WOREDA ARSI ZONE OROMIA REGION ETHIOPIA

A SENIOR ESSAY RESEARCH ARTIAL FULIFULLMENT OF THE REQUIREMENTS OF BACHELOR OF ART IN GEOGRAPHY AND ENVIRONMENTAL STUDIES

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Impacts Of Soil Erosion On Agricultural Productivity And Farmers Livelihood

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DECLARATION

Abreham Sewagegn and Wubishet Biruk do here by declare to Wolkite University Department of Geography and Environmental Studies that this thesis is a product of our original research work, and it has not been submitted to any other university for any academic degree. Any materials and information in a report other than our own are duly acknowledged.

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Acronyms

Das: Development Agents

FAO: Food and Agricultural Organization

GIS: Geographic and Information System

MoFD: Ministry of financial and economic development

SWGAO: Sire Woreda Governments and Agricultural Organization

SWMO: Sire Woreda Management Organization

NRCS: Natural Resource Conservation and Sustainability

OR: Oromia Region

Abstract

Soil erosion is a worldwide challenge for sustainability of agriculture especially in the tropical region of Ethiopia is one of the poorest countries in the world and most of its population lives in the high land area endowed plenty of resources the most severe soil erosion is observed in the eastern high part of the country Soil fertility declines is mainly caused by intensification of agriculture on already fragile land this process steeply dapples nutrients and extremely soil fertility loss through erosion can be precursor to desertification. The rates of soil erosion that exceed the generation of new top soil are a dynamic process which leads to decline in the soil productivity, low agricultural yield and income. The balance between soil-forming and depleting processes is of utmost importance for attaining long-term sustainability in any production system. Land degradation in the form of soil erosion is a major impact in the high land regions of Sire around Eastern zones Sire particularly Lode Benben Keble. To achieve this objective the necessary data's been collected from secondary and primary source. The primary data's were obtained from questioners, interview, field observation and focus group discussion, and analyzed in qualitative and quantitative method. Field survey was conducted to collect the necessary data from 66 respondents which were selected by purposively probable sampling techniques.

CHAPTER ONE

1. INTRODUCTION

1.1 Back ground of the study

To guide us toward a sustainable future, the impacts of human activities on natural resources need to be understood and quantified. In this study on global agriculture, we use a Life Cycle Assessment framework to estimate potential long-term soil productivity losses caused by soil compaction and water erosion due to agricultural crop production. We combine several data sets to model spatially resolved Life Cycle Inventory information at the global level and multiply results with characterization factors from a previous publication. The global picture shows a compaction-stressed "Global North" and an erosion-stressed "Global South", with some countries and regions in between, for example, China and parts of South America. Results show that both compaction and water erosion impacts matter at the global level and those overall potential long-term productivity losses of 10–20% can be expected, with high relative impacts on low input production systems. These losses might limit long-term agricultural productivity and lead to additional land use change. Our work adds to and extends the discussion of global assessments of soil degradation. Furthermore, we prove the suggested framework to be applicable and useful for Life Cycle Assessments and other studies and provide results that can be used in such global assessments.

The loss of soil on the land surface by wind and water erosion has been identified as a major constraint in generating enough food to feed the world`s escalating population. Soil erosion has been a major threat to soil quality since the beginning of agricultural. Ethiopia is one of the poorest countries in the world. In addition, most of its population lives in the high land area endowed plenty of resources the degradation is observed in oromia the largest geographic area. Soil fertility declines is mainly caused by intensification of agriculture on already fragile land this process steeply dapples nutrients and extremely soil fertility loss through erosion can be precursor to desertification (EPALUR, 2004).

Extensive and serious soil erosion that is evident throughout our Keble attributes to large extent to the low productivities of the land precipitous retain in appropriate land use and land farming

couple with population pressure are the main causes for soil erosion Soil erosion is a well-documented fact in oromia region. This is characterized by deterioration of physical and biological resources. Soil erosion control is an issue of survival to region which has been exposed for sever soil erosion, natural resource degradation, deforestation, depletion of water resources. These sever problems are caused by human and natural factors such as miss-use of natural resources, rugged topography, continuous and primitive agricultural practices, increasing human population, overgrazing, etc. the land productivity has reduced and frequency of occurring droughts has increased.

To overcome this problem the government of the national, regional state of oromia and non-governmental organizations has been exerted valuable efforts on soil erosion and conservation activities through mobilization and food for work programs. Besides, afforestation program has been carrying out for about two decades. Significant changes on productivity have been observed on the treated areas. However, the result obtained was not as expected. This is due to lack of integration among disciplines, lack of commitment; soil had been treated without detail study and design and not much focused on the participatory soil erosion development planning. Therefore, the team of the soil has chosen based on selection criteria's during the survey the team has examined problems as well as stetted solution or potentials within the soil erosions that have great impact to change the livelihood of the community.

1.2 Statement of the problem

Soil erosion has long been a serious problem in Africa especially in highlands, the poor land use practices; improper management systems and lack of appropriate soil conservation measure's played a major role for causing soil erosion problem (Fournerier, 2016). Ethiopia has among the highest estimated rate of soil nutrient duplication in Sub-Saharan Africa that reduce productivity and increase vulnerability to drought and food insecurity (Berry, 2003). In Ethiopia, agricultural land production is being seriously eroded by unsustainable land management practices both in area of food crops production and grazing lands (Daniel, 2002). Soil erosion is major obstacles to sustain crop production in Oromia especially where much of the population is living and agriculture is intensive.

Soil erosion was become severe especially in the upper catchments of lode benben kebele. Because of the undulating slope and deforestation, improper land use, free grazing, continuous

and back work farming practices, generally lack of land management in the watershed and there are many gullies and hills in all land use types. Because of these problems and others the cultivated land and land productivity, which leaves the soil unprotected from erosion forces of intensive rain fall, execrated threat the soil loss since the vegetation coverage reduced from time to time in terms of natural and human phenomena. Through, both the upper and lower catchment of the watershed problem has been for soil and water conservation, forestry, crop and livestock production and small scale of rural infrastructure including water, representing the major sectors in the agriculture development become affected the lower catchment of the watershed by different severity of erosion and land degradation.

According to agricultural administrative office of sire woreda soil erosion was very serious due to high population number which leads to intensified use of all ready stressed land resources and expansion of production to marginal and fragile lands, which aggravates soil erosion resulting loss of soil fertility and decline crop productivity. The major problems of soil erosion in the study area were caused by due to rapid population growth, deforestation, overgrazing (SWGAO,2016).The population growth was become increase year to year at the same time, increase the demand of peoples for land and forest land is cleared and converted to crop land or vegetation cover was declined by deforestation, overgrazing and disturbance due to rapid population growth and soil erosion become highly accelerated (SWAO,2016).The main concern of this study is to examine the cause of soil erosion and its impacts on crop productivity in study area .The motivation of the researcher was in Sire Woreda there is rapid soil erosion (SWAO, 2023) However, the current study was based on the assessment of soil erosions impact on crop productivity. Therefore, these researches work was conducted to fill the research gap is time difference by providing necessary information about soil erosions impact to the concerned bodies and institutions. In addition to this before times there few studies that been studied to study about soil erosions impact on crop productivity. This study attempts to fill the gap and find out solutions for the soil erosions impact on crop production in the study area.

1.3. Objectives of the study

1.3.1. General objectives

The general objective of the study is to assess the impacts of soil erosion on agricultural productivity and farmers' livelihood.

1.3.2 Specific objective

- To examine the level of erosion trends of productivity of farmland.
- To assess efforts and effectiveness of stakeholders to maintain and mitigate productivity of the soil.
- Examine the impacts of erosion on farmer livelihood.

1.4. Research question

1. How to examine the level of erosion trends of productivity of farmland.
2. How to assess efforts and effectiveness of stakeholders to maintain and mitigate productivity of the soil.
3. How examine the impacts of erosion on livelihood

1.5. Significance of the study

The study was give the way for farmers and for all consumers to protect soil erosion and provides policy recommendation to the concerned body to reduce the impact of soil erosion on crop production. That research has its own significances in providing valuable information solution to a particular impact Likewise; this study was providing the impacts of soil erosion on crop production in lode Benben Keble. As discussed earlier the prevalence of soil erosion, many have pronounced impact on the living standard of the society, the degree of living standard, as well as economic growth of Keble. Therefore, it needs urgent attention to solve the problem. This study will;

Promote policy maker, practitioners, and administrators of Sire woreda to look for appropriate mechanisms to satisfy the maximum needs of the lode Benben Keble society. Generate new idea for further knowledge on particular intervention at the area.

1.6 Delimitation of the study

The study was conducted in oromia region in eastern Arsi zone sire woreda lode benben Keble these study asses how soil erosion affects the Productive capacity of land identify the main causes of soil erosion and its effects on crop production in the lode Benben Kebele delimited manner.

Conducting comprehensive research at a national level is very important. However, it is difficult to carry out at a suggested level. Because it requires huge cost and consumes much time accordingly, these studies were forced to limit both the area and concept of the study in order to manage this study in delimited manner.

1.8 organization of the paper

The research work of this paper is containing five chapters. The first chapter deals with background of the study, statement of the problem, objectives of the study, include general and specific objectives, significance of the study, delimitation of the study. The second chapter deals with literature review. The third chapter deal about research methodology. Chapter four presents the result and discussion of the study. Finally chapter five contains conclusions and recommended.

CHAPTER TWO

2. REVIEW LITERATURE

2.1. Theoretical Literature Review

Ethiopia in the complex environmental problems in today soil erosion and deforestation remain the most serious both are already wide spread and continue to spread further.some270,000km2 of farm land deemed to be undermined of their and productive base (Eth,high and reclamation study,1996). The impacts of erosion induced degradation of the soil resource ranges from reducing soil depth and there by undermining the moisture holding capacity to loss of essential plant nutrients. This is without motioning the off size effects such as deterioration of water availability flooding and salutation of water resources (Project proposal for soil conservation research in ANRS, 2000).

2.2 Concept and definition of soil erosion

Soil erosion consists of two principal sequential events these are detachment of soil particles from soil mass and the transportation of the detached particles (young and wersma, 2003).The major causes of soil erosion are grouped into two. These are natural and socio –economic factors.

2.2.1 Natural factors

The rugged topography and steep slopes affects soil erosion rate though its morphological characteristics. Two of these namely gradient and slope length are essential component in qualitative relationship for estimating soil loss (wish emeier and smith,2000).According to Thomas (1991) identified that scope shape together with ground filed attributes exercise strong influence on the nature and extent of visible erosion. Topography influence soil loss by length, gradient and shape, shapes of scope, soil loss increases very sensitively with gradient, and commences already on slope less than 1 %(mucher and het 1980). Measured losses up to 5+/ha from dry soil and 11+/ha from wet soil on 0.2% slope. Where simulation of main store was applied with in annual losses from groundnut filed on1percentage slope reached 15+/ha (Fourier, 1967).

2.2.2 Water erosion

Raindrop erosion is slow and continuous downhill movement of the five participles held in suspension the raindrop splashes after their impact on the soil. The downhill splashes are longer than the uphill splashes and this result in constant downhill movement of the most important fine soil particles (Ibid, 1994).

2.2.3 Socio-economic factors

Socio-economic factor includes deforestation, over grazing, land tenure, property right, poverty, population pressure and extensive farming (MOFED, 2006)

2.2.4 Deforestation

Deforestation is identified, as one of the major causes of soil erosion especially in tropical countries of several cause of deforestation is three. These are population increase, transfer of forestland to agriculture use and per capital income rise consumption of wood has been responsible for large-scale depilation of forest resources and consequently soil erosion. Agro-forestry systems for sustainable land use. The removal of trees also alters the hydrological cycle and soil water availability and the same time the replacement of perennial plants with annual level of soil periodically exposed encourage erosion (strook, 1995)

2.2.5 Population pressure

Increasing population number is one of the major causes of soil erosion the need for economic, social and purpose. Published that increased in population is not only that more land is brought under cultivation resists of increased in human population number meet the food demands there by accelerating by soil erosion simultaneously with the increases in population. Livestock population also goes up which aggravate over grazing and erosion and erosion population pressure through shortage of land force people to cultivate steep slope which accelerate water erosion (kipper, 1995).

2.3 Theoretical Literature

2.3.1. Land tenure

Land tenure refers to the arrangements of right under which the holder uses or owns the land of the holding in the agricultural sample senses. Tenures system is classified in to three categories. The first land own or held in ownership like position having reorganization from local

government, The second is land reframed from other persons there is in cash or proper cash of the product in the rental agreement and the third is land position in other farmers such as land possessed temporary from other without any rental agreement or any other means (cake, 2001).

2.3.2 Soil type

Due to its topography and various land forms with regard to the variation in altitude the soil type also differ; it is characterized by about 50% sand, 30% loam, 15% clay loam, 5% clay. Because of the land form of the watershed huge amount of soil is eroded by floods during rainy season as result parts with steep slope, low of organic matter. Now days various activities of soil and water conservation practices has done by governmental and non-governmental organization such as construction of Hillside terraces, Trenches and establishment of plant of plantation site (Santos, 1999).

2.3.3. Soil depth

The soil depth of the watershed ranges from 0.5m-6m. Most part of the cultivated land has 1.5m soil depth. Small part of the watershed has soil depth less than 1 m. small part of the watershed become rock out crop. Soil erosion is severing in the watershed. It has already washed away most of the good top soil and some of the subsoil. The area has high intensity of rainfall (Sharma, 1998) during rainy season.

2.3.4. Farming system

Agriculture is the main means of living for the community of the watershed. The population commonly practices crop production and livestock rearing. The major dominant crops grown in the area by rain feed are barely, wheat, tiff, maize, and livestock rearing of cattle local & hybrid, sheep goats and chickens. There is also traditional and modern beekeeping. Generally, about 70% of the societies of the watershed are depending on agriculture. Land productivity of the watershed is low due to poor soil fertility and erratic nature of the rainfall. The sowing period of the crops is June to July and the harvesting time September to November (kraver, 1989).

2.4. Types of soil erosion

Sheet erosions almost invisible lighter colored soils are a sign that over the year's erosion has taken its toll (Pimentel, 2006).

Wind erosion is highly visible. Although it is a problem, water erosion is generally much more severe.

Rill erosion occurs during heavy rains, when small rills form over an entire hillside, making farming difficult.

Gully erosion makes gullies, some of them huge, impossible to cross with farm machinery.

Ephemeral erosion occurs in natural depressions. It differs from gully erosion in that the area can be crossed by farm equipment.

2.5. Causes of soil erosion

As mentioned, the predominant causes of soil erosion are either related to naturally occurring events or influenced by the presence of human activity. Some of the principal causes of soil erosion include:

Rain and rainwater runoff: In a particular heavy rain, soil erosion is common. First, the water starts to break down the soil, dispersing the materials it is made of. Typically, rainwater runoff wills impact lighter materials like silt, organic matter, and finer sand particles, but in heavy rainfall, this can also include the larger material components as well as.

Farming: when land is worked through crops or other agricultural processes, it reduces the overall structure of the soil, in addition to reducing the levels of organic matter, making it more susceptible to the effects of rain and water. Tilling in particular, because it often breaks up and softens the structure of soil, can be a major contributor to erosion. Farming practices that reduce this activity tend to have far less issues with soil erosion (Ayele kuris, 2003).

Slope of the land: The physical characteristics of the land can also contribute to soil erosion. For example, land with a high hill slope was perpetuating the process of rainwater or runoff saturation in the area, particularly to the faster movement of the water down a slope.

Lack of vegetation: Plants and crops help maintain the structure of soils, reducing the amount of soil erosion. Areas with less naturally occurring flora may be a hint that the soil is prone to erosion.

Wind: Wind can be a major factor in reducing soil quality and promotion erosion, particularly if the soil's structure has already been loosened up. However, lighter winds were typically not causing too much damage, if any. The most susceptible soil to this type of erosion is sandy or lighter soil that can easily be transported through the air

2.6. Effects of soil erosion

A major problem with soil erosion is that there is no telling how quickly or slowly it was occur. If largely impacted by ongoing climate or weather it may be a slow-developing process that is never even noticed. However, a severe weather occurrence or other experience can contribute to rapid-moving erosion, which can cause great harm to the area and its inhabitants (GDE, 2007).

Loss of topsoil: obviously, this is the biggest effect of soil erosion. Because topsoil is so fertile, if it is removed, this can cause serious harm to farmer's crops or the ability to effectively work their land.

Soil compaction: When soil under the topsoil becomes compacted and stiff, it reduces the ability for water to infiltrate these deeper levels, keeping runoff at greater levels, which increases the risk of more serious erosion.

Reduced organic and fertile matter: as mentioned, removing topsoil that is heavy with organic matter is reducing the ability for the land to regenerate new flora or crops. When new crops or plants cannot be placed successfully in the area, this perpetuates a cycle of reduced levels of organic nutrients.

Poor drainage: Sometimes too much compaction with sand can lead to an effective crust that seals in the surface layer, making it even harder for water to pass through to deeper layers. In some ways, this can help erosion because of the densely packed soil, but if it perpetuates greater levels of runoff from rainwater or flooding, it can negatively affect the crucial topsoil.

Issues with plant reproduction: when soil is eroded in an active cropland, wind in particular makes lighter soil properties such as new seeds and seedlings to be buried or destroyed. This, in turn, affects future crop production.

Soil acidity levels: When the structure of the soil becomes compromised, and organic matter is greatly reduced, there is a higher chance of increased soil acidity, which was significantly affect the ability for plants and crops to grow.

Long-term erosion: unfortunately, if an area is prone to erosion or has a history of it, it becomes even harder to protect it in the future. The process has already reduced the soil structure and organic matter of the area, meaning that it was harder to recover in the end.

Water pollution: a major problem with runoff from soils – particularly those used for agricultural processes – is that there is a greater likelihood that sediment and contamination like the use of fertilizer or pesticide. This can have significant damage on fish and water quality.

2.7. Soil erosions impact on crop production

2.7.1. On-site impacts:

The implications of soil erosion extend beyond the removal of valuable topsoil. Crop emergence, growth and yield are directly affected through the loss of natural nutrients and applied fertilizers with the soil. The breakdown of aggregates and the removal of smaller particles or entire layers of soil or organic matter can weaken the structure and even change the texture. Textural changes can in turn affect the water-holding capacity of the soil, making it more susceptible to extreme condition such a drought (Berry, L. 2003.).

2.7.2. Off-site impacts:

Off-site impacts of soil erosion are not always as apparent as the on-site effects. Eroded soil, deposited down slope can inhibit or delay the emergence of seeds, bury small seedling and necessitate replanting in the affected areas. Pesticides and fertilizers, frequently transported along with the eroding soil can contaminate or pollute downstream water sources and recreational areas (Morgan, R.P.C. (1996).

2.8. Possible Solutions for Soil Erosions impact on crop production

When it comes to finding solutions for soil erosion, the most useful techniques found tend to be those that emphasize reinforcing the structure of the soil, and reducing processes that affect it (FAO, 2010).

Careful tilling: Because tilling activity breaks up the structure of soil, doing less tilling with fewer passes was preserve more of the crucial topsoil.

Crop rotation: Plenty of crop rotation is crucial for keeping land happy and healthy. This allows organic matter to build up, making future plantings more fertile.

Increased structure for plants: Introducing terraces or other means of stabilizing plant life or even the soil around them can help reduce the chance that the soil loosens and erodes. Boosting areas that are prone to erosion with sturdy plant life can be a great way to stave off future effects.

Water control: For those areas where soil erosion is predominantly caused by water – whether natural or man-made – specialized chutes and runoff pipes.

Help to direct these water sources away from the susceptible areas, helping stave off excess erosion. Having these filters in particular areas rather than leading to natural bodies of water is a focus to reduce pollution.

Increased knowledge: A major factor for preventing soil erosion is educating more and more people who work with the land on why it is a concern, and what they can do to help reduce it. This means outreach to farmers in susceptible areas for ways that they can help protect crops from inclement that they can help make sure their soil remains compact without restricting their plant growing.

2.9. The major soil conservation mechanism

2.9.1. Stone bund

Stone bund is embankment of stone build along the contour across the slopping land (Morgan, R.P.C. (1996). This structure is semi-permeable structures unless sealed with soil in their upper part. They increase the moisture retention capacity of the soil profile, water availability to plant, and increase the efficiency of fertilizer application.

2.9.2. Soil bund

Soil bund refers to the embankment of soil build along the contours across sloping land. The bund reduces and stops the velocity of runoff and consequently reduces soil erosion and the steady decline of yields (Hurni, H. (1985).

2.9.3. Terracing

Commonly it involves the construction of broad channels across the slope of rolling land and it is a means to degrease the length of thereby reducing soil erosion and retaining runoff. It also helps to conserve rainwater and facilitate tillage operations on sloppy lands (WISEHMIER, W. H AND D. Smith, 2000).

2.9.4. Counter plowing

One of the common and practices of farming a cross the steeped slopes takes into account the slope gradient and elevation of soil across the slope. It is the method of plowing the contour line of slope (Bennett, H.H.1999).

2.9.5. Crop rotation

Same pathogens tend to build in the soil if the same crops are cultivated consecutively. To continues cultivation of the same crop also lead to an imbalance on the fertility demands of the soil (Lal, R. 2002).

CHAPTER THREE

3. RESEARCH METHDOLOGY

3.1. Description of the study area

One of the 25 woredas in the Arsi zone of the Oromia National Regional State, Sire Woreda, served as the study's location. The district is 114084 hectares in size and features a semi-arid climate, a steep watershed, and an undulating plain. Agriculture and mixed farming systems, which produce wheat, barley, red paper, maize, teff, beans, potatoes, cabbage, onions, and cattle, constitute the main economic activity. Out of the 92547 people, 96.33% identify as Protestant and 3.7% as Orthodox. Since 1994, the district's number of educational and medical facilities has increased significantly. Today, it contains four secondary schools, two health clinics, and more than 37 elementary schools. 1092 hectares make up the research area; 75% of it is used for agriculture, 822 hectares are used for grazing, and 35 hectares are covered in scant forests.

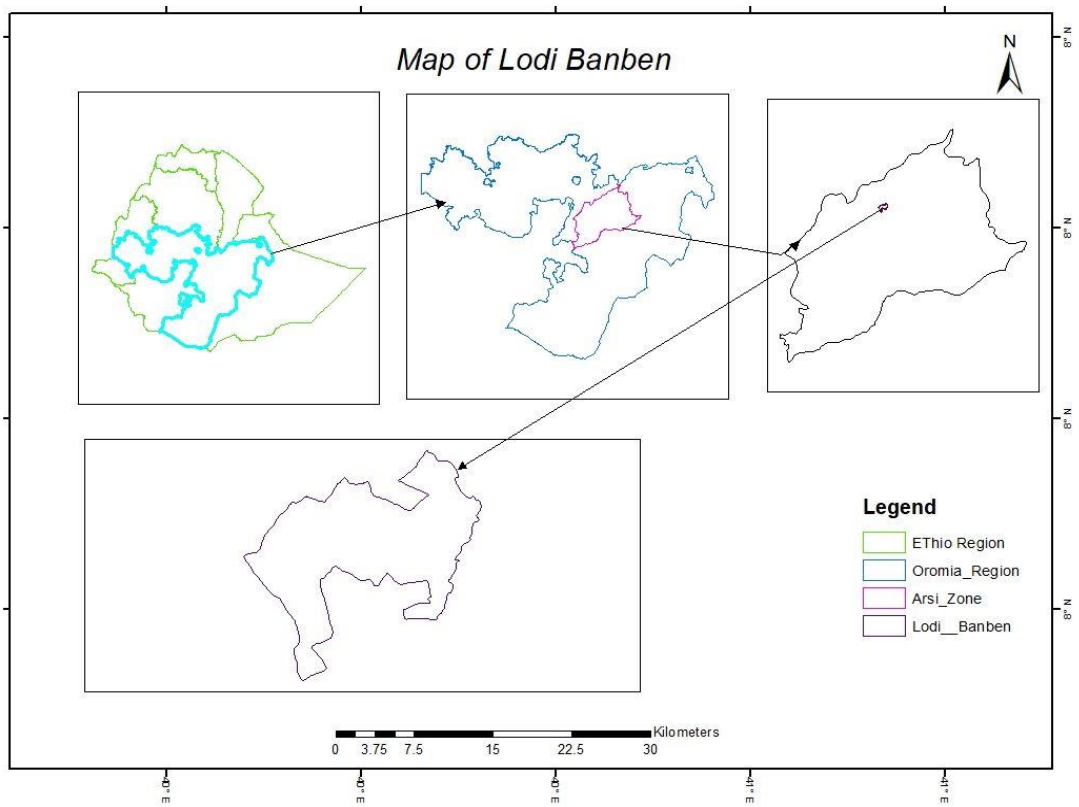

Figure 1. Map of Study area

3.2 Research design

In order to undertake this study was applied descriptive Research Design and used a mixed approach. That needs both qualitative and quantitative types of data. Qualitative type of data was used to gather detail information from concerned bodies through interview of informants, field observation and questionnaire and descriptive forms, quantitative data was collected numerically like percentage and tables.

3.3. Data sources

Primary sources: were used to get primary data for the study. Primary data was collected through questionnaires, interview, and observation

Secondary source: was collected from the valuable data documents published and unpublished recording in different times in municipal office and other related organization found the town. It also includes books and report.

3.4. Data collection methods

Questionnaires: The research had employed both open-ended or unrestricted format where respondents was asked questions and give freedom to decide the detail form and length of answers, and close -ended or restricted types, which present assets of fixed alternative from which respondents had to choose an appropriate answer.

Key informants interview: In order to get detail information from knowledgeable person being able to put information on practical use and who were known much about the impact of soil erosion on crop production in study area, the structured interview was used. So this study was used these methods of data collection

Field observation: In contemporary filed observation is an important technique to collect original data and used to observe naturally occurring behavior of people in their natural setting the data is gathered audio type. This is because sometimes the information of the research gathered from the informants may contradict with what the real situation. Therefore, observation was better to get the information from original sources. During the field observation the proposal was clearly seen that the land is being under the erosion by naked eye

3.5 Sampling Technique

3.5.1 Population and Sample Size

According to Sire woreda agricultural office expertise (SWAO), the Sire woreda has 18 kebeles, the researcher was selected two kebele that of lode Benben and Lode Chancho. The researcher was used purposive sampling method to select the sample kebeles because; there is soil erosion that is the way of increasing time to time in the sampling kebele. There are 5654 total population and 800 households in lode Benben kebele. From this, the researcher was selected 50 respondents by using simple random sampling techniques. In addition, there are 1722 total population and 187 households in Lode Chancho kebele. From this, the researcher was selected 16 respondents by using simple random sampling techniques. Totally, the researcher was selected 66-sample respondents from 987 total households because there was homogeneity of economic activities, language, cultures, religion as well as way of life and group of people in target population

$n = N/1+Ne^2$ where n = sample size, N = total population and e = margin error

Then, to determine the sample size for both Lode Benben and Lode Chancho kebeles, we can use the formula n = N / (1 + Ne^2) for each kebele.

For Lode Benben kebele:	**For Lode Chancho kebele:**
- Total population (N) = 5654	- Total population (N) = 1722
- Margin of error (e) ≈ 0.1407	- Margin of error (e) ≈ 0.2488
Calculating the sample size:	Calculating the sample size:
n = 5654 / (1 + 5654 * 0.1407^2)	n = 1722 / (1 + 1722 * 0.2488^2)
n ≈ 5654 / (1 + 5654 * 0.0198)	n ≈ 1722 / (1 + 1722 * 0.0619)
n ≈ 5654 / 112.08	n ≈ 1722 / 107.04
n ≈ 50.47	n ≈ 16.07

In total, the sample size from both kebeles is approximately 50 (from Lode Benben) + 16 (from Lode Chancho) = 66 respondents.

Table 3.1 Sample population

Sample kebele	Total Population	Total Household	Sample Household
Lode benben	5654	800	50
Lode chancho	1722	187	16
Total	7386	987	66

3.5.2 Sampling techniques

The researcher was used Simple random sampling because the probability sampling where every item has equal chance of being selected that of each population. Knowledgeable person is identified by being able to put your information to practical use.

Simple random sampling of the study is free from different kinds of bias and minimizes the sample errors.

3.6. Method of data analysis and interpretation

Data collection through various methods were processed and analyzed in using appropriate quantitative and qualitative analyzed techniques qualitative data was analyzed in the form of qualitative description and to understand behavior and perception of target audience included interview .focus groups case study while quantitative data was analyzing and collecting numerical data to understand concept opinions or experiences.

3.7 Ethical consideration

Gathering data was carried out with consent of respondents by respecting their beliefs and culture of the respondents was inform about the objective of the study and their agreement was taken before desired that information provide was confidential and used only for the purpose of research.

CHAPTER FOUR

4 FINDINGS AND DISCUSSIONS

4.1. Characteristics of respondents

Before the discussing the main objectives of the study, it is quite necessary to explain the characteristics of respondents. Accordingly the respondents is asked about some aspects of their personal back ground before entering to the main body of the questionnaires such responses have analysis as follows

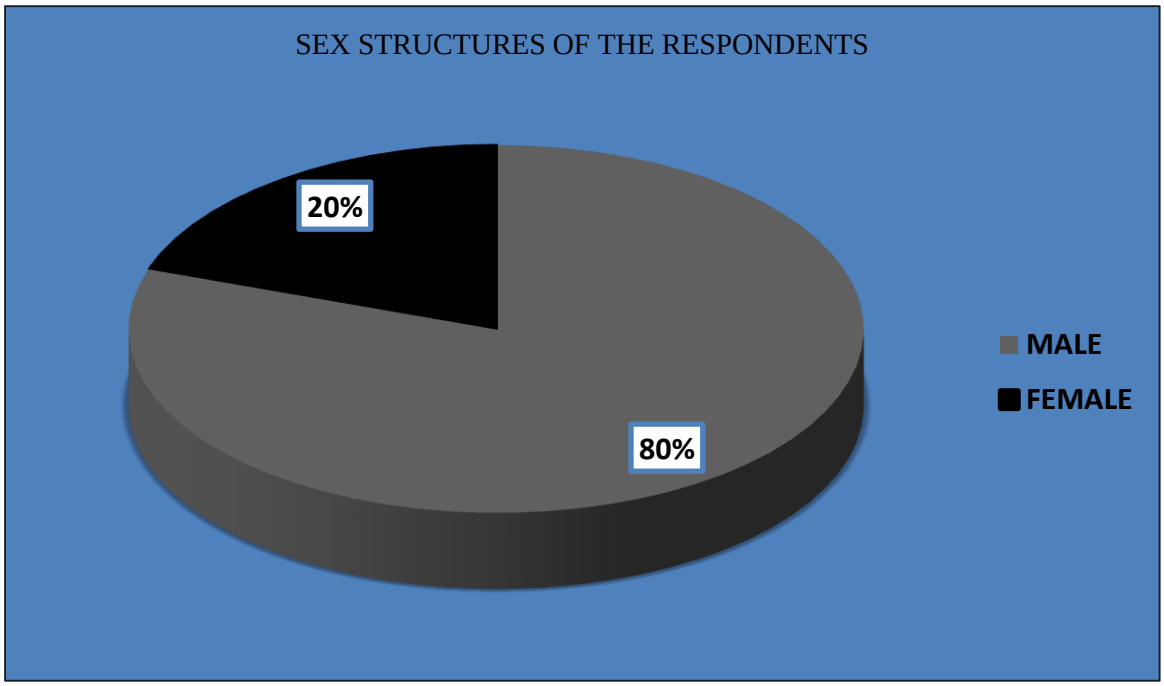

Fig 4.1 the sex structure of the respondents

(Source: own field survey, Feb, 2024)

As indicated on fig 4.1, about 80% of respondents are male while the remaining 20% have female respondents. This indicates that male respondents is greatest in number than female respondents.

Table 4.1 Age structure of the respondents

Age	Frequency	Percentage
25-35 years	14	21.2%
36-46 years	40	60.6%
47-57	12	18.18%
Total	66	100%

*(*Source: own field survey, Feb, 2024)

As indicated on table 4.1 the majority of the respondents 60.6% of them are found between the age group of 36-46 years, 21.2% of the respondents are found between the age group of 25-35 years and the remaining 15.15% of the respondents lies between the age categories of 47-57 years.

Table 4.2 Marital statuses of the respondents

Marital status	Frequency	Percentage
Single	9	13.63%
Married	47	71.21%
Divorced	10	15.15%
Widowed	-	-
Total	66	100%

(Source: field survey, Feb, 2024)

As indicated on table 4.2, the majority of the respondent 71.21%of them are married, 13.63% of respondents are single and the remaining 15.15%of the respondents is divorced.

Table 4.3 Education levels of the respondents

Education Level	Frequency	Percentage
Diploma	16	24.24%
Degree and Above	4	6.06%
Un educated/Farmers	46	69.69%
Total	66	100%

(Source: field survey, Feb, 2024)

As indicated on table 4.4 shows the educational back ground of the respondents, As a result 24.24% of them are diploma and the remaining 6.06% of the respondent have degree and 69.69% of respondents are farmers. Therefore, the majority of the respondents are in the level of farmers.

Table 4.4 Family size of the respondents

Family Size	Frequency	Percentage
1-4 Members	17	25.75%
5-8 Members	35	53.03%
>8 Members	14	21.21%
Total	66	100%

(Source: field survey, Feb, 2024)

Table 4.4 shows that, The family numbers of the respondents as a result 25.75% of them have the family number between 1-4,and 53.03% of the respondents have the family numbers between 5-7.and the remaining 21.21% of the respondents have the family numbers between >8 Therefore, the majority of the respondents have the family size in between 5-7.

Table 4.5 Occupation structure of the respondents

Occupation	Frequency	Percentage
Government employee	8	12.12%
Merchants	5	7.57%
Farmers	53	80.30%
Total	66	100%

(Source: field survey, Feb, 2024)

The above table 4.5 shows that, The Occupation structure of the respondents as a result 80.30% of them were farmers, and 12.12% of the respondent's government employee and remaining 7.57% of the respondents were merchants

4.2 The magnitude of impacts of soil erosion on crop production

Table 4.6 Magnitude of impacts of soil erosion on crop production

Magnitude	Number of respondent	Percentage
High	57	86.36%
Medium	9	13.63%
Low	-	-
Total	66	100%

(Source, own filed survey, Feb, 2024)

The above table 4.6 shows that 66 respondents 86.36% of them responded that there is a high level of impacts of soil erosion on crop production in lode Benben and Lode hancho keble and the remaining 13.63% of the respondents responded that the level of impacts of soil erosion on crop production is medium. Therefore the majority of the respondent responded that impacts of soil erosion on crop production in high level in lode Benben and Lode chancho keble.

4.3 Respondents Perception on soil erosion

4.3.1 Awareness on soil erosion.

The sampled households were asked to describe whether or not they were aware of the existence of soil erosion and causes of soil erosion. Irrespective of their gender, age and educational level, all the respondents had their own perception of the extent of land degradation, such as the formation of gullies and land dissection as a result of soil erosion and the associated financial implications on their livelihoods. In trying to avert the problem in future through community mobilization, such knowledge is vital.

Table 4.7 Knowledge of farmers on soil erosion

Knowledge of soil erosion	**Frequency**	**Percentage**
Yes	61	92.42%
No	5	7.57%
Total	66	100%

(Source, own filed survey, Feb, 2024)

Table 4.7 above indicates that 92.42% of the respondents have knowledge of the existence of soil erosion and with 7.57% of the households not having noticed the existence of soil erosion. Households understand problems when they face the challenges associated with soil erosion such as a decline in land productivity and an increase in chemical fertilizers that need to be applied. From the responses of the farmers, it is clear that soil erosion has affected their livelihoods.

4.4. Types of soil erosion

Table 4.8 Types of soil erosion

Form of erosion	Frequency	Percentage
Splash erosion	9	13.63%
Sheet erosion	28	42.42%
Rill erosion	3	4.54%
Gully erosion	14	21.21%

(Source, own filed survey, Feb, 2024)

Based on the responses from the interviewed households (Table 4.8) indicated that splash erosion, sheet erosion, rill erosion and gully erosion are the predominant forms of soil erosion in the study area. The number of households that identified the above mentioned soil erosion forms as the major impacts were sheet erosion about 42.42%, which form soil erosion from crop production in study area. These variations in soil erosion forms are in line with what was reported by the NRCS (2006), namely that water erosion results in the formation of rills to gullies, stream-bank cutting at the site of removal, and down-slope deposition and sedimentation of downstream channels and water bodies. (Tripathi and Singh, 1993:27) also maintained that water erosion could occur as splash, sheet, channel (gully) and stream.

4.5 Causes of soil erosion

Table 4.9 Causes of soil erosion

Causes	**Frequency**	**Percentage**
Deforestation	23	34.84%
Steep slope cultivation	6	9.09%
Continuous cultivation	8	12.12%
Rapid population growth	18	27.27%
Poor livestock Management	11	16.66%
Total	66	100%

(Source, own filed survey, Feb, 2024)

Households were aware that the causes of soil erosion were: deforestation, steep-slope cultivation, continuous cultivation and rapidly population, poor livestock management, all these are related to the mismanagement of the land resources such as soil and forests. The perception of the households as to the causes of soil erosion is in line with studies conducted by others (Titilola, 2008:6; Decorous, Barios, Varmantes, Polenard, Anaya, &Esteves, 2008:327), who report that the most frequent cause of land degradation and soil erosion stem from excessive human pressure or poor management of the land, overgrazing, over-cultivation of crop land and deforestation, are the main culprits. As observed in table 4.9 above. What households perceive the consequences and livelihood impacts of soil erosion to be is in support of the objectives of the study therefore these are vital for programming soil conservation and reforestation activities. The development agents assigned to the area and the experts at district level are fortunate in that the households are willing to mobilize the community to tackle the problem.

4.6 Consequences of soil erosion

Table 4.10 Consequences of soil erosion

Consequence	**Frequency**	**Percentage**
Loss of crop production	31	46.96%
Gully formation	14	21.21%
Loss of soil fertility	21	31.81%
Total	66	100%

(Source, own filed survey, Feb, 2024)

Table 4.10 above shows the responses from the households in to the effects of soil erosion. Loss in crop production was indicated by 46.96% of the households where as 21.21% indicated that the consequence of soil erosion was gully formation. The number of households who responded that soil erosion led to loss of soil fertility was 31.81%. All the parameters indicated in the table are consequences of soil erosion though the degree of severity varies. The overall impact of soil erosion means a loss of land productivity with reduced farm income which directly affects the livelihoods of the rural population with in the area.

4.7 Soil Erosion Conservation Practices

To overcome the problem of soil degradation, the government has implemented soil conservation activities, such as construction of physical structures (terraces) to reduce overland flow thereby preventing removal of soil, soil fertility improvement practices (compost application), agro-forestry and reforestation of deforested hilly areas. These practices and the positive results yielded so far show how communities can reduce land degradation and improve their livelihoods and food security. Direct observation and interviews with farmers indicated that there were some initiatives, but there was still a long way to go.

Table 4.11 Soil erosion conservation practice

Application of conservation measures	**Frequency**	**Percentage**
Yes	54	81.81%
No	14	21.21%
Total	66	100%

(Source, own filed survey, Feb, 2024)

Table 4.11 above summarizes the responses to questions on conservation practices, such as terracing, soil fertility improvements through the application of compost, undertaken and the results achieved. The number of the respondents who indicated that they had practiced soil conservation activities such as terracing was 81.81% with only 21.21% admitting that they had not applied any soil conservation measures. Reforestation of degraded areas and gully protection activities such as check-dam (a physical structure constructed in gullies to reduce flow of water thereby reducing damage to the land) construction, gully-side embankment protection and re-vegetation support restoration of land productivity. The income of farmers is increased and the problem of wood for fuel is eased.

CHAPTER FIVE

5 CONCLUSIONS AND RECOMMENDATION

5.1. Conclusions

From the findings of this research researchers conclude that, soil erosion is a serious major environmental problem in Sire woreda particularly in Lode Benben and Lode Chancho keble because of the following causes, population growth, deforestation, overgrazing, over cultivation and agricultural expansion. Due to soil erosion, crop productivity in study area reduced as result of reduction of fertility, reduction of natural forest; farming of gullies and reduction of farm land, since sever soil erosion problems existed in study area. It has been a considerable impact up on local rural economy and social life of the society. Members of households, selected through simple random sampling were interviewed. Both gender groups were included in the sample, with male and female. The major livelihood earners according to household members are farming and livestock rearing. When asked about situation of change in crop productivity, the majority of the respondents indicated that they had observed changes (decline) in production over time. Soil erosion is major drivers of land degradation and poses key problems to livelihoods of the community members in the study area. Sheet, rill and gully erosion are the main types of erosion within the study area and the middle form of erosion, namely sheet erosion, is the most common type of erosion the study area. Deterioration in soil fertility as a result of severe soil erosion is a critical deterrent to crop production and a lack of fodder has been a major factor in the decline in livestock production.

The methods used in the design of the study, specifically the sampling and data collection both households and key informants, have addressed the objectives of the study. Therefore, the aim of this research has been achieved as it has been shown that both soil erosions are negatively affect crop production in the study area.

All farmers try to do toward water and soil conservation on the crop lands by applying different traditional soil and water conservation measures like terracing, planting trees, cheek dam and all of the methods by integrated.

5.2. Recommendations

The responsible body should create awareness to the society about soil erosions impact on crop productivity. In addition to this the people should practice in different management activities in order to reduce and manage soil erosion such activities are terracing, countering, tree planting, etc.The educational/training program, which was provided for farmers, should be modified by considering the existing knowledge and practices in a particular area.Agricultural office should be gives advice and guideline for farmers how to use (control) land from soil erosion. The community should also develop diversity of crop rather than mono (single) crop.The farmers should be work cooperatively with Agricultural office/rural development office geographer to minimize soil erosion.The communities should develop how to preserve their farm land from soil erosion and their causes that affect crop productivity. The Protection of forest area very well: This study has shown that the protection of a forest area in the upland of the area has significantly reduced the rate of soil erosion. Family Planning: For the sustainable development of the area, the existing family planning education has to be expanded. The governmental and non-governable organization should consider granting assistance to the farmer in the form of credit as these would enable them take action to use of sustainable soil conservation practices. There is need for more development agents (DAs) to lay more emphasis on sustainable practice and also disseminate information to farmers. Protections over grazing pasture land by livestock; by make awareness to the local community how to control pasture land effectively. The community and other responsible body should accept all the necessary information helps to improve their productivity. Sire woreda agricultural office should provide the tool for development agents to solve problems related with soil erosions impact on crop productivity. There is a need for more publicity on soil conservation practices which should be done mostly on mass media especially in radio and television so as to create more awareness and favorable attitude of farmers toward soil conservation practices. In general for the future the governmental body should have responsible to advice the people about cause of soil erosion and their impacts on crop productivity as well as their management mechanisms. The major source of energy for the community in study area is fuel wood. Due to this the community can cut the forest and accelerate and increase soil erosion. So it’s good if there are other alternative sources such as solar energy biogas.

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Appendix - I

WOLKITE UNIVERSITY

COLLEGE OF SOCIAL SCIENCE AND HUMANITIES

DEPARTMENT OF GEOGRAPHY AND ENVIRONMETAL STUDIES

QUESTIONNAIRES FOR RESPONDENTS

Dear respondents

The main purpose of this questionnaire is to collect data as part of under graduate research work to the fulfillment of degree in Geography and Environmental studies and it is concerned with the land administration worker and woreda office worker. The study is conducted In lode benben and lode chancho Keble. The soil erosions impact crop production. Therefore you kindly read carefully, respond genuinely to the question provided blow, and circle the letter and no need writing your name.

Personal information

1. Sex: A. male B. female

2. Age: A.25-35yrs B. 36-46yrs C.47-57yrs D.above<57

3. Level of education: A. illiterate B. 1-8 grade C. 9-12 grade

D. diploma E. degree and above

4. Occupation: A. government B. merchant C. farmer D retired

5. Marital status: A. single B. married C divorced D.widowed

6. Number of children: A. 1-4 B. 5-8 C. >8

Part 2 general information

1. What does the expansion of the existing the impacts of soil erosion on crop production in lodebenben and lodechancho Keble?

High B. medium C. low

2. Do you perceive soil erosion as impact on crop production in the study area?

a) Yes b) No

3. If the answer is yes for the above question, how do you view the level of soil erosion on your Crop production?

a) Very severe b) Severe c) Moderate d) Slight

4. Do you expect changes soil erosion impact over the last years in lode benben and lode chancho Keble?

a) Has become more severe b) Has become less severe

c) No change

5. Your perception for the major cause of soil erosion on crop production?

a) Poor Arable Land Management b) Population Pressure

c) Soil being to erodible d) Deforestation

e) Over of Grazing Land f) expansion agricultural land on arable land

6. On question number four, what main cause accelerated soil erosion in the study area?

a) Deforestation b) Population Pressure c) Over of Grazing Land

d) Expansion agricultural land on arable land e) Poor Arable Land Management

7. What extent of impact of soil erosion on crop production?

a) Severe b) Moderate c) Has no effect

8. What is the effect of soil erosion in lodebenben and lodechancho Keble?

a) On- site effect b) off-site effect c) other natural depletion

9. Have you observed a decrease in soil depth due to erosion in your area?

a) Yes b) No c) Not certain

10). Do you believe that soil erosion can be controlled on crop production?

a) Yes b) No c) Not certain

11. Do you perceive that soil fertility is declining due to soil erosion in your area?

a) YES b) NO c) Not certain

12. On the whole, what do you think of the quality of your farm land in crop production your area? a) Very poor b) Poor c) Adequate d) Fertile

13. Do you think that the impacts of soil erosion on crop production could be controlled?

A) Yes C) No C) Not certain

14. Do you think that deforestation is the cause for soil erosion in your lode benben and lode chancho Keble? a) Yes b) No c) Not certain

15. What kind of soil erosion conservation structures do you construct by your own crop production?

a) Stone bund b) Soil bund c) crop rotation d) terracing

e) Counter practices f) others

16. Do you think that the soil conservation measures you took were or are enough?

a) Yes b) No c) Not certain

APPENDEX II

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DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL STUDIES

Interview questioners

This interview questionnaire prepared for the purpose of data collection from lode benben and lode chancho Keble agricultural expertise and kebele population about the following points. So, dear please, give the correct answer form the interview

Tanks more about you're voluntary!!

1 What are the main soil erosions in your Keble?
_____
_____
_____

2 What is the soil erosions impact on crop production in your Keble?

_____
_____
_____

3 How the soil erosions impact on crop production can be minimized?

_____
_____
_____

4 What are the causes that affect crop production in lodebenben and lode chancho kebele?
_____
_____
_____

5 What will be the role of government, NGOs and other stack holders to ensure sustainable crop production in lod benben and lode chancho Keble?

_____
_____

Thank You Very Much Once Again for Your Time and Concern!!!

APPENDEX III

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DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL STUDIES

Observation check list format

No	Item	Yes	No
1	Is there any soil erosion problem in a study kebele?		
2	Is there is the level of soil erosion is high?		
3	Is soil erosion are caused by overgrazing, population pressure, and deforestation?		
4	Is soil erosion is reducing crop productivity?		
5	Are soil and water conservation practices on cultivated land to control soil erosion?		
6	Is there tracing, check dame for the control of soil erosion?		