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# Farmers' Perception of the Impact of Land Degradation and Soil and Water Conservation Measures in West Harerghe Zone of Oromia National Regional State, Ethiopia.

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**Abstract**
This study was conducted to assess the farmers' perception of the impact of land degradation and its' conservation measures on crop productivity and income in West Harerghe Zone of Oromia National Regional State, Ethiopia. The study was based on the data obtained from 398 sample households using pre-tested structured interview schedule. The data were analyzed using simple descriptive statistics with the appropriate statistical tests. The result of the analysis revealed that out of the total sampled households, 82.7 percent were perceptive about the problem of soil erosion and majority of these households (54.5 percent) perceived erosion on their land as severe. The perceived fertility decline on their farm was, 28.1 percent less severe, 57.9 percent sever and 13.9 percent very severe. More than 55 percent of sampled respondents also believe that the impact of land degradation on yield/productivity decline of their lands was severe. Likewise, majority (98.9 percent) of the total households were perceptive about the impact of soil and water conservation in improving soil fertility and yield/production. However, significant proportion farmers who perceived the impact of land degradation and the conservation measures on crop productivity and income were using traditional measures. Therefore, to encourage adoption of improved conservation measures extension, institutional support programs and projects which promote soil and water conservation technologies should have strategies which focus on enhancing the willingness of farm households.
**Keywords:** Land degradation, soil and water conservation, perception, Ethiopia

## *1. Introduction*

Land degradation due to soil erosion and nutrient depletion is considered as one of the main problems constraining the development of the agricultural sector in Ethiopia (Kirubel and Gebreyesus, 2011). Land degradation is manifested mainly in the form of land where the soil layer has been eroded away and nutrients have been continuously extracted with little or no any replenishment. The problem is particularly severe on cultivated marginal and sloping land because such areas are generally susceptible to soil erosion (Million and Belay, 2004). This has significantly contributed to the hunger faced by some five to seven million people in the country, thereby requiring external assistance every year for their survival and more than 45 percent of the total population to toil below the absolute poverty line (Gete *et al.,* 2006).

Given the continued degradation of natural resource and the very high population growth rate, the opportunity to increase production through area expansion is very limited in the country. The greatest potential for increasing agricultural productivity is likely to come from improved land management practices and efficient application of improved agricultural inputs (Kidane, 2001; Assefa, 2009). In pursuit of this, Ethiopia has been in continuous struggle to increase agricultural production through sustainable use of natural resources during the last four decades (Bekele *et al.,* 2009). However, farmers may practice different conservation measures depending on their degree of perception of the problem of land degradation and awareness of the conservation measures available around them (Shiferaw and Bantilan, 2004). Thus, understanding farmers' perception of the impacts of land degradation and the conservation measures help to provide specific policy recommendations for designing appropriate conservation strategies of land management. Therefore, this study aims to assess farmers' perception on problem of land degradation (*i.e.,* soil erosion and decline in soil fertility) and its' conservation measures on crop productivity and household income in West Harerghe Zone of Oromia National Regional State.

## *2. Research Methodology*

### *2.1. Description of the Study Area*

West Harerge Zone is one of the 17 Zones in Oromia National Regional State, geographically located between 70 32' - 90 47'N latitude and 410 24' - 430 48'E longitudes (between 70 52' 15'' - 9028'43'' North latitude and 400 03' 33'' - 40034'13'' East longitudes. The capital town of the Zone is Chiro, which is located at a distance of 326 km East of Addis Ababa. The area coverage of the Zone is 1,723,145ha (17,231km2), comprising of 14

 

districts with a combined population of 1,871,706, of whom 912,845 are women. While 160,895 or 9.36% are urban inhabitants, a further 10,567 or 0.56% are pastoralists (ZBOFED, 2012). West Harerghe is subdivided in to three major climatic zones known to be Temperate tropical highland locally known as *dega* (12.49%), Semi-temperate/Tropical rainy mid land or woinadega (38%), and Semi-arid/Tropical dry or kola (49.5%). The topography of the zone is characterized by steep slopes in the highlands and mid-highlands and large plains in the lowland areas. The ecological zones are set based on the differences in altitude variation ranging between 500 up to 3500 meters above sea level *kola* (500 - 1500 m a.s.l), *woinadega* (1500 - 2300 m a.s.l) and *dega* (2300 - 3500 m a.s.l). The mean monthly minimum temperature ranging from $16^0$C to $20^0$C, while the mean maximum is $24^0$C to $28^0$C. Rainfall is dispersed throughout the year into two rainy seasons *belg* rains falling in February-April and *meher* or main season rains fall from June-September with small showers in dry months. Annual rainfall averages range from below 700 mm for the lower *kolla* to nearly 1,200 mm for the higher elevations of *woinadega* and *dega* areas. The rainfall is variable from year to year both in terms of intensity and distribution during the growing seasons causing a wide range of climatic hazards (PEDBRSO, 2010).

*2.2. ampling Procedure*

Multi-stage stratified random sampling technique was followed to select PAs and households proportionally for the study. Considering the objective of the study and representativeness of the sample, 18 kebeles were selected from three randomly drawn Districts (Messela, Oda Bultum and Daro Lebu). As sever degradation and huge investment in its' conservation measures were undertaken in high-and mid-altitude areas, the selected kebeles are found in the two agro-climatic zones. To give equal chance in selection of the study units from each concerned woredas, probability proportional to size (PPS) was applied. Again PPS was used to draw sampling units proportionally from each kebele administration of the three woredas. Consequently, the total sample size, 398 households were randomly drawn from the eighteen kebeles using simple random sampling procedure via sampling frame.

*2.3. Data Analysis*

Data were analyzed using descriptive statistics. Mean and proportion comparison methods (independent sample t-test and $\chi^2$ test), respectively were used to test whether there is significant difference between adopters and non-adopters in terms of the selected variables.

## *3. Results and Discussion*

3.1. Demographic and socio-economic characteristics of the respondents

Of the total sampled households, only 23 (5.8 percent) were female headed. The mean age of the sample household heads was 43.27 with the minimum and maximum ages of 21 and 75 years. Significant proportions (50.5 percent) of the household heads were not able to read and write, while 11 percent could read and write but were without formal education. However, 31.3 percent of the respondents had primary school education or have joined the former illiteracy campaign; while 6.3 percent had secondary school education. The mean family size of the total sample respondents was 7.03 persons ranging from 1 to 17, which is higher than the national average of 5 persons (CSA, 2007). This implies that, the farmers had a large family size in the area, which could reduce the demand for hired labour as members of the farm families could carry out some of the farming and non farming activities.

The average farm size of the sample households was found to be 0.98 hectares ranging between 0.06 and 3.45 hectares. This shows that they are small scale farmers, which is a typical feature of rural farmers in Ethiopia. Of the total land size, about 0.73 hectare on average was cultivated and covered with annual and perennial crops. This figure is by far below the national average of 1.53 ha (CSA, 2007). The total livestock holding measured in terms of TLU was found to be 2.09. This is relatively large number in this crop-livestock mixed farming system where land holdings are very small and grazing areas are continuously converted into crop land. According to the information obtained from focus group discussions, because of serious shortage of land, most of the farmers are using zero grazing and the productive and reproductive performance of animals has been declining due to shortage of feed resources, particularly in dry seasons. The average numbers of oxen owned were 0.9. This indicates farmers on average have less than a pair of oxen required for farm operation.

Sales of crops, livestock, and off-farm activities are important sources of cash income in the study areas. However, sales of crops constitute 84.82 percent and 83.01 percent of the total income for adopters and non-adopters, respectively. In 2011/2012 production season, the net crop and livestock income of the adopters was birr 17984.62 and birr 1418.91, while that of the non-adopters was birr 13077.64, and birr 765.39, respectively.

3.2. Major soil and water conservation measures in the study area

As in the other parts of the country, in the study area different types of traditional conservation measures are old age practices developed through gradual, but dynamic processes across generations. Subsequently, at the time of the survey, 98.5 percent of the non-adopters were using traditional measures to reduce runoff speed and for the purpose of water harvesting and soil conservation. Traditional earth bunds (86 percent), stone bund (16.3

 

percent), water way (97.1 percent), tied ridges, (4.7 percent) and stone check-dam (1.4 percent) were the major traditional measures used by the same households. These figures are good indications of how conservation practices are important in the farming system of the area.

The most widely and intensively used improved soil and water conservation practices were *fanyajuu,* cut off drains, soil bund, stone bund, check-dam and farm forestry. As well, majority (97.8 percent) of these households adopted grass strip, mostly with soil and stone bunds and 58.5 percent of them planted different trees on their farm. From the users of the technologies, only 33.9 percent were using a single conservation strategy, while 121 (66.1 percent) used combinations of two, three and more conservation strategies on their plots.

From the field observations through transect walk, the researcher also learned that despite the presence of technical standards for the construction of improved structures there were variability among farms constructed on similar slope gradients in terms of height, width and spacing. In addition, the quality of structures constructed by food for work (FFW) was relatively low and the farmers were expected to invest on it for maintenance. Ttraditional and improved measures have also similar characteristics in terms of purpose and material required for implementation. Both are practiced for the purpose of soil trapping and water harvesting. However, they are different in durability, duration, labour source for construction and time of construction (Wagayehu, 2006). The sampled respondents also indicated that they used conservation measures in their farm for the purpose of conserving soil (6.2 percent), conserving water (3.8 percent) and for both purposes (90.3 percent).

These attributes of the conservation measures are also considered as one of the factors influencing farmers' adoption decision. In view of this, farmers were asked about the problems associated with the major improved conservation strategies of land management practices. All respondents agreed that improved conservation measures are more effective than the traditional ones but require more labour, frequent maintenance, reductions of farm size and difficulty to turn oxen (Table 2). The output of the focus group discussions with different groups of farmers also confirmed that comparing with their relative advantages; the problems of stone bund and check-dam are tolerable (labour intensive and maintenances requirement). As to the farmers, stone bunds and check-dam are suitable to reduce surface runoff velocity and maintain eroded sediments by retaining soil, and thereby make possible cultivation of fallow and virgin land. Whereas the problems related to soil buds (ineffectiveness in reducing soil erosion, space it occupies and difficulty for farm operation) are intolerable. This shows how farmers give different weight for each problem so as to make choices among the practices.

To maintain the fertility of their farm, 95.2 percent and 61.9 percent of the sampled households also used intercropping and crop rotation, respectively. Moreover, 47 percent and 78.4 percent of the total sampled households used organic manure and chemical fertilizer for a similar purpose. The average application of chemical fertilizer of program and non-program households at the time of the survey were 191.85 Kg/ha and 160.62 Kg/ha, respectively. The results show that there was no significant difference between the two groups in the mean application of both chemical and natural fertilizers during the same year.

### 3.3. Farmers' perception of the impacts of land degradation and its' conservation measures on crop productivity and income

The survey result shows that higher proportions (82.7 percent) of the sampled households were aware of about the problem of soil erosion and majority of these households (54.5 percent) perceived erosion on their land as severe. The sampled households' responses about the rate of soil erosion in their area for the last ten years based on their knowledge showed that, 37.1 percent erosion is happening very rapidly, 11.9 percent moderately and 51 percent slowly. They were also asked when erosion becomes severe in their area. Accordingly, 19.6 percent reported that severe erosion was started 20 years and before, 24.4 percent as 15-20 years, 29.3 percent as 6-14 years and the rest 25.4 percent as the last 5 years, 1.3 percent reported that there is no erosion at all.

Farmers were also asked to judge the fertility status of their farmlands and the result indicated only 7.9 percent of farmers perceived their lands to be high in fertility, 21.6 percent judged the fertility status to be medium, another 62.4 percent said their lands were low in fertility, and the remaining 8.1 percent said their lands were poor in fertility. The analysis response of farm households on the severity of fertility decline on their farm shows, 28.1 percent perceived less severe, 57.9 percent sever and 13.9 percent very severe problem in fertility decline.

Of the total respondents, 49.5 percent and 22.5 percent using traditional measures were those with medium and high perception on land degradation (soil erosion and soil fertility decline), respectively. This indicates that perceiving problems of land degradation not always guaranteed for the use of improved soil and water conservation measures in the study area. Rather, other factors which affect their decision should come into play.

Farmers were asked whether some of their practices are causing damage on their own farm or not. A significant proportion (57.8 percent of sample households, 30.7 percent of the adopters and 69.3 percent of the non-adopters) did not realize that some of their practices cause damage to their own farm plots and relate cause of soil erosion to run off (45.2 percent), excess rain fall (28.1 percent) (Table 5). They were also interviewed regarding their practice that cause damage to down slope land users plots, again majority of sample respondents (62.7 percent) reported they did not understand some of their farming practices contributes to the occurrence of soil erosion to

 

down slope land users' plots. Such views agree with the result of Woldeamlak (2003) in the North Western highland of Ethiopia and Kidane (2008) in South Wello, Ethiopia. This implies that still farmers fail to understand their contribution to soil erosion, which may need extension intervention to improve their understanding regarding causes of erosion. The result of different focus group discussions conducted with different members of people in the area also confirmed for the same.

Concerning the perception of farmers to the causes of soil fertility decline on their farms, the respondents ranked soil erosion (43.9), lack of bunds (34.2), limited use of manure (11.1), age of land due to repeated cultivation (7.3), shortage of fallowing (1.2) and limited use of fertilizer (0.5) as the first reason for the decline of soil fertility. This shows how farmers in the study area associate soil fertility decline with soil erosion and absence of buds on farm plots, which is probably an opportunity to promote conservation strategies.

With the intention of understanding the community perception on the impacts of land degradation, the respondents were asked to mention the major consequences of degradation that they faced. Accordingly, 89.4 percent of the households suggested that land degradation bring productivity decline, 10.61 percent reported it decreases the soil depth, color and changed the type of crops grown, 16.06 percent claimed it exposed stone rocks, deteriorate water holding capacity and made land preparation difficult, and for 44.55 percent of them, it results gully and sandy soil formation which reduced farm size. Of all the identified consequences, the worst that the farmers faced was soil productivity decline. More than 55 percent of sampled households also believe that the impact of land degradation on yield/productivity decline of their lands was severe. Comparing with the non-adopters, the severity of degradation and its' impact on yield was better recognized among the adopters; where over 63.4 percent of them have very bad erosion which caused significant yield reduction (Table 4). The findings of Woldeamlak (2003) and Seid (2009) also indicated that understanding and recognition of soil erosion as a problem on own farm and its cause and impact on crop yields is the first step towards searching for and adoption of remedial measures.

Based on their perception, the soil and water conservation adopters were also asked to suggest their views about the importance of soil and water conservation measures. Thus, 62.7 percent of them suggested that soil and water conservation technologies are extremely important, 31.2 percent very important, 5.8 percent somewhat important, 0.9 percent not very important. This finding on farmers' perception analysis also showed that more percentage (98.9 percent) of the total households were perceptive about the impact of soil and water conservation in improving soil fertility and yield/production. One of the reasons behind fewer numbers (0.9 percent) of household perceptions on soil and water conservation is believed to be inaccessibly of information on the extent of the severity of the problem at large. Regarding the effectiveness of conservation structures, 82.9 percent of the interviewee confirmed that the currently adopted conservation technologies with the support of different projects are by far effective than the previous innervations with different approaches.

At the suggested level of perception on the importance of conservation measures, majority (91 percent) of the households strongly agreed that both the community and government bodies should be responsible for conservation activities, 4.55 percent strongly agree that it should be by only landowners, and the rest 2.12 percent strongly agree that it should be only by the government. In line with this, 73 percent of the sample respondents argued that to make the intervention sustainable, farmers should not be paid for construction of soil and water conservation practices on their farms. Majority of the respondents (95.6 percent) also mentioned farmers should be responsible for maintenances of the physical conservation measures which are constructed either in PSNP or by farmers themselves on farm land. As to the respondents' view, farmers should be paid or supported on farms or plots where constructions of bunds are difficult for individual households (especially land between valleys).

### *4. Conclusion and policy implication*

Farmers have their own perception in evaluating the problem, causes and consequence of land degradation (soil erosion and soil fertility decline). However, regardless of farmers' perception on the impact of land degradation, its influence on use of improved measures was not significant as anticipated. Significant proportion farmers who perceived the impact of land degradation and its' conservation measures on crop productivity and income were not using any of the practices or were using traditional measures. This might be due to the failure of the interventions to notice inter-household variations (age, education *etc*.), or it may also be related with lack of willingness of farmers to use the improved land management technologies. Hence, such interventions should consider heterogeneity in the above factors in the design and promotion of the conservation practices. Moreover, to encourage adoption of improved conservation measures extension, institutional support programs and projects which promote soil and water conservation technologies should have strategies which focus on enhancing the willingness of farm households.

 

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***References***
Assefa D. 2009. Assessment of Upland Erosion Processes and Farmer's Perception of Land Conservation in Debre-Mewi Watershed, Near Lake Tana, Ethiopia. A Thesis Presented to the Faculty of Graduate School of Cornell University in Partial Fulfillment of the Requirements for the Degree of Masters of Professional Studies.104p.
Bekele S, Okello J, Ratna VR. 2009. Adoption and Adaptation of Natural Resource Management Innovations in Smallholder Agriculture: Reflections on Key Lessons and Best Practices. Environment, Development and Sustainability, 11: 601-619.
Gete Z, Menale K, Pender J, Mahmud Y. 2006. Stakeholder Analysis for Sustainable Land Management (SLM) in Ethiopia: Assessment of Opportunities, Strategic Constraints, Information Needs, and Knowledge Gaps. Environmental Economics Policy Forum. 97p.
Kidane G. 2001. Factors Influencing the Adoption of New Wheat Verities, in Tigray, Ethiopia: the Case of Hawizen District. An MSc Thesis Presented to the School of Graduate Studies of Alemaya University.164p.
Kidane T. 2008. Determinants of Physical Soil and Water Conservation Practices: The Case of Bati District, Oromyia Zone, Amhara Reion, Ethiopia. M.Sc. Thesis Presented to the School of Graduates of Alemaya University, Alemaya. 162p.
Kirubel M, Gebreyesus B. 2011. Impact assessment of soil and water conservation measures at Medego watershed in Tigray, northern Ethiopia. *Maejo International Journal of Science and Technology. 5*(03): 312-330.
Million T, Belay K. 2004. Factors influencing adoption of soil conservation measures in southern Ethiopia: The Case of Gununo Area. *Journal of Agriculture and Rural Development in the Tropics and Subtropics,* 105 (1): 49-62
PEDBRSO (Planning and Economic Development Bureau of the Regional State of Oromia), 2010. Zonal Atlas of West Harerghe Zone. 112p.
Seid H. 2009. Determinants of Physical Soil and Water Conservation Practices: The Case of Bati District, Oromyia Zone, Amhara Reion, Ethiopia. M.Sc. Thesis Presented to the School of Graduates of Alemaya University, Alemaya. 162p.
Shiferaw B, Bantilan C. 2004. Rural Poverty and Natural Resource Management in Less-favored Areas: Revisiting Challenges and Conceptual Issues. Journal of Food, Agriculture and Environment, 2(1): 328-339.
Woldeamlak B, Sterk G. 2003. Farmers' Participation in Soil and Water Conservation Activities in Chemoga Watershed, Blue Nile Basin, Ethiopia. Land Degradation and Development. Journal of Agricultural Economics, 13: 189- 200.
WHZBOFED (West Harerghe Zone Finance and Economic Development Office), 2007. Annual Report

Table 1. Household income (in ETB)

| Income type | Total sample | | Adopters | | Non-adopters | | t-value |
|---|---|---|---|---|---|---|---|
| | Mean | STD | Mean | STD | Mean | STD | |
| Age | 43.27 | 10.47 | 44.74 | 9.70 | 42.03 | 10.95 | 2.59** |
| Farm experience | 21.48 | 9.55 | 23.95 | 8.98 | 20.05 | 9.68 | 4.14*** |
| Family size | 7.03 | 2.80 | 7.32 | 2.79 | 6.78 | 2.79 | 1.95* |
| Land size | 0.98 | 0.57 | 1.07 | 0.65 | 0.89 | 0.46 | 3.04*** |
| Livestock (TLU) | 2.09 | 2.06 | 2.81 | 2.24 | 1.49 | 1.66 | 6.57*** |
| Net crop income | 15309.2 | 5956.6 | 17984.6 | 6764.3 | 13077.6 | 4010.5 | 3.35*** |
| Net livestock income | 1062.6 | 1036.1 | 1418.9 | 1134.4 | 765.4 | 840.0 | 6.33*** |
| Off/non-farm income | 1859.7 | 3503.3 | 1798.6 | 7403.5 | 1910.6 | 3108.2 | -0.31 |
| Net household income | 18231.5 | 7673.5 | 21202.1 | 8623.7 | 15753.7 | 5717.9 | 7.170*** |

Source: Computed from survey data
*** means significant at the 1% probability level

 

Table 2. Improved soil and water conservation practices used by adopters

| SWC technologies | N (%) |
|---|---|
| Grass strip | 179(97.8%) |
| Cut off drain | 112(61.2%) |
| Soil bund | 130(71.0%) |
| *Fanyajuu* | 89(48.6%) |
| Stone bund | 99(53.5%) |
| Check-dam | 13(7.1%) |
| Farm forestry (in number) | 107(58.5%) |
| Integrated SWC | - |

Note that there are multiple response
Source: Computed from survey data

Table 3. Farmers' response to problems associated with conservation measures

| Problems of SWC | Improved SWCPs | | | | Traditional SWCPs | |
|---|---|---|---|---|---|---|
| | Soil bund | *fanya juu* | Stone bund | Check dam | Earth bund | Stone bund |
| Labour intensive | 42.7 | 62.8 | 87.9 | 97.1 | 4.7 | 17.6 |
| Requires frequent maintenance | 72.9 | 49.5 | 57.8 | 58.4 | 21.9 | 86.9 |
| Difficult to implement | 12.6 | 17.6 | 29.4 | 29.4 | - | 3.3 |
| Take land out of production | 72.9 | 9.5 | 13.8 | 12.6 | 37.6 | 3.4 |
| Difficult to turn oxen | 55.3 | 18.8 | 29.4 | 17.6 | 11.6 | 1.3 |
| Increases rodent and pest incidence | 5.0 | 16.3 | 16.9 | 17.1 | 35.9 | 7.4 |
| Not effective to reduce soil erosion | 29.4 | 2.5 | 3.3 | 1.3 | 31.3 | 55.5 |

Note that there are multiple responses
Source: Computed from survey data

Table 4. Farmers' perceptions about the impact of land degradation and SWC

| Variables | Total sample (N=398) | | Adopters (N=183) | | Non- adopters (N=215) | | $\chi^2$ |
|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | |
| Perception of the severity of soil erosion | | | | | | | |
| Severe | 217 | 54.5 | 103 | 56.3 | 114 | 53.0 | |
| Moderate | 112 | 28.1 | 59 | 32.1 | 53 | 24.7 | 11.150** |
| Low | 64 | 16.1 | 21 | 11.5 | 43 | 20.0 | |
| No erosion | 5 | 1.3 | - | - | 5 | 2.3 | |
| Perception of soil fertility decline | | | | | | | |
| Very severe | 110 | 13.9 | 69 | 17.4 | 41 | 10.5 | |
| Severe | 456 | 57.9 | 225 | 56.8 | 231 | 59.1 | 8.482** |
| Less severe | 221 | 28.1 | 102 | 25.8 | 119 | 30.4 | |
| Perceived impacts of land degradation on land production | | | | | | | |
| Severe | 221 | 55.5 | 116 | 63.4 | 105 | 48.8 | |
| Moderate | 135 | 33.9 | 54 | 29.5 | 81 | 37.7 | |
| Low Effect | 29 | 7.3 | 12 | 6.6 | 17 | 7.9 | 32.296*** |
| No Effect | 13 | 3.3 | 1 | 0.5 | 12 | 5.6 | |

Source: Computed from survey data
*** and ** means significant at the 1% and 5% probability levels, respectively

 

Table 5. Farmers' perceptions of causes of soil erosion and decline of soil fertility

| Causes | % Responses number (398) | | | | |
|---|---|---|---|---|---|
| | 1st | 2nd | 3rd | 4th | 5th |
| Cases of soil erosion | | | | | |
| Excessive rainfall | 28.1 | 20.6 | 16.9 | 19.4 | 15 |
| Cultivation of steep slopes | 11.9 | 16.3 | 17.3 | 31.6 | 22.9 |
| Over cultivation | 12.5 | 10.6 | 1.95 | 31.6 | 25.8 |
| Poor agricultural practices | 6.3 | 35 | 25 | 2.5 | 31.2 |
| Runoff | 45.2 | 25.4 | 17.3 | 9.8 | 2.3 |
| Reasons of soil fertility decline | | | | | |
| Limited use of fertilizer | 0.5 | 1.2 | 7.5 | 12.6 | 78.2 |
| Limited use of manure | 11.1 | 30.1 | 17.6 | 7.3 | 33.7 |
| Soil erosion | 43.9 | 27.1 | 16.3 | 9.8 | 2.8 |
| Lack of bund | 34.2 | 11.9 | 25.4 | 17.6 | 10.8 |
| Absence of fallowing | 1.2 | 3.0 | 7.3 | 11.1 | 77.4 |
| Age of land due to repeated cultivation | 7.3 | 16.3 | 17.6 | 27.1 | 31.7 |

Source: Computed from survey data

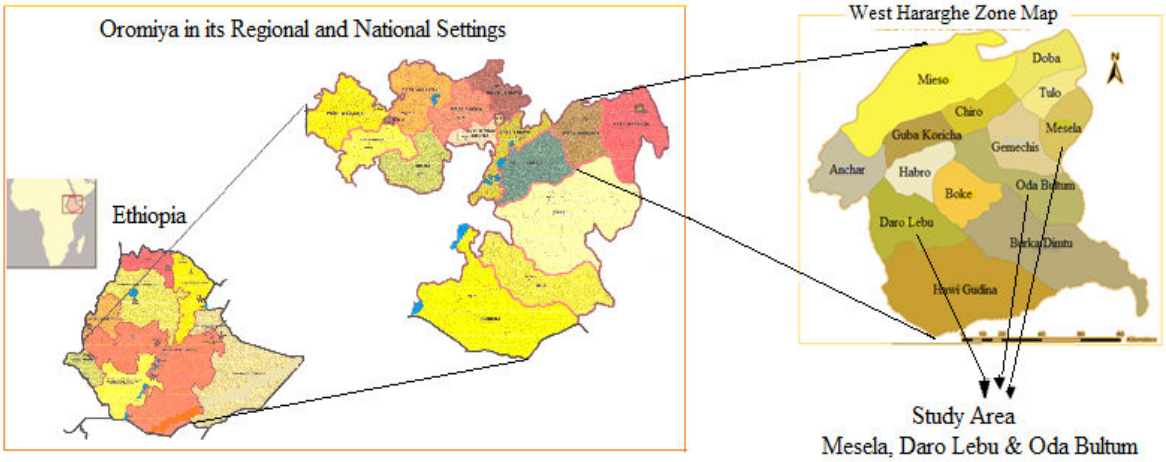


Fig. 1. Map of Ethiopia and West Harerghe Zone