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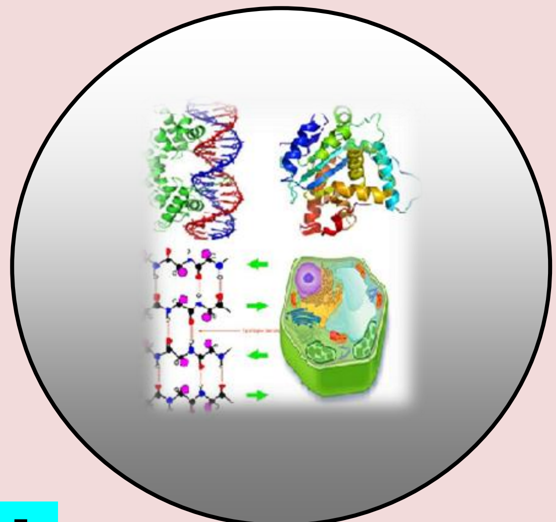

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RESEARCH PAPER

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Assessment of Participatory Integrated Watershed Management Practices in Essera District Dawro Zone, South Western Ethiopia

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ABSTRACT

For several decades, integrated and sustainable watershed management has been suggested and tried in several countries in the world, as an effective way to address complex water and land resource challenges. However its implementation has not been successful in most cases, due to various barriers. In Ethiopia, this approach is new and requires appropriate strategies to overcome the barriers and practice effective integrated and sustainable watershed management. To design suitable and effective strategies, there is need to understand watershed management approaches implemented by different watershed projects at various spatial levels, which promote or hinder integration, sustainability and coordination. This paper therefore explores the prospects, approaches and barriers of integrated and sustainable watershed management of Essera district, by examining the existing complex set of biophysical and socio-economic conditions, stakeholders‟ attitudes and perceptions, arrangements for participation of communities, available institutional structures and Information was gathered from samples kebeles and Essera district agricultural and natural resource management development office, direct observations, semi-structured interviews with development agents and watershed committees.
Keywords: Participatory Watershed Management, Agricultural Systems and Integrated Natural Resource Management.

INTRODUCTION

Background*:* The backbone of the agrarian economy in most developing countries is rain fed agriculture. Participatory watershed management has been practiced as a means to increase rain fed agricultural production, conserve natural resources and reduce poverty in Ethiopia.

The economic development of developing countries depends on the performance of the agricultural sector, and the contribution of this sector depends on how the natural resources are managed. Unfortunately, in the majority of developing nations, the quality and quantity of natural resources are decreasing resulting in more severe droughts and floods (Fikru, 2009). Sustainable livelihood and increased food production in agricultural based developing countries require the availability of sufficient water and fertile land (Tesfaye, 2011).

In most of the developing countries, the major factor for land degradation is the improper and unsustainable land use and management due to population pressure and small farm sizes, land tenure insecurity, land redistribution, limited access to credit and education (IFPRI, 2005).In participatory integrated watershed management, the approach can be qualified through two aims. First, the process must be participatory in terms of the particular issues to be worked on, and how related activities are carried out (Hinchcliffe et al., 1995; Rhoades, 2000; Turton and Farrington, 1998). A critical question to ask when formulating a participatory watershed management is, “Why would a farmer want think beyond the farm level?” Only by gaining clear answers to this question can a participatory watershed approach be developed. Participation of local community in watershed development and management is essential to sustain the watersheds to address the land degradation and loss of soils, extensive watershed management practices were launched in Ethiopia, particularly after the famines of the 1970s. Since then, huge areas have been covered with terraces, bunds and millions of trees have been planted (Herweg, 1993; Yeraswork, 2000). Even though a number of watershed management techniques were introduced to combat land degradation, adoption of these practices remains below expectations.

Watershed management is a landscape-based strategy that aims to implement improved natural resource management systems for improving livelihoods and promoting beneficial conservation, sustainable use and management of natural resources. Integrated watershed management (IWM) has been promoted in many countries as a suitable strategy for improving productivity and sustainable intensification of agriculture **(**Bekele, 2007). The watershed management effectively accounts multiple linkages between livelihood and natural resource management (Hope 2007; Tiwari et al. 2008). Vegetation, soil, and water resources can be protected more efficiently through this approach since whole ecosystems and people participation can significantly be considered (Kerr 2002; Srivastava et al. 2010; Price et al. 2011). This contributes for improvement of watershed resources and livelihood of the people (Pathak et al. 2013; Khajuria et al. 2014).

Therefore; the studied helped us to assess integrated watershed management practices and to generate recommendations that we can assess participatory integrated watershed management practiced in the study areas. The However, effect of such watershed management practices, effectiveness of group organized, are rarely evaluated for most their conservation problems identified by watershed residents themselves and the ultimate beneficiaries (upper catchment residents). Principles guiding watershed approach development include equity, sustainability and local empowerment.

Statement of the Problem

The Ethiopian economy is primarily agricultural. In any single year, agricultural production makes up more than 40 percent of the GDP. Much of the foreign currency earnings are derived from it and some 85 percent of the country’s population derives their livelihood directly from the sector. Smallholder farmers operating under entirely rain-fed condition dominate the sector. Smallholders account for 95 percent of the total area under crop cultivation.

Land degradation, which includes degradation of vegetation cover, soil degradation, water pollution and nutrient depletion, is a major ecological problem in Ethiopia (Temesgen, 2012).

Degradation of vegetation cover and soil degradation mainly caused by lack of effective watershed management practices and inappropriate use and management of the natural resources. For instance over the last two decades, the Government of Ethiopia and donors have spent significant sums on micro-watershed and macro-watershed rehabilitation and development. Most of these projects were not successful due to lack of effective community participation, limited sense of responsibility over assets created; inefficient implementation of technologies, inadequate polices lack of integration among stakeholders, unmanageable planning units and evaluation techniques for their feedback (Tesfaye, 2011). Poor integrated watershed management practices seem to be responsible for the land degradation.

The watersheds that are severely affected by land degradation which includes soil erosion, nutrient depletion, and degradation of vegetation cover and heavy sedimentation. Active involvement of the people is a pre-requisite for participation. Participation patterns must continue from planning through evaluation. Poverty and unsustainable livelihoods in the Save Catchment have contributed to watershed degradation, and planning has failed to take more effective account of multiple linkages between poverty and water source management. Integrated water management has not managed to bring the intended positive impacts on livelihoods and the environment. Land use activities in the catchment have degraded the ecosystem in ways that ultimately undermine the environment, human welfare and long term sustainability of human activities within the catchment. Without espousing proper catchment management to address issues of community participation, sustainability, equity and technical support the result is further ecosystem degradation and subsequent household food insecurity Ethiopia is experiencing a wide food disparity with the food demanded and the food supplied from domestic production In the study area, farmers are confronted with low availability of productive resources on the one hand and lack of other employment options on the other. This has led to a continuous fragmentation of landholdings.

Literature on agricultural intensification state that as key resources such as land become scarce, humans may adjust over time by increasing labor efficiency, substituting other resources, innovating new technologies, creating new resource management institutions, or implementing conservation (DODDS, 1998). In Ethiopia, efforts to conserve soil resources and prevent degradation date back to the mid-1970s and 80s (BEKELE and HOLDEN, 1998; USAID, 2000). Since then many public organizations and NGOs have been involved in addressing the widespread problem of land degradation.

Significance of the Study

The outcome of the study will generate information for different stakeholders, engineers, researchers, policy makers, governmental and non-governmental organization, and farmer's local level organizations to design and develop effective sustainable integrated watershed management practices and strategies. Moreover, the methodology that will be developed in this study and the result will be found can serve as background information to undertake similar research in similar setting.

Objectives of the study

General objective

To assess participatory integrated watershed management practices in Esseradistric, Dawro zone of South Western Ethiopia.

Specific Objectives

- To identify the key problems of participatory integrated watershed management practices and the root causes

- To evaluate conservation activities as a response of ever expanding land degradation through watershed management practices.

Limitation of the Study

This study has some limitations and faced some constraints: From these, a financial constraint was the main drawback during conducting this study. The data collection time (January to April, 2017) was found to be inconvenient for most of the farming population in the study areas as it was peak agricultural activity season. Most farmers were reluctant to spare their scarce time for interview. The time allocated for the survey was found to be insufficient to arrange and integrate some of the questions in the questionnaire and to make proper follow-up and control of the data collection process.

Even though the household questionnaire interviewed to each household was designed to be concise, it was lengthy and in some areas some of the questions were not understood by interviewees. However, the research has attempted and took all the best to make study effective and valuable work.

LITRATURE REVIEW

Watershed Management Practices in Ethiopia

Watershed management practices are planned changes in land use and vegetative cover and other non-structural and structural actions that are made on a watershed to achieve ecosystem-based, multiple-use management objectives. Watershed management practices implemented in rain fed regions are oriented largely toward rehabilitating degraded lands; protecting soil, water, and other natural resources to produce food, forage, fiber, and other products; enhancing the flows of high-quality water from upland watersheds to downstream places of use (FAO, 1986; Khan, 2002). While many land uses can occur on watersheds, natural resources production and environmental protection are equally important managerial objectives.

Watershed management attempts to incorporate and systematize the different uses, services, and values of water jointly in management decisions and regulatory activities rather than attempting to maximize selected resources or regulate individual negative impacts (Cobourn, 1999; German et.al, 2006; Darghouth et.al, 2008). In this multidisciplinary approach, the local people are the chief actors in the process. Watershed projects in developing countries that focus on water harvesting and soil conservation typically state three objectives: 1) conserve and strengthen the natural resource base, 2) make agriculture and other natural resource-based activities more productive, and 3) support rural livelihoods to alleviate poverty. Local people, especially the poor and disadvantaged, organize themselves with support from governmental and nongovernmental organizations to actively manage land resources (Kerr et.al 2002).

The Ethiopian government has for a long time recognized the serious implications of continuing soil erosion to mitigate environmental degradation and as a result large national programs were implemented in the 1970s and 1980s. However the efforts of these initiatives were seen to be inadequate in managing the rapid rate of demographic growth within the country, widespread and increasing land degradation, and high risks of low rainfall and drought. Since 1980, the government has supported rural land rehabilitation, these aimed to implement natural resource conservation and development programs in Ethiopia through watershed development (MOARD, 2005). The institutional strengthening watershed project in Ethiopia was implemented by FAO, and was principally aimed at capacity building of Ministry of Natural Resource’s technicians and experts and development agents in the country.

The projects used the sub-watershed as the planning unit and sought the views of local technicians and members of the farming community to prepare of land use and capability plans for soil and water conservation. This approach was tested at the pilot stage through FAO technical assistance under MOA during 1988-1991(MOARD, 2005). This was the first step in the evolution of the participatory planning approach to watershed development. By late 1990, watershed development was considered the focal point for rural development and poverty alleviation.

Several NGOs and bilateral organizations adopted watershed development in the last decade in their perspectives intervention areas with collaboration of government partners. For instance the land rehabilitation project, with WFP Food-for-Work assistance aimed at addressing the problems of food insecurity through the construction of soil conservation structures, community forestry, and rural infrastructure works. The project focused on selected food deficit Watersheds in the country where the incidence of chronic food insecurity is most severe.

In Ethiopia Watershed management was merely considered as a practice of soil and water conservation. The success stories of early watershed projects were marked as the basis of major watershed initiatives in Ethiopia. But only technological approaches were adopted from those early successful projects and the lessons related to institutional arrangements were neglected. The newly implemented projects neither involved nor took effort to organize people to solve the problem collectively. Where village level participation was attempted they typically involved one or two key persons like village leaders. These projects failed due to their centralized structure, rigid technology and lack of attention to institutional arrangements.

Community Participation in Watershed Management

Participatory watershed development planning and management will be employed to improve the livelihoods of community/households/ in rural areas and optimize the use of existing natural resources (ANRSFRE, 2008). Environmental deterioration can best be reversed through involving local people directly with the state, transforming the common experience of conflict into co-operation (Jeffery and Vira, 2001, cited in: Dube and Swatuk, 2002)**.** Governments and NGOs have recognized that protection of watersheds cannot be achieved without the willing participation of local people (Pretty and Ward, 2001). Therefore for successful and sustainable watershed management, people's participation is essential. This is one of the lessons learned from the failures of centrally planned watershed development projects through which local people have been either forced to construct terracing, bunding, rehabilitating gullies and other technical measures that external experts believed would cure watershed degradation (Rhoades, 1998).

Farmer's participation is essential not only for implementation of soil and water conservation activities like terracing, bunding by food for work but also during planning of sustainable management of land and water resources. Farmers are closer to the real problems, and therefore they are aware of issues that experts may miss, and their objectives are more practical for economic development (Stocking, 1996). Furthermore, farmer's participation in conservation work is also considered important in improving the adoption of the recommended technology (Ashby et al., 1996).

In most of the centrally planned projects, like Ethiopia, soil and water conservation programs are promoted with standard technical solutions such as terracing, contour bunding etc. on the assumption that soil conservation measures are universally applicable and local farmers are unaware of soil erosion and ignorant of its causes and consequences (Pretty and Sahl, 1999, cited in: Johnson, 2001, MoARD, 2005). However, these measures, which were often forced on the people, may cause more erosion than their own indigenous practices, either because the new conservation works are not maintained or are technically less well adapted than existing practices (Kerr et al., 1996).

The large majority of watershed development projects are based on rigid and conventional approaches considering only physical planning without attention to socio-economic or ecological conditions, for instance in Ethiopia in the 1980s the large Borkena Dam in South Wollo was constructed without considering ecological conditions of the area resulted in filling with silt and coarse material (MoARD, 2005). Managing a watershed involves not only individual plots, but also common property resources like forests, springs, gullies, roads and footpaths, and vegetation along streams and rivers (Swaran, 2001**).** The needs and priorities for different users are different in each watershed. By seeking information from farmers about their constraints and priorities, their potential for new technologies, appropriate policies and technology can be designed for each watershed. Therefore participatory watershed management involves all actors to jointly discuss their interests, prioritize their needs, evaluate potential alternatives and implement, monitor and evaluate the project outcomes (Azene and Gathriu, 2006).

User participation is vital for the success of watershed development projects. A participatory approach implies a major role for the community and involves partnerships with other interested groups, from bottom to top, and with policy makers. But the key concern is to identify approaches that can attain an efficient, effective and accountable line between the community, the local bodies, the state and the central bodies (Carney and Farrington, 1998). According to Johnson (2001), participation implies that stakeholders work together to set criteria for sustainable management, identify priorities, constraints, evaluate possible solutions, recommend technologies and policies and monitor and evaluate impacts. The essence of participation is often unclear and clarification is required regarding who is participating, how and in what.

Despite Wood hills' expression (Johnson, 2001)**,** "making invisible visible", participatory watershed management is not a neutral concept, but it is a complex system, which involves political issues concerning who has decision-making power and who has access to resource.

Watershed Management Approach

Watershed management is an approach of area planning of natural resources to sub-serve the socio-economic needs of the human society or community concerned. Watershed management program would permit maximum possible stability through the process of production, consumption and regeneration. This approach has become the key for improvement of water resources and productivity of rain fed areas and ecological restoration. Among agronomists, watershed approach is seen as a means of scaling out technologies, primarily those for soil and water conservation or generally for environmental protection (Hinchcliffe *et al.,* 1995)**.**

The participatory integrated watershed management approach currently being adopted has shown encouraging results over the previously adopted commodity based or sectorial approaches. The strategies in integrated watershed management programs include land configuration systems, agronomic measures, alternate land use systems, run-off harvesting and recycling methods and measures for control of mass erosion problems. Watershed management is also the process of organizing the use of land, water, and other natural resources to provide necessary goods and services to people, and mitigates droughts (Sheng, 1996 and 1998; Khan, 2002). This approach recognizes the intrinsic inter-relationships among soil, water and land use, and the connections between upland and downstream watersheds. It incorporates soil and water conservation and land-use planning into a holistic and logical framework. This more encompassing approach is achieved by recognizing the positive and negative impacts on people that are caused by planned or unplanned interactions of water with other watershed resources.

It is also necessary to appreciate that the nature and severity of these interactions are influenced by how people use these resources and the quantities of resources that they use. The effects of these interactions follow watershed boundaries and, not political administrative boundaries.
Watershed management activities on the uplands of one political unit can significantly impact the people on a downstream political unit regardless of the respective land ownership, often resulting in unacceptable downstream or off-site effects. Participatory approaches and community watershed management plans have been widely used, with varying success, to reconcile the overlay of human activity on naturally defined watersheds. In the integrated watershed reviewed, participatory approaches were employed to establish micro-watershed management plans. The participatory processes succeeded where there were common purposes that could interest all or most of the population. A watershed management approach to land stewardship accommodates the interests of the widest possible number of people. The approach examines the benefits obtained from land stewardship by optimizing production and maintaining environmental integrity. It also facilitates to ignore effective conflict resolution from a sustainability perspective (Khan, 2002).

The move away from planned investments toward farming systems and participatory approaches was designed to seek synergies and to limit the need for tradeoffs. However, it posed two considerable challenges. First, it was not clear under what circumstances the new watershed management approach could achieve both conservation objectives and income increases. Second, it remained to be demonstrated whether investments made upstream under a demand driven watershed management program could have a positive effect on downstream conditions by improving hydrological services or reducing negative externalities.

Integration of Watershed Management Activities

"Integration" means different things to different people. Within African Highlands Initiative (AHI) alone, several forms of integration are required. First, integration means managing benefits to diverse watershed-level components, including tree, water, livestock, and crop and soil components. Integration also means integrating diverse solutions through a multi-disciplinary or multi-sectorial approach. This form of integration is required not only given the "systems" thinking in a biophysical sense, but to support technical solutions with social, policy and market interventions (Kindu and Zenebe, 1997).

Integrated watershed management (IWSM) is a process of formulating and carrying out a course of action to managing human activities in an area defined by watershed boundaries in order to protect and rehabilitate land and water, and associated aquatic and terrestrial resources, while recognizing the benefits of orderly growth and development. It is an integrated and holistic approach to the development of an area with the ultimate objective of improving the quality of the live of the people who dwell within it (FAO, 2000).

The lack of integration from the different disciplines, sectors and limited level of participation of the stakeholders are among the limiting factors contributed to low level of success. Farmers' involvement in problem identification, priority setting, planning and implementation of the programs has been minimal (Zenebe, 2005).

The Role of Public Institutions in Watershed Management

The integrated and participatory watershed management approach adopted in recent years has driven new institutional arrangements amongst public agencies and with local communities. Successful operations typically created a decentralized delivery structure that could effectively partner local communities.

In best-practice examples, the institutional framework is focused on the local level, with clear arrangements for integration within permanent agencies and for interagency collaboration.

MATERIALS AND METHODS

Description of the Study area

The physical background of this study area can be expressed by location of area topography and drainage, climate, soil and vegetation cover of an area.

Dawuro is one of the 13 zones in SNNPR. It is situated 7^o 14' North latitude and 37^o 5' East longitude. The Zone has 5 districts (w*oredas)*: Loma, Mareka, Essera, Gena Bosa and Tocha, its capital, is located about 438 kilometres south West of Addis Ababa. Essera district, which is purposefully selected for study, is rich in forest resource. It is relatively located East of Konta special district, South of Tocha district, West of Loma district, south west of Mareka district and north of Omo River. The capital town of Essera district is Bale which is 340 kms far from the regional city of Hawassa.

Essera districts lies in three agro- ecological regions: *Kola* region which is within 500-1500 meters above sea level (m.a.s.l) and receives 500-1,500milimeters (mm) of rainfall; *Woyina Dega* within 1501-2500 m.a.s.l and receives 1281501-2500 mm; and *Dega* at above 2500 m.a.s.l and receives more than 2500 mm (Zeleke and Autho, 2014).

Map of study district

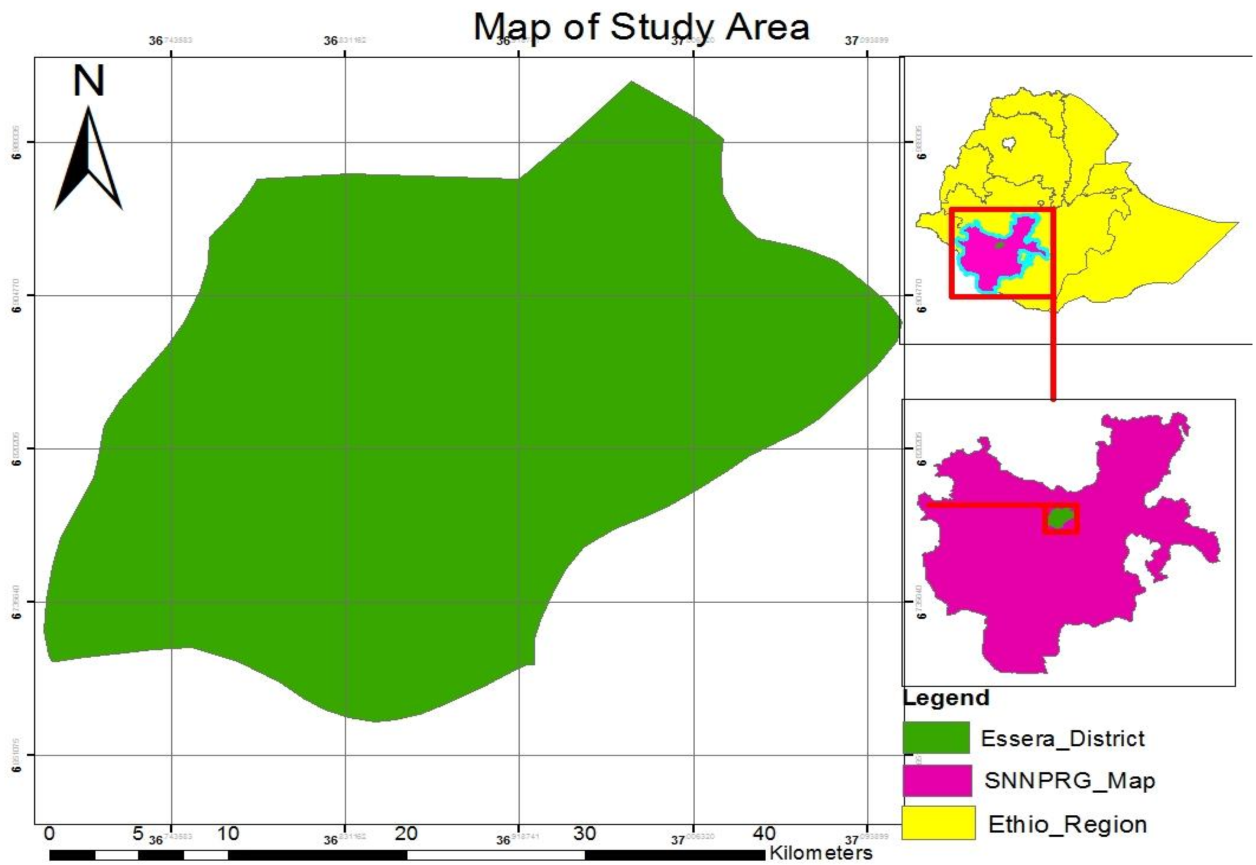

Table 1. Land use characteristics of Essera District.

Component	Area in hectare	Percent
Annual crop land	20354.43	18.5
Perennial crop land	8250.35	7.5
High forest land	22994.7	20.9
Woodland and bush land	5501.3	5
Plantation forest	10010.6	9.1
Pasture land	11001.4	10
Land for investment	22003.6	20
Others	9901.62	9
Total	110018	100

Source, Esserawereda Agriculture and Natural Resource Management Office (EWANRMO, 2017).

Sampling techniques

The sampling techniques used were a combination of purposive and random sampling techniques. The first step was purposive selection of sub-watersheds. The second stage was the simple random sampling of households from the list of villages. To facilitate this final stage, lists of names of households in each selected village was obtained from the kebele Chairpersons, the field extension officers and technical support organizations operating in the study areas.

Methods of data collection and tools

Questionnaire

Questionnaire was used as the major instrument to collect primary data. In this research, the investigator used open and closed ended types of questionnaire for the sample of respondents. The questionnaire consist different well-structured questions related to the problem. The questionnaire was pre-tested for five households before administration and some rearrangement, reframing and correcting in accordance with respondent perception was done. The questionnaire was administered to the randomly selected household heads or representatives by a team of field assistants who were trained for the purpose were in close supervision by the investigators.

Primary datawas collected through structured interviews. Structured questionnaires were used to collect primary data from households in the watersheds, development agents and key informants who know about the topic deeply. Additional information was obtained from focus group discussions and key informant interviews like with community leaders, watershed committee and farmer groups. Primary data sources were used in order to get first-hand information from respondent and it were help researcher in providing information for specific purpose of addressing the problem at hand so that questionnaires were prepared and distributed to sample respondents to gather necessary information for the study and interview was conducted with participants.

Data was gathered formally through semi-structured questionnaires that fitted out through face to face and direct interview of respondents. In addition, data was gathered informally through contacting participants of the study area, through group discussion.

The data collections were carried out both at household and plot level by interviewing and field observation, respectively. At household level, the necessary data related to background information, household characteristics (sex, age, educational status…etc.), watershed problems and root causes, watershed characteristics and its management, (conservation activities, cultivation system…etc.) were collected using structured questionnaire through interviewing the household heads.

Key Informant Interview

The investigators used semi-structured questions for interview, because of its flexibility and can be made clear any time. Seven Key Informant Interviews were selected. These include three Development Agents, three village leaders and twoWoreda Agricultural and Natural Resource Management Development who have good knowledge and experience on integrated water shade management activities.

Focused Group Discussion

Focused group discussions were held with elderly farmers, village leaders, and socially respected farmers who were known to have better knowledge on the present and past environmental, social and economic status of the study areas, to substantiate the information collected through individual farmer interview. Through group discussions information on the current status of soil, condition of indigenous knowledge of farmers for soil conservation and major socio-economic and policy based problems, and environmental constraints of soil conservation were collected. For this purpose the investigator conducted Focus Group Discussion with five participants selected, two from Development Agents and three elder farmers on the basis of purposive sampling method.

Field Observation

Direct personal observation conducted encompasses visiting of cultivated and uncultivated land, topography, vegetation cover, settlement pattern and the overall aspects of soil and water conservation practices of the study area. Thus the researcher's description based on his visit of the study area was included in the analysis**.**

Secondary Data

Secondary data was gathered through reviewing, examination of documents, reports and records of published documents from kebele agricultural office. It is the main source of information and these data are available and they are inexpensive and of course obtained quickly.

Methods of Data Analysis

The information obtained through key informant interview and group discussion were more described and presented qualitatively and used to substantiate and supplement findings from the quantitative analysis of structured questionnaires For the detailed personal interviews, a random sampling technique was used to select a total of 180 households (HHs) from among different kebeles HH farmers participating in the agricultural activities in the study area. The sampling was done using a list of all households in the villages which was obtained from the representative village administrations and local development agents. A structured questionnaire was used for the interviews, which were conducted both in the homestead and on the farm land. To develop the farmer's trust in the interviewer, each farmer was well informed about the purpose of the survey and why he/she was chosen for the interview. Data generated from the interview included types of SWC measures (traditional and improved) adopted by the farmer, their extent and their effectiveness.

RESULT AND DISCUSION

Descriptive Analysis

This chapter presents the survey data and interpretation of the analytical findings. Of the 180 sample respondents all reported that they have participated in the conservation of some soil and water conservation activities in watershed management practices. However, the degree of adoption differs widely between households.

As it was discussed with the farmers erosion is one of the problems to decrease our production so this is as problems to solve those problems discuss with our group members how to solve such a problem and also with development agents.

Demographic Characteristics

From the sample of 180 households (HH), the result indicates that 79% of the heads of household are male. These household heads include a wide range of people, village elders, decision makers (local administration), younger people, older people, poor farmers and rich farmers. Out of the total sample households in the study area, 21% of the household heads are women, who are single, widowed or divorced. No female household heads had almost adopted SWC practices. During discussions with women headed households the main reasons why women headed households are not involved in the participation of SWC practices are that female heads have limited access to the information and that other socio-economic issues related to traditional social barriers limit women's resources.

Education Status of Household

Table 2. Educational status of household heads.

Educational status	Frequency	Percent
Illiterate	50	28.0%
Write and read	30	17.0%
Primary school	90	50.0%
Secondary school	10	7.0%
Total	180	100.0%

Sources: Field survey (2017)

Age Status of Households

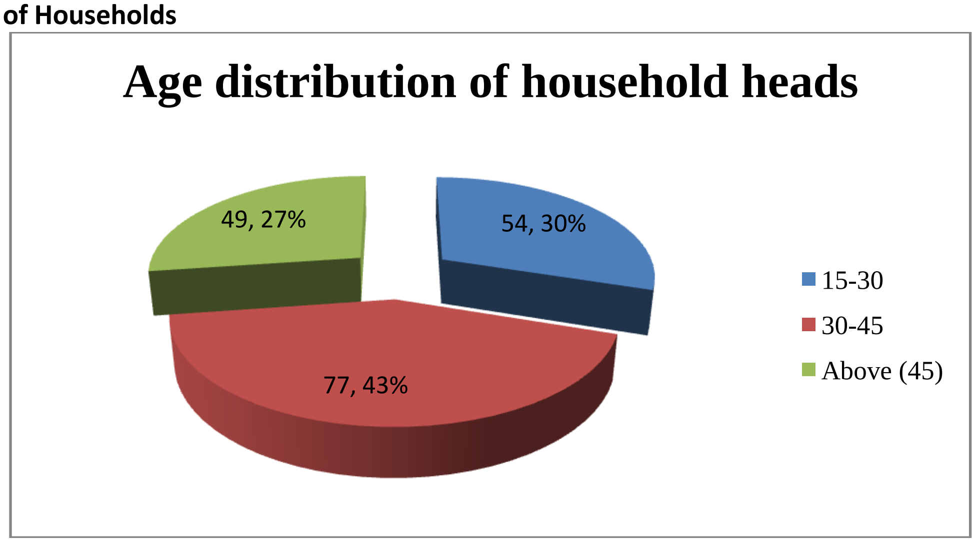

Figure 2. Age distribution of household heads.

Sources: Field survey (2016)

From the survey results, better-educated households have more realistic perceptions about soil erosion problems and more knowledge related to SWC and hence can more easily be involved in conservation activities.

From discussion with key informants, with respect to educational status of households in relation to their location within the watershed, downstream farmers are better educated than upstream farmers of the in different watershed of study district because the downstream area is vulnerable to erosion and flooding and consequently local government play great role in this area by creating awareness and providing different supports to the community.

Table 3. The perceived major causes of soil erosion and their ranks.

	Ranks and percentage of responses (n=30)							
Causes of soil degradation	1s	2nd	3rd	4th	5th	6th	7th	8th
Deforestation	1	5	7	11	4	2	0	0
Over grazing	0	2	8	11	6	2	1	0
Over cultivation	0	4	4	9	3	5	5	0
Poor agricultural Practices	5	0	4	14	3	3	0	1
Cultivation of steep slopes	8	7	2	0	9	1	3	0
Excess rain fall	21	3	2	3	1	0	0	0
Poor gov't policies	0	0	0	0	0	0	1	0
Others	0	0	0	0	0	0	0	6

Table 4. Farmers' perceptions of soil erosion hazards.

Perception on erosion	Proportion of total Respondents (%)
Whether soil erosion was perceived as a problem in own farm	
– Yes	100%
- No	-
Severity of the problem, if yes to the above question	
– Severe	2%
- Medium	31%
- low	67%
Observed change in soil erosion severity over the past 5 years	
- Has become more severe	-
- Has become less severe	100%
- No change	-
Extent of impact of soil erosion on farm production	
– Severe	18%
- Moderate	61%
- Has no effect	21%
Believing that soil erosion can be controlled	
- Yes	53%
- No	47%

Perception and Attitude of Farmers

Perception of soil erosion as a hazard to agricultural production and sustainable agriculture is the most important determinant of participatory integrated watershed management practices. When interview with, those farmers who perceive soil erosion as a problem on their lands and have negative impacts on productivity and when farmers do not understand soil erosion as a problem, they do not expect benefits from controlling erosion and as a result their productivity decrease they decide against adopting any conservation technologies.

Thirty six percent of the sample farmers believed that overgrazing was the most important cause of soil erosion followed by 24% of the farmers who considered that deforestation caused the most erosion. Interestingly, only 12% found that cultivation of steeply sloping land was the most important cause.

Table above presents farmers' awareness and perception of the erosion problem in the different watersheds. All of the surveyed farmers (100%) acknowledged that soil erosion was a problem in their farm. Almost two thirds of the farmers observed that erosion had increased over the past 5 years. The opinion of the farmers on the impact of soil erosion on farm production was almost evenly divided between severe and moderate Comparing the number of respondents who rated the impact of soil erosion on farm production as 'smaller' to the number of respondents who rated the intensity of erosion as 'severe', it can be stated that the link between soil erosion and decline in land productivity may possibly be ambiguous to the farmers as above. Additional evidence to this assumption is the explanation given by the farmers during informal discussions about decline in fertility levels of their lands. They generally agreed that there had been a decreasing trend in fertility levels of their plots of land, but that was attributed to immature of the land due to overuse, and erosion was rarely mentioned. In general terms, it can be concluded that the farmers were well aware of the problem of soil erosion.

Table 5. Distribution of sample household heads by land holding.

Farm size (ha)	Number of farmers	%
Up to 1	49	27
1 to 2	36	20
2 to 3	77	43
3 to 4	18	10
>4	-	-

Sourses: Field survey (2017)

Table 6. Distribution of farm plots by slope category, level of fertility, soil color and degree of erosion.

	Description	Number of plots	
		Frequency	%
Slope category	Flat (< 6%)	11	26.2
	Gentle (6 - 15%)	29	69
	Steep/mountainous (>15%)	2	8
Fertility	Low	13	31
	Medium	19	45.24
	High	10	24
Soil color	Red	35	83
	Black	3	7.14
	Brown	0	0
Degree of erosion	Low	31	74
	Medium	9	21.4
	High	2	4.7

From the sampled households70% of respondent farmers believed that erosion can be controlled. Hence, their lack of interest to adopt the introduced SWC measures cannot be explained by a lack of awareness about the problem and the potential for solving it.

The most of the farmers had indicated soil erosion as an important agricultural problem, yet the majority again was willingly participating in the construction of different bunds. In the study area the majority of farmers were well aware of the problem of soil erosion.

Farmland Characteristics

Land Size and Distribution

Land in the study area is scarce mainly due to population pressure. The farm size varies between 0.25 and 3.75 ha (Table 5). The majority of farmers' land size was from 1 to 2 ha (Table7). Average land holding for the sample households is 1.8 ha in upstream area and 1.9 ha in the downstream area. Because of the small farm size, fallow lands are not common and there is also a shortage of grazing land. Limiting fallow land loses an opportunity to increase soil fertility and reduce soil loss from erosion.

Slope, Fertility, Soil Color and Degree of Erosion

Interviewers together with respondents classified each farm plot into flat (<6%), gentle slope (6-15%) and steep/mountainous (>15%), which require different types of soil conservation measures to reduce soil erosion. The physical characteristics of farm plots are indicated in Table 8. Of the total plots, only 12.8% are flat. This implies that according to soil and water conservation experts about 87% of the farm plots require conservation of one kind or another, in addition to volunteer flat land conservation practices. Respondents have also classified their own plot fertility into three categories: low, medium and high. A total of 42 farm plots divide into 17%, 68% and 15 % low, medium and high fertility respectively (Table 6). The farmers identified general soil colors: 87 % black, and 12 % sandy. Farmers usually consider black color soils as fertile in the study area. This may affect farmers' decisions on conservation because they want to take better care of fields that give better yield.

Types of major crops

The major, stable cultivated crops are maize (44% of the plots) followed by sorghum and teff (22% and 20% of the plots respectively) (Table 6)

Table 7. Major types of crops in the study area.

Major types of crops	Number of plots in hacters	
	Frequency	Percent %
Maize	23	54.7
sorghum	7	16.7
Teff	5	11.9
Others	7	16.7

Sources: Field survey (2017)

Soil and water conservation practices in the area

Various major soil and water conservation practices (traditional and improved) have been identified by the local development agent in the study area within the previous two years. Farmers in the area were exclusively practicing traditional methods. Thus, the use of "improved" soil and water conservation measures is a recent development.

Traditional and newly introduced SWC practices

Until recently, soil and water conservation practices without technical knowledge have been ignored or underestimated by development agents; however, surveying both traditional and improved soil and water conservation practices provides an understanding of farmers' way of thinking about the interventions (Hudson, 1992).

To prevent land degradation, especially soil erosion, in the study watersheds, farmers use a number of improved soil and water conservation technologies. These technologies include application of manure, traditional and newly introduced cut-off drains, plantation of both traditional and newly introduced trees, stone bunds, leaving crop residues in the field and fallowing on the farm.

Cut-off drains

The survey results show that almost two thirds of the 42 sampled cultivated land(ha) had few traditional practices and more improved cut-off drains (or both) (Table 7). The farmers construct these drains to prevent loss of seeds, fertilizers, manure and soil due to water flowing onto the plot from uphill. The excess water is disposed away from the field**.** However, according to farmer opinions, most of the drain structures enhance soil erosion through time. As we seen with key informants cutoff drain practiced or implement on their erosion affected lands because implementing the fertility of their land increased time to time.

Leaving crop residues

Another traditional practice common in the area is leaving crop residues on the field after harvest. There are two types of agricultural crop residues: process residues4 and field residues5. Area farmers are generally not attempting to use crop residues to improve the fertility of soil. The survey results showed that most of the users are implementing this measure in order to protect the soil from erosion. During the transect walks with the farmers, there were only small amounts of crop residues visible in farm plots. Key informants indicated that the farmers had serious fuel wood and animal feed shortages and therefore gradually used the crop residue for off-plot purposes

Most of the farm households in the area, especially women members, collect crop residues from the field for animal feed and fuel wood. Similarly, research conducted by Tilahun (1996) found that farmers in kebele removed all crop residues from their fields and used them in their livestock pen or home garden. Some of the residues from cereals (wheat, barley and teff) and legumes (haricot beans and pea beans) are stored in the home compound and sold as fodder or used to feed livestock during the dry season.

Contour farming

Contour farming is a practice of cultivating the land along contours of equal elevation in order to reduce the runoff on lands with a slope over 6%. It is used alone or in combination with other conservation practices such as cut-off drains and plantation of different trees. (As indicated in Table 7, these two other practices are each used on two thirds of the surveyed plots.) Of the sampled plots, 45% had contour farming (Table 7) and although the farmer was aware of the soil and water conservation function of contour farming. In addition to this, it was implemented during land preparation before planting season because their ploughs the land for preparing an appropriate seedbed for production.

Fallowing

Fallowing is one of the best methods to reduce soil fertility loss (Hudson, 1992). In the study area, fallowing is restricted to highly degraded lands which cannot be restored within a short period of time. In most cases only stones are found on these lands. Only 8% of the surveyed plots were fallowed (Table 7). During discussions with the farmers it was learned that through time, the traditional fallowing periods are practiced less and less as a result of the increasing population pressure and decreasing agricultural productivity.

Application of manure

Application of manure was used on more plots than any other conservation practice, 67% of the total farmers applied manure near the homestead, rather than to land at a distance. Based on focus group discussions with key informants, farmers have increased the amount of manure applied because of the high price of inorganic fertilizers (such as DAP and UREA) which the farmers cannot afford.

Plantations

Trees and other non-crop plants are planted on 66% of the surveyed plots sometimes together with other conservation practices. During the transect walks, trees and other plants such as sisal were observed to be planted along the contour in order to reduce runoff and conserve the soil and water around the root of the plants. In general these plants are drought tolerant, not edible and therefore not destroyed by animals in the area. Another advantage is that farmers use these to mark the border between adjacent fields

Soil bund practices

About 61% of the surveyed plots included soil and stone bunds. In the common land especially around the mountainous area, farmers were constructing bunds because of the cash hey would earn from a safety net program. During focus group discussions with key informants, it was learned that farmers are well aware of erosion problem in the area. Moreover, they agree that bund terraces are effective in protecting the soil. The newly introduced SWC measures, stone and soil bunds, were widely acknowledged as being effective measures in arresting soil erosion and as having the potential to improve land productivity. Nevertheless, due to the top-down approach (haven't participation of Development Agents with local farmers), adoption of these new soil and water conservation practices by the farmers appears less likely (Mitikuay H, Karl H., Brigitta S., 2006).

During discussions with key informants in each of the study areas, the farmers mentioned that ineffective designs by the development agents are responsible for causing gullies. Farmers use mostly soil/stone bunds that are impermeable intended to maintain all rainfall but when overtopped at one location will cause gullies unless they have specially designed spillways and protected soils below. These structures are better suited for semi-arid and arid parts of the country than in the high rainfall areas. This is in line with a study conducted by Belay (1992) in southern Ethiopia which concluded that farmers are willing to conserve their soil and water but demand more appropriate technologies, and that poorly designed practices can be the major cause of erosion in areas treated with SWC.

Key informants indicated that the farmers were not aware of this SWC practice. Other farmers using this type of structure explained that the advantage of fanyaju terraces is that it changes gradually into a bench terrace, does not need too much maintenance, and decreases the speed of runoff more than a soil bund. This is consistent with findings of earlier studies in southern Ethiopia. Tegene (1992) reported that the farmers considered the introduced soil and fanyajuu bunds as inappropriate technologies because they occupy cultivable area, and they harbor rats and other rodents.

Perceived Benefits from Conservation

Farmers were asked to rate the conservation measures on the basis of soil deposited. More than half of the respondents considered the increase in soil deposition to be major benefit, while 22% indicated that conservation structures improve soil fertility. Clearly one expects the increase in soil deposit and added fertility to ultimately contribute to enhance yield. But yield enhancement as a result of conservation was seen as a major benefit by only 12% of the respondents. Farmers were also asked to compare the introduced conservation measures with the traditional ones.

85% of the respondents indicated that introduced conservation practices perform better in retaining soil from being eroded than the traditional ones. Whereas only 12% of the respondents considered that local practices are better we indicated farmers rationally judge an innovation based on their perception with regard to its attributes.

Situation of Soil and Water Conservation Practices of the Study Area

The investigator observed the prevalent soil and water conservation measures in the study area. There are different conservation structures constructed on the individual farmers land holding and outside the farm lands. Commonly observed conservation structures are traditional methods. Modern conservation structures are mainly constructed on the fragile lands outside of cultivated and grazing lands. According to the reports of farmers the construction of modern soil conservation measure locally known as *'daga'* (modern soil conservation structure) took place by the government through campaign.

Furthermore, according to the report of woreda's Agriculture and Natural Resource Management Development, the farmers are resistant of adopting SWC structures since they assumed that the structure consume their lands. Mainly the farmers of steep slope area are highly resisting the experts' design of 'daga' constructions. Because as the steepness of the slope increase the gap between the structures are expected to close to one another which result the occupying of their land by the structures.

Assessment of Indicators and Severity of Soil Erosion on the Farm Land

Even if all farmers perceive problem of soil erosion on their land, their attitude towards its severity shows great variation on the surveyed watershed. This may be due to the variation of factors and their intensity affecting soil erosion. As indicated on the details regarding Farmers' Household profiles, land holdings and occupations, the socio- economic condition of the farmers in all surveyed area is more or less similar but there are certain physical feature variations. Therefore, the investigator decided to analyses the perception of the farmers on the severity of soil erosion on their farm land according to their respective kebele. According to them, gradient influences the decision of farmers that the farmers at the steep slope always practice conservation due to the severity of soil erosion

Factors affecting integrated participatory watershed management practices

Personal factors in relation to watershed management practice

The personal factors that are considered in relation to adoption behavior of SWC included age, education and family size. The influence of farmers' ageon the adoption performance of soil and water conservation is positive and it is statistically significant with cut-off drain types of SWC. A unit increase in age of HH head increases the adoption behavior of improved cut-off drains by 0.35% the positive sign indicates that, as a farmer's age increases, the adoption behavior of improved cut-off drains increases. The hypothesis that younger farmers do not expend more effort on improved soil and water conservation measures, especially improved cut-off drains compared to older ones, was motivated by the view that older farmers have experience .Therefore, they were more aware of the problems of erosion and the importance of soil and water conservation practices. Another reason for the expected positive relationship between age of HH head and conservation effort is that older farmers have sufficient land for adopting improved SWC structures while younger farmers do not.

Socio-economic factors in relation to participatory watershed management practice

The main and significant economic factors considered in this study are the area of farmland, land to labor ratio and livestock holding of the household. Economic factors can play important role in determining the adoption of SWC practices. Among the economic factors, farm size10 is an important variable in relation to the adoption of soil and water conservation. Areas of farmland had positive and significant influence on the adoption of improved soil/stone bund terraces and cutoff drains, but not on tree plantation.

From the survey result, for a 1 hectare increase in farmland, the probability of adoption of bunds increases by 20%. Large farms have land available for soil/stone bund while on small farmers all land is needed for crop production. Amsalu and Graaff (2007) similarly found that farmers who have a larger farm are more likely to invest in soil conservation measures because they have the funds to do so. Land to labor ratio11 negatively affected the adoption of cut-off drain SWC. A unit increase in land to labor ratio decreased the adoption of cut-off drains by 51% Implementation of SWC structure is labor intensive and therefore implementation is watershed management practice real put in to practice in the study area.

Institutional factors in relation to PIWM practices

For the purpose of this thesis the institutional factors consist of: visits by development agent (DA), technical support, training, land tenure and distance to market. Institutional factors did not affect significantly the rate of adoption of soil and water conservation practices with the exception of the distance between the market and household home. Interestingly the larger the distance to the watershed the decrease the participation of integrated watershed management practices (Table 16). For each minute increase in walking to the market the soil/stone bund terraces increased by 0.11% and the number of cut-off drains increased by 0.03%. Farmers cannot adopt technologies if they do not have access to all the relevant information, but the information they are given is often incomplete, focusing only on the technical aspects and overlooking some key criteria from a farmer's point of view. From the result, access to training had a significant negative effect on use of cut-off drains because the information they were get about cut-off training is often incomplete relative to other practices. So, most trained farmers adopt other practices rather than cut-off drain. Therefore, nor can they adopt technologies if they do not clearly perceive information that scope of returns could be expected after adoption.

Biophysical factors in relation to participatory integrated watershed management practices

Another group of characteristics that determines the management practices of SWC structures are the biophysical factors. They include the distance between the plot and the household and the slope of the plot (flat, steeper and very steeper). Longer walking distance14 between plot and the household was significantly related to a reduced adoption of soil/stone bund terraces and cut-off drains. A one minute increase in walking time decreased length of soil/stone bund terrace by 0.31% and length of cut-off drain by 0.25%.Berhanu and Swinton (2003) in their study of investment in soil conservation in Northern Ethiopia likewise found that plots distant from homesteads discouraged investment in soil conservation. Sloping land had significantly more soil bund terraces than flat fields a unit increase in the ordinal slope (from flat to very steep slope), increases the probability of adopting bund terraces by 16.1%. This is similar to the findings of Amsalu (2006).

Watershed management programs generally adopt the micro-watershed level as the basic management unit, since this allows the integration of land, water, and infrastructure development and the inclusion of all stakeholders in a participatory process. The micro-watershed approach also raises some difficulties when it comes to scaling up. Working at the micro-watershed scale does not necessarily aggregate or capture upstream-downstream interactions. In best-practice approaches, planning includes an institutional mechanism where stakeholders have a voice and are able to agree on measures from the micro-watershed scale upwards that can achieve both local and larger-scale objectives. The approach also needs to deal with institutional challenges of interagency collaboration and local-regional–level coordination.

Based on a diversified criteria and knowledge, farmers evaluated the fertility of soil in their own land in the catchments. Conventionally, farmers in the study area categorize their land in to three fertility status namely: good, medium and poor. The survey result depicted that majority of the respondents in both sites categorized their land in to moderate and good fertility classes, and relatively high percentage of respondents in the intervention area responded that their soil fertility as good.

Participation Mechanisms

Communities may become frustrated and discouraged from participating due to the establishment of inflexible institutional arrangements and work procedures designed for efficiency rather than responsiveness to community preferences (Howe, 1979). Because not all parties involved in integrated watershed management initiatives are equal in their competency in terms of the way they express and organize themselves, as well as their access to information and finances, small groups of elites are often at the forefront of community integrated watershed management initiatives while the majority of the community are unwilling to participate due to a lack of incentives. As a result the interests of the majority are not represented. Sometimes community participate watershed management practices without by their initiation, without giving deep awareness the community leaders/chairperson simply told to them to do the watershed management practices without knowing the advantages, with the help of different social organization in the community.

CONCLUSIONS AND RECOMMENDATION

CONCLUSION

The problem of watershed degradation could not be solved without addressing the socio-economic problems of the area. Demand based technologies; people's participation, effective conservation, education and sense of ownership are the key elements essential for the sustainable management of natural resources. Simple and low cost technologies are more acceptable for farmers rather than expensive and labor intensive conservation techniques. Farmers need technologies which they can easily understand and implement on their farms with minimum cost.

Participatory water resources management processes in the Save Catchment must be based on shared knowledge. Stakeholders should work towards building grassroots organizational and financial capacity.

Participatory, integrated watershed management presents many challenges to research and development actors. To move forward here, it is important to take a systematic look at the tasks and skill base required to operationalize PIWM, and the degree to which existing institutions can be mobilized to fill the gap. Funding for action research and social learning approachestotestnew types of institutional arrangements and linkages (partnerships) can be starting point from which broader experiences are drawn and strategies formulated. Another key challenge lies in forging stronger linkages between research and development, so that development (community or organizational facilitation) is linked to and given at least equal status as research, and action research given equal weighting as more conventional empirical research. For this, university training, institutional mandates and incentive systems, and opportunities for social learning at local and institutional levels must be given close consideration if the integrated mandate embodied in PIWM (Participatory Integrated Watershed Management) is to be enabled.

RECOMMEMDATION

❖ The approaches to expansion of SWC structures should not be top-down and coercively. It should be participatory and depend on the indigenous knowledge of the farmers.

❖ Sustainable and participatory soil and water conservation structures must be developed to reduce degradation and achieve the productivity of the eroded land

❖ It is important to enhance farmers' awareness on the indicators of soil erosion in addition to physical conditions of their land. Even if farmers have good perception of prevalence of soil erosion in their farm land, they attached its existence mainly with what they can observe physically such as rills and gully formations.

❖ Farmers have good awareness on trends of soil erosion over time which they underline the causes with shortage of land due to rapidly growing population size. However, they have no intention for livelihood diversification and other methods of coup upping with the problems of land fragmentations. Therefore, it is advisable if the concerned body intervene to encourage farmers' awareness of reversing the problems and adopt any other ways of livelihood.

❖ Any policy and program aimed at land resource management in general and soil and water conservation in particular has to give due attention and priority in training and mobilizing farmers that help in raising their perception and awareness level so as to manage and use the land resource in sustainable way.

❖ Government or NGO's should provide alternative source of fuel (Electricity, Natural gas etc.), so that natural vegetation and crop residue would be saved and used for soil and water conservation.

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