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þÿ H O U S E H O L D S   P A R T I C I P A T I O WATERSHED MANAGEMENT: THE CASE OF ZEMA WATERSHED IN GONJI KOLELA DISTRICT, AMHARA NATIONAL REGIONAL STATE, ETHIOPIA

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Declaration

First, I declare that this thesis is my real work and that all sources of materials used for the thesis have been properly acknowledged. I seriously declare that this thesis has never been presented to any other institution anywhere for the award of any academic degree, diploma, or certificate.

Name: - Abebe Worku Sheferaw

Signature ____________Date____________

Thesis entitled Households' participation in watershed management: The case of Zema watershed in Gonji Kolela District, Amhara National Regional State, Ethiopia by Abebe Worku Sheferaw is approved for the Degree of Master of Art in Geography and Environmental Studies.

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Acronyms/Abbreviations

ANOVA	Analysis of Variance
ANRS	Amhara National Regional State
ANRSADB	Amhara National Regional State Agricultural Development Bureau
CARE	Cooperative for Assistance and Relief Everywhere.
CGIAR	Consultative Group on International Agricultural Research
ENTRO	Eastern Nile Technical Regional Office
FAO	Food Agricultural Organization
FGD	Focus Group Discussion
GKDADO	Gonji Kolela District Agricultural Development Office
Gtz	German Technical Cooperation
IRWM	Integrated Water Resources Management
IWM	Integrated Watershed Management
IWMI	International Water Management Institute
KIs	Key Informants
m asl	Meter above sea level
MOA	Ministry Of Agriculture
MoARD	Ministry of Agricultural and Rural Development
MoFED	Ministry of Finance and Economic Development
NBI	Nile Basin Initiative
NGO	None Governmental Organization
RKA	Rural Kebele Administration
SPSS	Stastical Pakage for Social Science
SWC	Soil and Water Conservation
UNESCO	United Nations Educational, Scientific and Cultural Organization
VIF	Variable Inflation Factor
WLE	Water, Land and Ecosystem
WMP	Watershed Management Programme

Abstract

Watershed management is the integrated use of land, vegetation and water in a geographically discrete drainage area for the benefit of its residents. For sustainable use, households' participation in each watershed management activities is imperative. Hence, this study was designed to understand households' participation in watershed management practices in Zema watershed, Gonji kolela district of the Amhara National Regional Sate, Ethiopia. The study employed both quantitative and qualitative approaches. Simple random sampling method was used to select two rural kebele administrations for the study. A total 181 households were sampled using proportional stratified systematic sampling techniques. Primary and secondary data sources were employed to collect the necessary data. Key informant interview, survey questionnaire and non-participant observation were the primary data collection for the study. Descriptive and inferential statistics were employed to analyze the collected data. Binary logistic regression model employed to identify variables affecting households' participation in watershed management. The study revealed that more than 50% of the respondents participated in integrated watershed management practices, of which 96.7% were headed by men. The dominant watershed management practices in the watershed were terracing, area enclosure, soil and stone bunds respectively. Majority of households perceived that watershed management activities are important for income generation, enable better utilization of natural resources, employment opportunity and increase productivity. The binary logistic regression result indicated that agro climatic zone, farm land size, sex of household heads, training, distance of farmland from the homestead and availability of credit were determinant factors for households' participation in watershed management. To achieve the objectives of sustainable watershed management, households' participation with different watershed management practices should be implemented at local levels.

Key Words: Households, Gonji Kolela district, participation, watershed management.

Chapter One

Introduction

1.1. Background of the Study

At present, billions of poor and marginal farmers in the world rely on degraded land and water resources. To rehabilitate and sustainable use of these degraded resources, watershed management is the inevitable component. It is the integrated use of land, vegetation and water in a geographically discrete drainage area (Darghouth *et al*., 2008). In addition to this, watershed management deals with several kinds of resources including soil, water, forest, human resource and integrated knowledge in management (Seesomonn, 2010). For this reason, the key to the success of any watershed project and its sustainability depends on household's participation. Yalew (2010) revealed that participatory watershed management considered a management strategy aiming at reduce poverty, conserve natural resources and promote good institutions, social linkage and economic returns. For instance, it has emerged as "a new paradigm for sustainable rural livelihoods and it occupied the central-stage of rural development in the fragile and semiarid environments of the developing nations" (Yoganand and Tesfa, 2006). Therefore, the concept of integrated and participatory watershed management has emerged as the cornerstone of rural development in the dry, semi-arid and other rain fed regions of the world (Kumar and Palanisami, 2009).

In the world, it is the pipeline for prosperity of the people for bridging the gap between poverty line and per capita income (Swami *et al.*, 2012). As Tesfaye (2011) indicated that 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. According to the same author, various large and small watershed projects in the world were increased in the past years followed by spontaneous different views among the villagers, managers and experts. However, the development trends of hard work (mechanical and biological treatment), regardless of the appropriate conditions of management, prevents the formation of collaborative management in watersheds (Safa, 2016). As it was described by the same author, sustainability and the environment without the participation of the people and help them in protecting the environment is not possible. The degree of popular participation in watershed development programs is a major determinant of success or failure, but the factors which make participation efforts successful still remained a mystery (Bagherian *et al*., 2009).

Most watershed projects in developing nations are implemented with the twin objectives of soil and water conservation and enhancing the livelihoods of the rural poor (Sharma and Scott, 2005 cited in Swami *et al.,* 2012). As a result, attention to participatory watershed management is increasing across the developing world as soil erosion continues to degrade agricultural land; reservoirs and irrigation infrastructure are clogged with sediment (Kenge, 2009). Peoples' participation has been at the centre-stage of the resource conservation and rural development efforts in the developing countries (Badal *et al.,* 2006). Even though participatory watershed approach has now become necessary in any developmental activity especially with regards to natural resource management, there are still major challenges that militate against its successful implementation in most developing nations (Mireku *et al.,* 2015).

In Africa, as Gtz and ANRSADB (2005) indicated that participatory watershed management presents many challenges to research and development actors. Firstly, the need to manage a complex, ambitious agenda in which diverse types of trade-offs and synergies must be identified and managed. Secondly, the gap between current institutional arrangements, which foster disciplinary planning and action and isolate research from development and those required to operationalize integrated planning and action, research and development. Finally, the bias of research toward more formalized, empirical methods over action research approaches and staying integrated when moving from systems thinking to systems action.

Tesfa and Tripathi (2015) indicated that in Ethiopia, watershed management has focused only on soil and water conservation measures. In addition to this, Woldeamlak (2003) revealed that majority of watershed management practices in Ethiopia relied on construction of physical structures, mainly *fanya juu* bunds.

1.2. Statement of the Problem

Watershed development planning in Ethiopia started in the 1980's (MoARD, 2005). Since then the government, nongovernmental organizations and local community efforts on rural development are based on watershed development program (Meaza, 2015). However, “watershed development and management program could not yield satisfactory results in achieving the intended goal due to the lack of indigenous knowledge, top down approach and lack of institutional collaboration” (Tesfa and Tripathi, 2015). Gadisa (2016) revealed that the top-down and rigid planning approach ignored local communities participation in which it mainly focuses on technical and physical works alone without giving attention to the economic viability and social acceptability. The same author indicated that during the political changes a large scale of forest areas, soil and water conservation structures were highly removed and destroyed by local communities in the country. This failure questioned on the continuation of watershed management program in the country.

Watershed management has been faced with many challenges while applied without community participation and using only hydrological planning units, where a range of interventions remained limited and post- rehabilitation management aspects were neglected (MOARD, 2005). Meaza (2015) noted that the major challenges in the watershed management were shortage of land, lack of awareness in resource management, disagreement between the households and local leaders, unwillingness of youngsters to participate in conservation practices due to landlessness and lack of integration between sectors.

Different scientific works have been conducted in relation to community based watershed management in Ethiopia including in the Amhara region. For instance, Yalew (2010) noted that watershed management is the integrated management of institutional, social, economic, technical, technological, environmental and physical aspects. However, his study fails to address households’ participation on watershed management activities within agro ecological dimension rather it focuses on the challenges and opportunities of integrated watershed management. Gadisa (2016) indicated that participatory community-based watershed management has been shown positive achievements in rehabilitation of severely degraded land. However, this study was not able to investigate households’ participation in site specific or appropriate integrated watershed management. Tesfaye (2011) explores the prospects, approaches and barriers of integrated and sustainable watershed management. However, these prospects, approaches and barriers of integrated and sustainable watershed management were not evaluated in depth from site specific perspective rather large areas of biophysical and socio-economic conditions. Biele (2014) revealed that in Amhara region effective soil and water conservation structures are important for sustainable utilization of natural resources. Even though, this study fails to address socio economic aspects of watershed management activities. Tilahun (2015) discovers the farmers' perception on the use of structural soil conservation measures in Gonji Kolela District. However, this study lacks integrity and focuses only the perception of farmers on physical watershed management activities. Hence, this study is indented to fill these gaps and knowledge to the existing literatures by focusing on site specific and appropriate watershed management practices.

1.3. Objectives of the Study

- The general objective of the study was to understand households' participation in watershed management of Zema watersheds, Gonji kolela district of the Amhara National Regional Sate.

The Specific Objectives of the Study

The specific objectives include to:

- investigate the practices of watershed management at household level in the study area.
- assess households' perception towards watershed management in the study area.
- identify major factors that determine households' participation in watershed management.

1.4. Research Questions

The following questions are formulated based on the above objectives.

- What are the watershed management practices at household level in the study area?
- What is the households' perception towards watershed management in the study area?
- What are the major factors determining households' participation in watershed management?

1.5. Significance of the Study

The result of the study could generate information for different stakeholders, researchers, policy makers, governmental and non-governmental organization, and farmer's local level organizations to design and develop sustainable integrated watershed management practices and strategies. Particularly identifying the dominant watershed management activities may help for the district agricultural development office to design effective ways of community participation in other watershed management activities. Moreover, the methodology that would be developed in this study and the outcome would be found can serve as background information to undertake similar or other themes of the study.

1.6. Scope and Limitation of the Study

This study is conducted in Zema watershed of west Gojjam zone. The study mainly focused on households' participation in watershed management. The scope of this study is limited to Zema watershed of Gonji kolela district which focuses on some selected *kebeles*. In the district there are 24 *kebeles,* but the study stressed on two *kebeles* and 181 samples systematically.

The study faced some limitations which include unavailability of sufficient literature on households' participation in watershed management. To overcome this problem the researcher used online internet data. The other limitation of the study was unwillingness of the respondents to provide all necessary and important information. To overcome this constraint, the researcher and enumerators created awareness for the respondents that their responses are used only for the research purposes.

1.7. Organization of the Study

This paper has structured into five chapters. The first chapter provided the back ground of the study, statement of the problem, objective of the study, research questions of the study, significance of the study, scope and limitation of the study. While the second chapter discussed theoretical and conceptual issues related to the study and reviewed empirical studies about the thematic areas. The third Chapter provided and described the methodology and description of the study area. The fourth chapter presented the key findings and discussed the results of the study. The final chapter provided conclusions and recommendations of the study

Chapter Two

Review of Related Literature

This part of the study consisted related literature on the concept, components and approach of watershed management; watershed management practices in Ethiopia; integrated watershed Management; challenges of watershed management in Ethiopia; participatory watershed management; factors affecting households' participation in watershed management and conceptual frame work of the study.

2.1. Concept of Watershed Management

Watershed is not simply the hydrological unit but also socio-political-ecological entity which plays crucial role in determining food, social, and economical security and provides life support services to rural people (Wani *et al*. 2008). A watershed is defined as any surface area from which runoff resulting from rainfall is collected and drained through a common confluence point (Temesgen, 2015). Similarly, watershed is the area that drains to a common outlet (Draghouth *et al.*, 2008). Watershed management refers to the management of the geographical area that collects all the water that falls on it into a single stream or river (Sebhatu, 2010). It is a hydrologic unit that has been described and used both as a bio-physical unit and as a socio-economic unit for planning and implementing resource management activities (Solomon *et al*., 2013 cited in Temesgen, 2015). The bio-physical unit in a watershed includes its water, soil, and vegetation. While, the socioeconomic unit includes people, their farming system (including livestock) and interactions with land resources, coping strategies, social and economic activities and cultural aspects (Lakew *et al*., 2005). Watershed management is the judicious use of natural resources such as land, water, biodiversity and biomass in a watershed to obtain optimum production with minimum disturbance to the environment (Alemu and Kidane, 2014). It is a holistic approach to managing watershed resources that integrates hydrology, ecology, soils, physical climatology and other sciences. Watershed management has emerged as "a new paradigm for planning, development and management of land, water and biomass resources with a focus on social and environmental aspects following a participatory approach" (Birhanu, 2011). Watershed management is more a philosophy of comprehensive integrated approach to natural resources management. It aims at integration of social resources management with natural resource management. The same author revealed that watershed management involves the judicious use of natural resource with active participation of institutions, organizations, in harmony with the ecosystem.

The watershed management practices played a crucial role in arresting runoff and help to reduce erosion hazard (Tesfa and Tripathi, 2015). Watershed management productively used to bring back and preserve the agro-ecological feasibility and production potential of various watersheds throughout the world, using land-use management techniques that integrate across sectors and also address socioeconomic concerns of local populations (Meaza H., 2014). Watershed management is considered as risk management, chiefly related to landslides, storms and floods.

Darghouth *et al*. (2008) indicated that Watershed management is the integrated use of land, vegetation and water in a geographically discrete drainage area for the benefit of its residents, with the objective of protecting or conserving the hydrologic services that the watershed provides and of reducing or avoiding negative downstream or groundwater impacts. The key characteristics of a watershed that drive management approaches are the integration of land and water resources, the causal link between upstream land and water use and downstream impacts and externalities, the typical nexus in upland areas of developing countries between resource depletion and poverty, and the multiplicity of stakeholders.

Watershed management is practiced as a means to increase rain fed agricultural production, conserve natural resources and reduce poverty in the semi-arid tropical regions of South Asia and Sub–Saharan Africa, which are characterized by low agricultural productivity, severe natural resource degradation, and high level of poverty (Kerr, 2002 cited in Tesfaye, 2011). Watershed management implies “the wise use of natural resources like land, water and biomass in a watershed to obtain optimum production with minimum disturbance to the environment” (Tesfaye, 2011).

At present, the overall objectives of “watershed development and management programs take the watershed as the hydrological unit, and aim to adopt suitable measures for soil and water conservation, provide adequate water for agriculture and domestic use, and improve the livelihoods of the inhabitants" (Biele, 2014). The same author expressed that management of watersheds can be made possible by using a variety of technologies such as vegetation conservation like grass, contours, alternative tillage techniques and physical structures like terraces, stone bunds, gabion box etc.

2.2. Components of Watershed Management

The three main components in watershed management are land management, water management and biomass management (Drake and Hogan, 2013).

2.2.1. Land management

Land characteristics like terrain, slope, and formation, depth, texture, moisture, and infiltration rate and soil capability are the major determinants of land management activities in a watershed. The broad category of land management interventions can be as follows: structural measures, vegetative measures, production measures, and protection measures (ANRSADB, 2011). Mechanical conservation measures may become necessary in watershed management in the initial stages. Structural measure include interventions like contour bunds, stone bunds, earthen bunds, graded bunds, compartmental bunds, contour terrace walls, contour trenches, bench terracing, broad based terraces, centripetal terraces, field bunds, channel walls, stream bank stabilization, check dams etc. Watersheds may contain natural ecosystems like grasslands, wetlands, mangroves, marshes, water bodies. All these ecosystems have a specific role in nature. Vegetative measures include vegetative cover, plant cover, mulching, vegetative hedges, grass land management, agro-forestry, etc. The production measures include interventions aimed at increasing the productivity of land like mixed cropping, strip cropping, cover cropping, crop rotations, cultivation of shrubs and herbs, contour cultivation conservation tillage, use of improved verity of seeds, horticulture, etc. Protective measures like landslide control, gully plugging, runoff collection, etc. can also be adopted. Adoption of all the interventions mentioned above should be done strictly in accordance with the characteristics of the land taken for management.

2.2.2. Water management

Water characteristics like inflows (precipitation, surface water inflow, and ground water inflow) water use (evaporation, transpiration irrigation, and drinking water) outflows (surface water outflow, ground water out flow) storage (surface storage, ground water storage, and root zone storage) are the principal factors to be taken care of in sustainable water management (Drake and Hogan, 2013). The same author indicated that broad interventions for water management are rain water harvesting, ground water recharge, maintenance of water balance, preventing water pollution and economic use of water.

2.2.3. Biomass management

Major intervention areas for biomass management are eco-preservation, biomass regeneration, forest management & conservation, plant protection & social forestry, increased productivity of animals, income & employment generation activities, coordination of health & sanitation programs, better living standards for people, eco-friendly life style of people and formation of a learning community a sustained basis. (Jimma University and Population, Health and Environment, 2010).

2.3. 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 programme 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 sectoral approaches. The strategies in integrated watershed management programmes 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 (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.

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).

2.4. Watershed Management Practices in Ethiopia

In Ethiopia watershed management is not a new practice. Farmers were familiar with traditional soil and water conservation practices in their day to day activities. Gadisa (2016) indicated that watershed management is not the new concept of the country because it had highly experienced indigenous peoples those have been practiced from an ancient period. But, it became the prominent after the recurrent malnutrition and famine problems followed the 1970's and 1980's drought and subsequent catastrophic phenomena. Land degradation in the form of soil erosion has been usually considered as the main driving causes of the problem. Thus, the previous governments and other partners have initiated various soil and water conservation activities though they were mostly unsatisfactory or failed.

Tesfaye (2011) revealed that in Ethiopia watershed management was merely considered as a practice of soil and water conservation. The same author noted that 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. According to this author 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. The institutional strengthening project 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 highland regions of the country (Tesfaye, 2011). 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. Since 1980, the government of Ethiopia has supported rural land rehabilitation, these aimed to implement natural resource conservation and development programs in Ethiopia through watershed development (Lakew *et al.*, 2005). Currently technically supported physical and biological conservation measures were widely implemented to prevent soil erosion, land degradation and climatic hazards in the country (Meaza, 2015). The present government taking lessons from the past, started community based integrated watershed management program removing all the shortcomings through the instrument of new policies for improved livelihood and living conditions of rural communities (Tesfa and Tripathi, 2015). Some of the success of watershed management was reduced run off, soil erosion and associated downstream siltation, increased vegetation cover and surface roughness, increased soil depth, increased recharge of groundwater table, increased production area and green environment, increased crop production and productivity and improvement in fodder availability (Temesgen, 2015). As a result, it showed positive achievements in rehabilitation of severely degraded land, and it becoming as sources of income for the local communities. Here, it doesn't mean that current watershed management practices are perfect but practically it has various problems that will be solved in the future.

2.5. Integrated Watershed Management

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 cited in Tadesse *et al*., 2013).

The concept of Integrated Water Resources Management (IRWM) arose out of the first United Nations Educational, Scientific and Cultural Organization's (UNESCO), International Conference on Water in 1997 (Drake and Hogan, 2013). The same author indicated that IRWM utilizes an "integrationist" agenda – integrating and coordinating management of water and land as a means of balancing resource protection while meeting social and ecological needs and promoting economic development. IRWM is focused on creating increased cooperation and collaboration between governmental institutions for more effective water and land management across large spatial scales. A common theme in IRWM literature is that it is not an end state but a continuous process of balancing and making trade-offs between different goals and views in an informed way.

Different people have given diverse definitions of integrated watershed management. Gtz and ANRSADB (2005) indicated that 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. This is required so that gains to one particular component (i.e. timber yield) do not have an overly negative impact on other components (i.e. water resources) – or on users depending on the viability of this other component for their livelihood. Integration also means integrating diverse solutions through a multi-disciplinary or multi-sectoral 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. A third form of integration can be seen in the need to manage interactions among diverse tenure systems, so that investment in individual and private "goods" can be balanced with investment in common and public goods. This last form of integration can be aided by collective action theory, which seeks a better understanding of the conditions required to enable greater investment in common property resources and public goods. Since this last form of integration can be treated in unison with the first, given that system "components" can be defined in biophysical or legal (tenure) terms.

In spite of the different definitions, there is a common understanding that integrated watershed management entails holistic approach, effective participation of all stakeholders and coordinated management of water catchments (Mitchell, B., 1990; Cobourn, 1999 cited in Wamalwa, 2009). The same author revealed that integrated watershed management is likely to be fostered by the critical biophysical and socioeconomic conditions, suitable institutional structures that are being established, water and forestry reforms, recognition of stakeholder participation and enhanced education of stakeholders, and leverage of resources from NGOs. Integrated watershed management practices comprises not only soil and water conservation but also considering socio-economic and cultural aspect of human beings in the area, understanding the way of animals life with respect to feeding systems, design considerations of some structures such as climate, degree of slope, soil texture and propose future use of structures (Tadesse *et al.,* 2013). In addition to this, an integrated watershed management creates opportunities for reclaiming degraded land, improving soil fertility, water resources development, increasing agricultural production, off-farm activities, diversifying income sources and providing access to markets, where the benefits are realized at household and community level (Gebregziabher *et al.,* 2016**)**. So effective watershed management depends on our ability to integrate our plans, actions and monitoring efforts across scales, from entire watersheds to small projects (Drake and Hogan, 2013). To do this, there are different types of watershed management technologies. According to ANRSADB (2011), these watershed management technologies can be divided in to three major groups; physical soil and water conservation technologies (check dam, cut off drains, stone bund, soil bund, gully control, terracing and water harvesting), biological soil and water conservation technologies (agro forestry, alley cropping, bund stabilization, live fencing, road side plantation etc) and improved and effective ways of crop production and soil content (minimum tillage, fallowing, mulching/manure, contour plowing, cultivating crops without plowing). In fact, watershed management integrates various aspects of forestry, agriculture, hydrology, ecology, soils, physical climatology and other sciences to provide guidelines for choosing acceptable management alternatives within social and economic aspects (Anchouri, 2002 cited in Yalew, 2010). For instance, 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 (Tesfaye, 2011). The same author revealed that various large and small watershed projects in the world were increased in the past years followed by spontaneous different views among the villagers, managers and experts. However, the development trends of hard work (mechanical and biological treatment), regardless of the appropriate conditions of management, prevents the formation of collaborative management in watersheds (Safa, 2016).

2.6. Challenges of Watershed Management in Ethiopia

Even though "participatory watershed approach has now become necessary in any developmental activity especially with regards to natural resource management, there are still major challenges that militate against its successful implementation in most developing nations" (Mireku *et al.,* 2015). There are different challenges that affect negatively the quality of interventions and scaling up of successful practices for sustainable watershed management in Ethiopia. The major challenges in the watershed management were shortage of land, lack of awareness in resource management, disagreement between the households and local leaders, unwillingness of youngsters to participate in conservation practices due to landlessness, climate variability, lack of follow up, lack of knowledge and means of utilizing the available resource, water scarcity, low skill of using agricultural technologies and inputs, lack of integration between sectors (Meaza, 2015). The same author indicated that lack of technology, information and skills and infrastructure were also affects the watershed management. Similarly, inadequate community participation, lack of professional standard, poor linkage between concerned institutions, poor sharing of information between different departments, Policy implementation constraint, inappropriate technological preference and Lack of site specific conservation plan are major challenges (Tesfa and Tripathi, 2015). Wolka (2015) revealed that in many areas land shortage challenges the size of channel and embankments. For instance, in various *kebeles* farmers reduced conservation structure embankment widths in order to have more land for crops. This resulted in many soil and water conservation structures being overtopped by flooding. The main challenges that facing watershed management are lack of sufficient capacity at all levels of government structures (federal, regional, district and *kebele*) to implement the new and sustainable approaches and excessively steep slopes of the watershed and small land holding system (Alemu and Kidane, 2014). Integration is a frequent challenge, given the role of disciplinary biases in favoring certain viewpoints and approaches, and the institutionalization of disintegration (Hussein, 2003 cited in Meaza, 2014).

In general, Watershed management has been faced with many challenges while applied without community participation and using only hydrological planning units, where a range of interventions remained limited and post- rehabilitation management aspects were neglected (MOARD, 2005). Several insights may be drawn from the challenges faced in implementing watershed management. Formulation of appropriate institutional arrangements for more widespread application, given the separation of different disciplines and of research from development within existing institutions is challenge in watershed management.

2.7. Participatory Watershed Management

According to Sharma (1999 cited in Kenge, 2009) watershed management is defined as a process of utilization, development and conservation of land, water and forest resources for continually improving livelihoods of communities in a given hydrological independent geographic area. FAO (2003) further stresses that watershed management is a coordinating framework for management that attempts to focus public and private, community and individual efforts toward addressing high priority land and water-related issues within a hydrologically defined geographic area. Participatory watershed management has been defined as a process “which aims to create a self-supporting system, which is essential for sustainability” (Wani *et al.,* 2005 cited in Yoganand and Tesfa, 2006). Lakew *et al*. (2005) stated that participatory watershed management can be defined as the rational and socially acceptable utilization of all the natural resources for optimum production to fulfill the present need with minimal degradation of natural resources such as land, water, and environment. The definition of community involvement in watershed management largely depends on the level of acceptance and understanding of the inhabitants’ communities where watersheds are essentially important asset for livelihood (Mireku *et al.*, 2015).

Participatory Watershed management is meant for growing biomass, the pipeline for prosperity of the people for bridging the gap between poverty line and per capita income (Swami *et al*., 2012). Participatory watershed management is the process and activities in which people in the community, government officials and researchers' collaborately work to meet the common objectives in balance of watershed system based on social, economic and environmental indicators (Seesomonn, 2010). It is considered as a management strategy aiming to reduce poverty, conserve natural resources and promote good institutions, social linkage and economic returns (Yalew, 2010). In addition to this, participatory watershed management has emerged as "a new paradigm for sustainable rural livelihoods and it occupied the central-stage of rural development in the fragile and semiarid environments of the developing nations" (Yoganand and Tesfa, 2006). The same authors indicated that Participatory watershed management made significant impact in terms of productivity gains in rain-fed areas which contributes to increased farm income and better livelihoods of the poor in fragile and high risk environments. Participatory watershed management provides opportunities to the stakeholders to jointly negotiate their interests, set priorities, evaluate opportunities, implement and monitor the outcomes. CGIAR (2015) indicated that participatory watershed management is the driving force for sustainable livelihood of the Community. Therefore, the long term community based participatory watershed management could be an appropriate vehicle for improvement of living conditions of rural communities (Tesfa and Tripathi, 2015). As a result, the key to the success of any watershed project and its sustainability depends on people's participation (Yoganand and Tesfa, 2006). Peoples' participation is "a dynamic group process in which all members of a group contribute towards the attainment of group objectives, share the benefits from group activities, exchange information and experiences of common interests, and follow the rules, regulations and other decisions made by the group" (Seesomonn, 2010). The experiences show that sustainability of watershed management is closely linked to the effective participation of the communities/households who derive their living from natural resources and the success of watershed development programs is largely dependent on the active participation of the watershed community (Kumar and Palanisami, 2009). The same authors indicated that a key concern for policy makers is the fact of making the farm households participate in watershed development activities. The amount of contribution made by the farmers is identified as the key indicator to represent household participation. Peoples' participation in watershed management has remained cursory even in policy formulations and consequent low adoptions (Ratna Reddy, 2000 cited Badal *et al*., 2006). In general, watershed management creates opportunities for reclaiming degraded land, improving soil fertility, water resources development, increasing agricultural production, off-farm activities, diversifying income sources and providing access to markets, where the benefits are realized at household and community level.

2.8. Households' Perception towards Watershed Management

Investigating the perceptions and beliefs of landowners should shed light on more targeted steps to take in natural resource conservation (Diana, 2014). Similarly lakew *et al*. (2000) indicated that knowledge of farmer's perception and attitude towards land degradation is important and first step to tackling the problem. Therefore, farmers remain the most important natural resource managers, researchers argue that local people's perception of environment, their interests, and priorities constrain their action to prevent land degradation and its impacts (Woldeamlak, 2003; Wagayehu, 2006 and Yitayal, 2012).

Since the 1990s, implementation of watershed management conservation measures has been taken as part of agricultural extension package of the present government (Woldeamlak, 2003). However, the practice has largely delivery oriented in which the farmer forces to the implemented conservation measures designed for them by technical expert (Simeneh, 2015). Alemayehu (2007) revealed that the majority of households perceived watershed management activities increased soil fertility, improved moisture status and increased crop yield. Brkalem (2015) also indicated that about 92% of the household respondents had perceived watershed management technologies increase productivity. Nyssen *et al.* (2006) showed that 75.4% of the farmers were in favor of stone-bund building on their land. Woldeamlak (2007) revealed that 94% of the interviewed farmers believe the physical SWC measures have the potential to improve cropland productivity, and lead to increased crop yield. Simeneh (2015) also indicated that more than 50% of households perceived watershed management activities have multipurpose advantages for their local communities. In line to this, Nerkar *et al*. (2016) indicated that majority of farmers perceived that an integrated watershed management activities are important for rehabilitating the degraded land. Gebeyanesh (2017) added that majority of the farmers perceived the introduced soil and water conservation (SWC) practices increase yield.

Simeneh and Getachew (2016) found that even though farmers have willingness to adopt the newly introduced watershed management technologies, they are reluctant to practice these measures on their farm lands. The same authors noted that the main reasons of households to resist participating in SWC work were: the work sites far from their home because of this they spent much of their time by journey and some community members also disappointed by output of their work. The other factor for unwillingness of participation on watershed management was unfamiliarity with technology (Gebreslassie and Tamirat, 2015). As Woldeamlak (2003) indicated that the major cause of disinterest shown by most of the farmers towards the SWC activities is their perceived ineffectiveness of these technologies.

2.9. Factors that Affect Households' Participation in Watershed Management

Kumar and Palanisami (2009) concluded that the number of workers in the farm family and number of wells owned found to significantly and positively influence the households contribution towards watershed development. The same authors revealed that Adequate training on watershed development, size of the user group and social homogeneity are also found to significantly influence the households' contribution towards watershed management.

According to Aklilu (2006), the adoption of watershed management conservation practice is influenced by farmers' age, farm size, perception on technology profitability, slope, livestock size, and soil fertility. Age of the household head is expected to be inversely related to the level of participation while education, training, the size of operational holding, the number of livestock owned, the family size, the existence of formal rules for benefit sharing and effectiveness of local institutions, the farmers' perception about the benefits of watershed, i.e. reduction in run-off, increase in employment opportunities, irrigated area, yield and water table are expected to have positive influence on participation of households in watershed management (Badal *et al.*, 2006). Debebe *et al.* (2013) also reported that age and distance to plot from home has a negative influence, but formal education, frequency of extension agent visit and area of cultivated land has a positive influence on soil bunds, cut-off drains and fanyajuu. In the northwestern Ethiopian highlands, labor shortage, problems with fitness of the SWC technologies to the requirements of farmers and land tenure insecurity discouraged farmers from adopting SWC measures such as soil and stone bunds, fanyajuu, etc. (Woldeamlak, 2007). In addition to this, Senait (2005) indicated that land owner ship type, distance of farm plot from home stead, resource availability and contact with extension agents were found to be the most important factors affecting choice of land management practices such as use of commercial fertilizer, manure, stone/soil bund or a combination of them. Related study conducted by Brkalem (2015) revealed that family size, education level, farm size, slope gradient, erosion type, off-farm income, training access, credit and livestock were important factors influencing use of improved watershed management practices by farmers. A study conducted by Mulugeta (1999) in Selale area, central highlands of Ethiopia added that land security, size of cultivated land, technology specific characteristics, formal schooling, wealth status of the household, availability of off- farm income and assistance from different sources were important determinants of adoption of physical soil conservation practices. A similar study by Adebabay (2003) in South Gonder zone, Farta district of Ethiopia reported that participation in conservation programs, land security, perception of soil erosion problem, the available land labor ratio and educational level of a household head were found to be important and significant factors for adoption of improved soil conservation technologies.

Bagherian *et al. (*2009) revealed that level of people's satisfaction of prior programs, people's attitude toward WMP, people's knowledge of WMP, their monthly income from alternative occupation and their expectations of WMP are factors provided the best prediction for the level of people's participation in WMP.

2.10. Conceptual Framework

Institutional, Physical and socio-economic factors affect households' participation in watershed management (Figure 2.1). This means that socio-economic and demographic variables, institutional related factors and physical factors are variables determining households' participation in watershed management. In this regard, Brkalem (2015) revealed that family size, education level, farm size, slope gradient, erosion type, off-farm income, training access, credit and livestock were important factors influencing use of improved watershed management practices by farmers. Badal *et al*. (2006) also indicated that participation of households on watershed management is influenced by age of the household head, training and family size. Likewise, Bagherian *et al*. (2009) added that land ownership and knowledge are determinant variables for households' participation in watershed management.

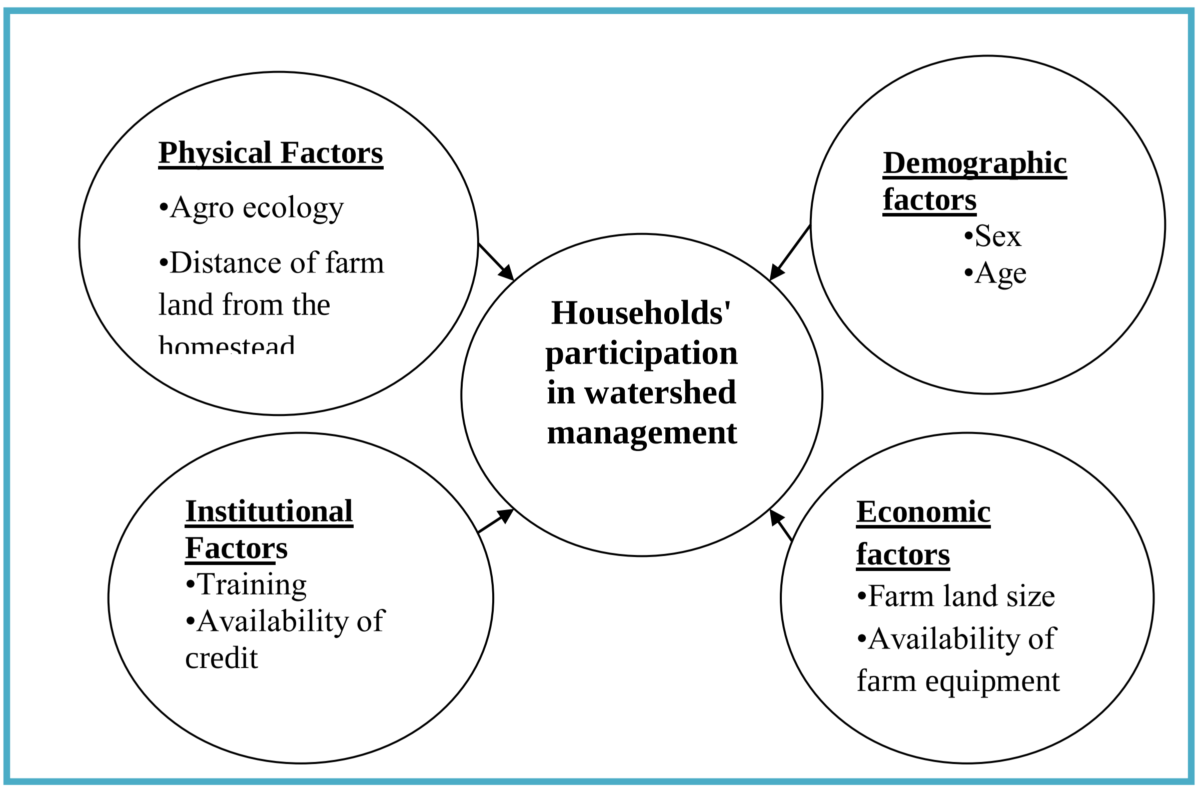

Figure 2.1. Schematic diagram showing the relationship between household watershed management and some explanatory variables.

Source: Modified from Brkalem (2015).

Chapter Three

3. Research Methods and Description of Study Area

3.1. Description of the Study Area

3.1.1. Location and topography of the study area

The watershed under consideration is located in Gonji kolela district of West Gojjam Zone, Amhara National Regional state (ANRS). The district town, Addis Alem is located 72Km a road distance away from Bahir Dar. The absolute location of Gonji Kolela district is $11^{0}00'\ 00''$-11^{0} 19'30"North latitude and $37^{0}31'00''$-$37^{0}51'30''$ East longitude (Figure 3.1). It is bordered by Dera in the north, Dega Damot in the south, Mirab Estie in north east, Huleteju Enesie in the east, Quarit in the south west, Yilmana Densa in the north and northwest (Figure 3.1).

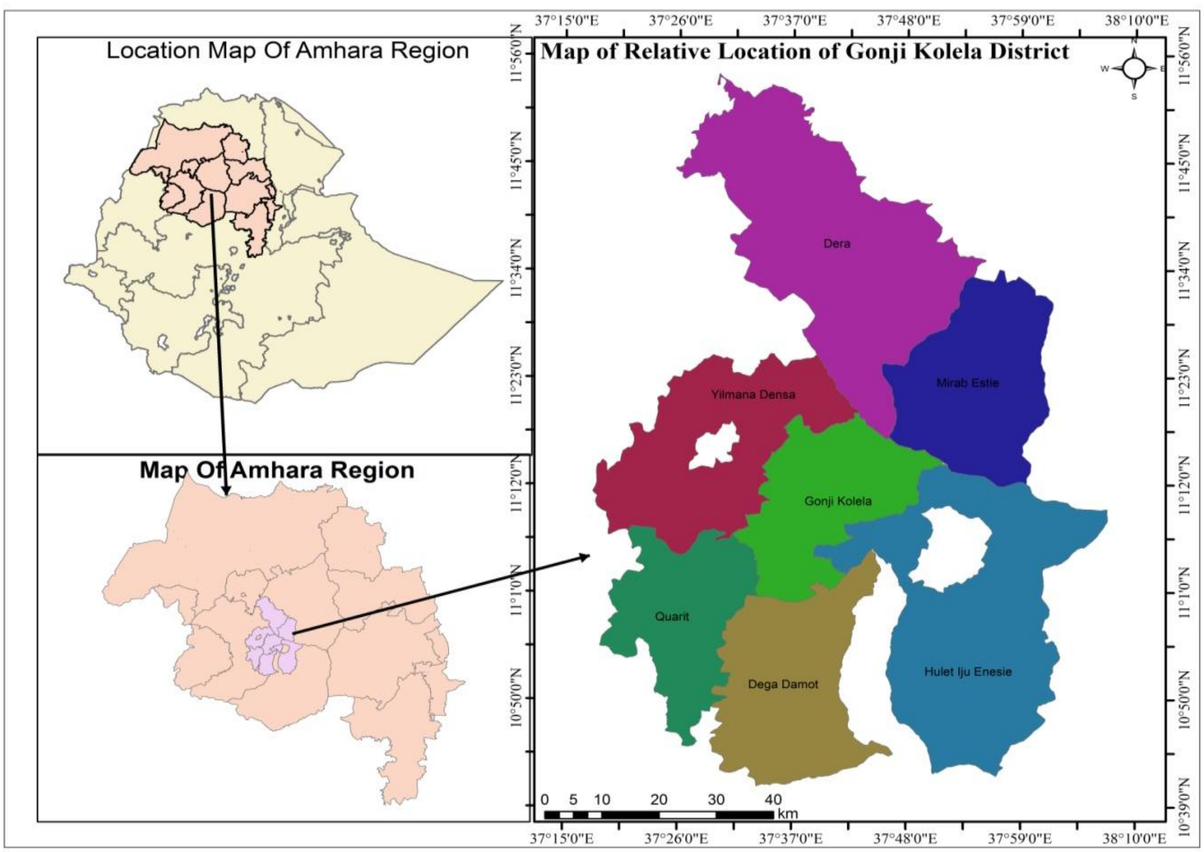

Figure 3.1. The relative location of Gonji Kolela district in the Amhara Region

According to GKDADO (2016) the total area of the district is about 662236 hectare. Out of this total area 34336 heactare is arable land, 29846 heactare is grazing land, 677 heactare is covered by forest and 14 heactare is other land use. The topography of Gonji Kolela district like the other districts in the zone comprises of mountains, plains, mountain ridges and deep gorges. It has wide variations of altitude ranging from 1372 to 2998 masl (Figure 3.2).

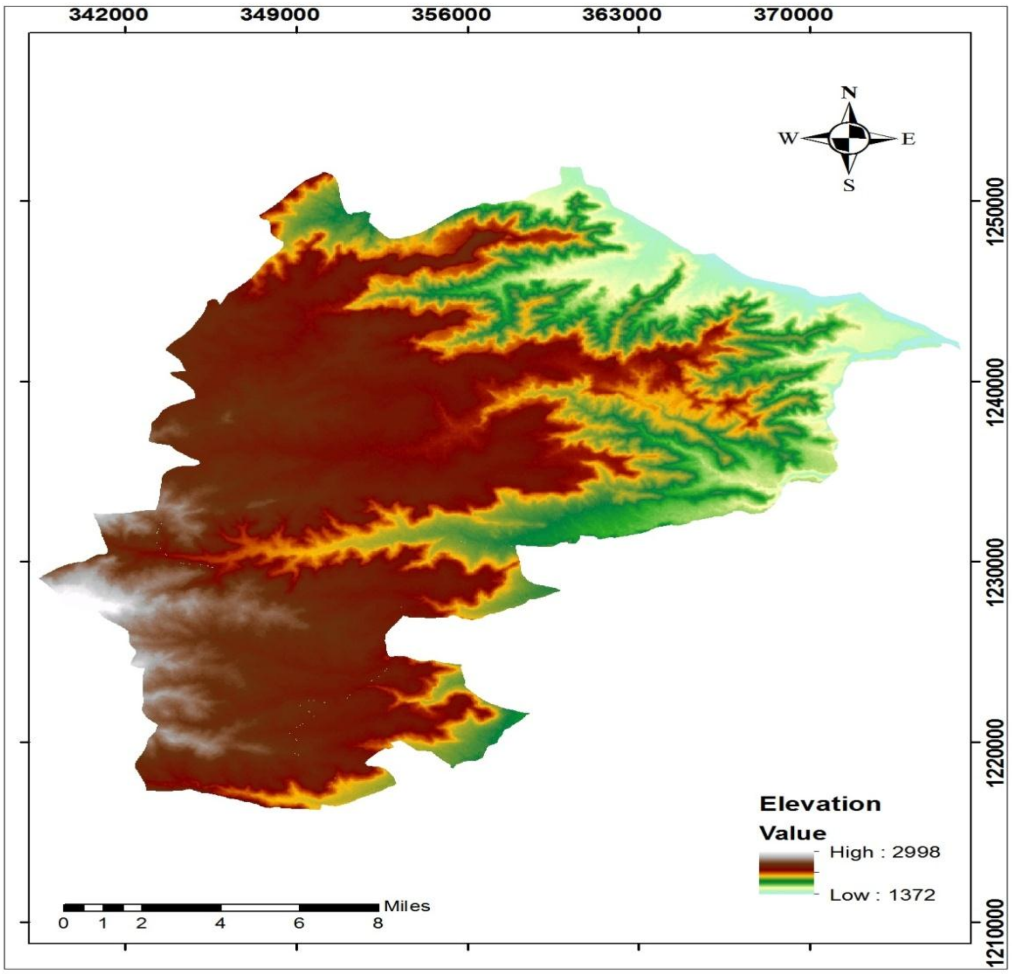

Figure 3.2. The topography of Gonji Kolela district

3.1.2. Climate

Climate determines both the type and efficiency of agricultural activities performed in a given area. There are different climatic elements that characterize the climatic types of the given area. The climatic condition of an area is sub-tropical 40% and 60% is tropical (The Gonji Kolela

District Agricultural and Development Office, 2016). According to national metrological agency (2016), the area has 21^0c and 27^0caverage annual minimum and maximum temperature respectively. Specifically, mean annual maximum temperature is the highest from April to July and mean annual minimum temperature is the lowest from December to February (Figure 3.4). The rainy seasons in the study area include *Belg* (little rain) and heavy *Kirmet* (heavy rains). The area receive rain fall mainly in the summer season (Figure 3.3). Besides, the maximum and the minimum rain fall in 2014/15 are 1602 mm and 1221mm respectively.

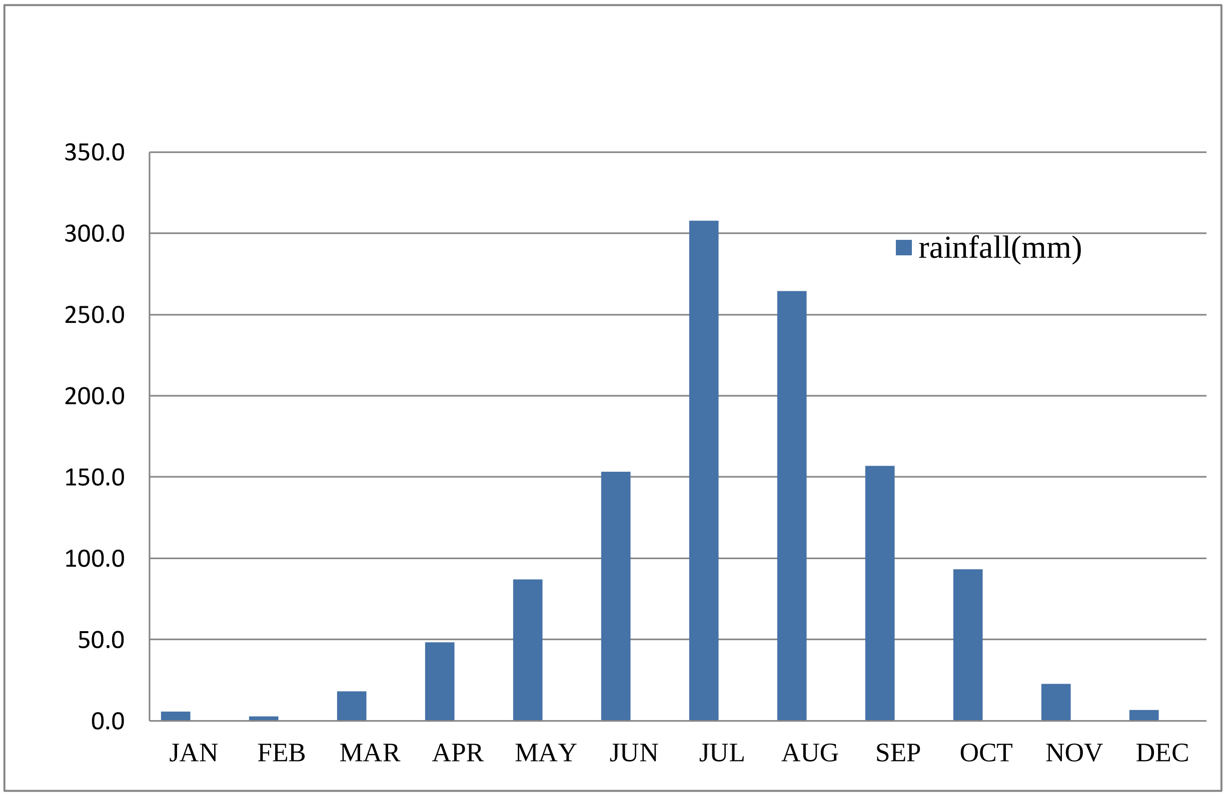

Figure 3.3 Annual rainfall of district of Gonji kolela from1995-2016

Source: National Metrological Agency 2016 (Adet Station)

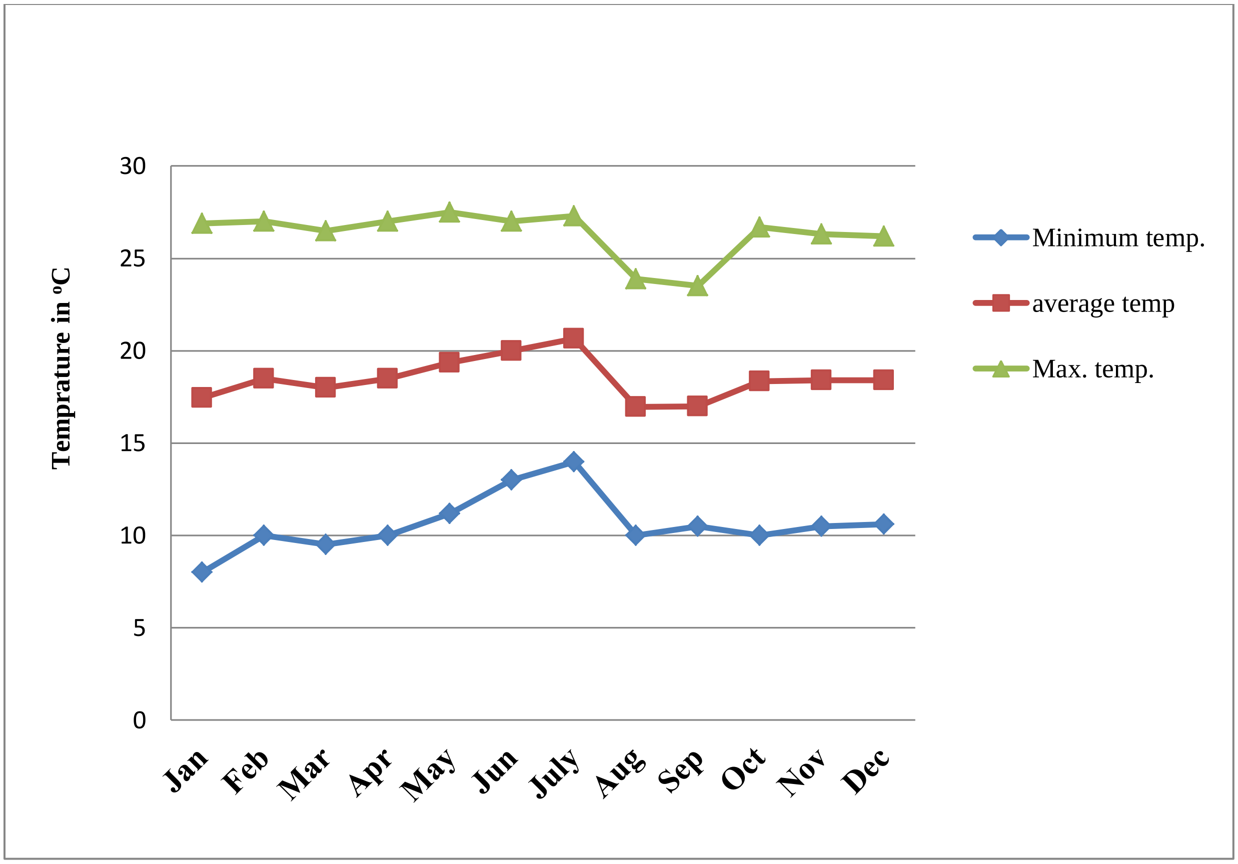

Figure 3.4. The minimum, maximum and average temperature of Gonji kolela district from 1995-2016

Source: National Metrological Agency 2016 (Adet Station)

3.1.3. Vegetation

The fact that discussion of natural vegetation depends on many factors among which climate, drainage pattern; relief and soil type are the major ones. In Gonji Kolela district, temperature and rain fall which largely are altitude dependent, determine the type and the density of vegetation.

The natural vegetation determines the climatic condition of an area and the area has covered by the forest and these forests are not dense. Those forests that are distributed in the district are *Kinchib* (local name), *Shiferaw* (Moringa), Eucalyptus globulus, the shrubs and deciduous trees (The Gonji Kolela Agricultural and Rural Development Office, 2016).

3.1.4. Soil

According FAO-WRB (2006) cited in Lemlem (2016), Vertisols are the predominant soil type with area coverage 7166.2ha, which located in moderately gentle sloping and very deep soil of the study area. This soil class can be characterized by heavy black clay, mostly water logged during the rainy season. It has high cation exchange capacity and base saturation content both in surface and subsurface horizons and decreases these quantities with increasing soil depth. The rest of the physiographic units are dominated by Cambisols, Regosols, Luvisols and Leptosols. Moderately deep to very deep major soil types dominate the study area.

3.1.5. Population and socio economic conditions of the study area

The total population of the district is 121447 out of this 61133 are males and 60314 are females (the Gonji Kolela District Agricultural and Rural Development Office, 2016). The majority of the inhabitants practiced Ethiopian Orthodox Christianity (98.19%) while Islam followers accounted for 1.76%. Agriculture lands are the most common land use type across this area and agriculture activities are extremely frequent (Tilahun, 2015). Agriculture is the mainstay of economy. About 91.9% of the area is predominantly used for crop production and the population livelihood depends on mixed farming (Tibebu, 2014).

3.2. Research Methods

3.2.1. Research design

The study is composed of mixed research design. Qualitative method was used to analysis perception and feelings of households' in watershed management. Quantitative analysis on the other hand, employed all about quantifying relationships between explanatory variables (socio-economic factors, demographic factors, physical factors and institutional factors) and dependent variables i.e. households participation in watershed management.

3.2.2. Sampling techniques

In this study, multi stage-sampling techniques were employed to select respondents to fill the questionnaire. First, Gonji kolela district is purposefully selected because the area includes highly degraded farmlands and watershed management is not sustainable (Tilahun, 2015). Second, in the district there are four major watersheds: Zema, Yita, Yezat and Awurafengel (Gonji kolela District Agricultural and Development Office, 2016). From these watersheds, Zema watershed was randomly selected for this study (Figure 3.5). Third, the sample *kebeles* were selected in a cluster sampling approach where all the *kebeles* in the watershed are first clustered into two major agro-ecological zones (*Kolla* and *Woina-Dega).* In the watershed there are nine *kebeles*. Out of these, Yinach, Woleke, Ardesa and Woizazirt *kebeles* are categorized in *Kolla* agro ecology, while Washera, Kenchchil, Ginbgeregera, Akilie and Debay Ambessagedel *Kebeles* are in Woina Dega agro ecology (The Gonji kolela District Agricultural and Development Office, 2016). Accordingly, Washera and Woleke *kebeles* were selected, one each from the two agro ecologies, in a random sampling techniques (Figure 3.5).

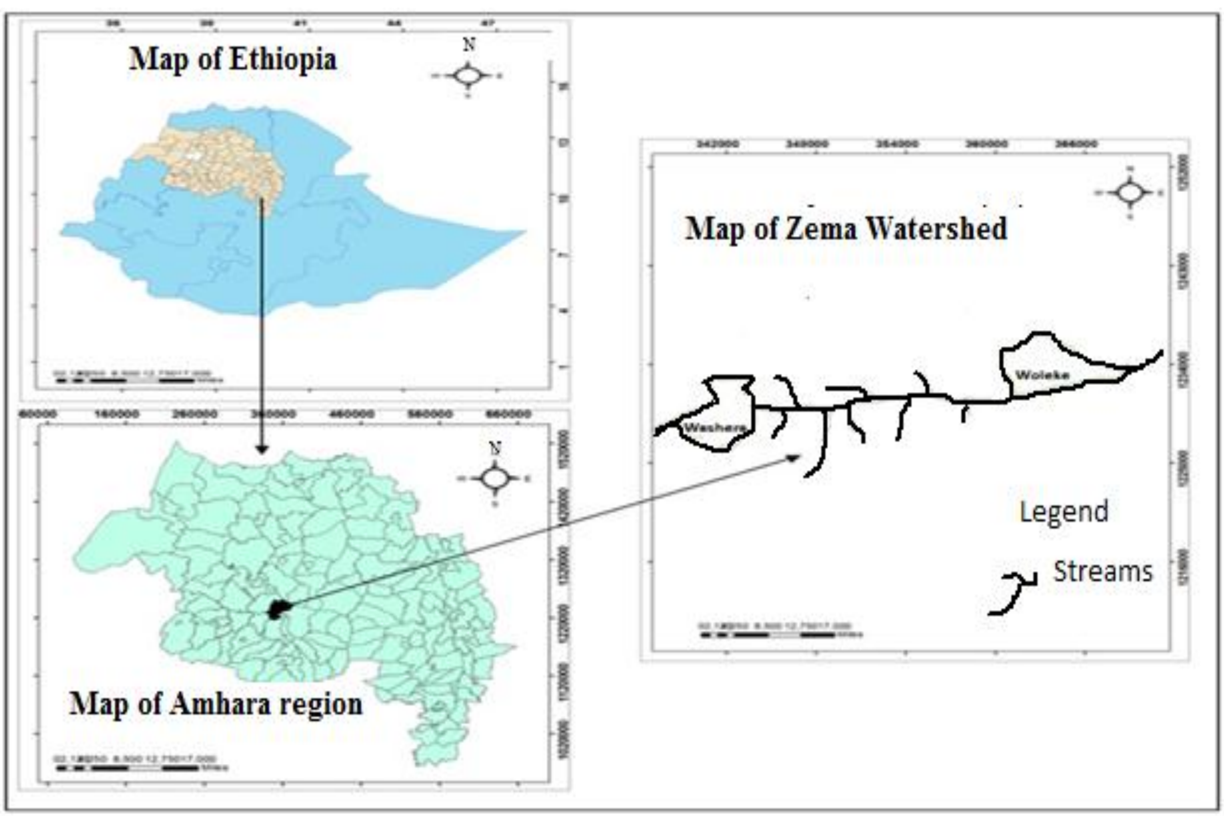

Figure 3.5. Map of the study area

The assumption is that within an agro-ecological zone, households have similar opportunities to participate in watershed management. Based on this, as shown in Figure 3.5, Washera *(*from *woina dega* agro ecological zone*) and* Wolekie *(*from *kola*a gro ecological zone*)* are selected for the study. The total households for the two *kebeles* are 1252 and 608, respectively (Gonji Kolela District Communication Offices, 2016). Fourth, the sample size of households was determined using Kothari (2004) formula as shown below.

$$n = \frac{Z^2 pqN}{e^2(N-1) + Z^2 pq}$$

Where: n: is the sample size for a finite population

N=size of population which is the number of households, 1860.

P=population reliability (or frequency estimated for a sample of size n). As we have not been given the *p* value being the proportion of defectives in the universe, let us assume it to be

p = .02 and p + q= 1, p=1-q

e=margin of error considered is 2% for this study.

z = 2.005 (as per table of area under normal curve for the given confidence level of 95.5%).

According to the formula, the sample size for all two *kebeles* is:

$$n = \frac{(2.005)^2 x\ 0.02\ x\ 0.98\ x\ 1860}{(0.02)^2(1860-1) + [(2.005)^2 x\ 0.02\ x\ 0.98]} = \frac{146.55}{0.81} \cong 181$$

Among these, 91 households were adopters of watershed management and the rest were not adopters.

Finally, a total of 181 households were sampled for a questionnaire survey from the two RKAs using proportional stratified systematic sampling technique based on the sampling frames obtained from the RKA offices (Table 3.1).

Table 3.1. Total and sample household heads of the study area

		Kebele name				Total sample in both *kebeles*
Sex of household	Watershed management	Washera		Wolekie		
		Total household	Sample household	Total household	Sample househod	
Male	Adopter	545	53	364	35	88
	Non adopter	556	54	156	15	69
	Total	1101	107	520	50	157
Female	Adopter	10	1	20	2	3
	Non adopter	141	14	68	7	21
	Total	151	15	88	9	24
Total	Adopter	555	54	384	37	91
	Non adopter	697	68	224	22	90
	Total	1252	122	608	59	181

Source: Washera and Woleke *kebeles* administration office (2016)

In the selection of qualitative participants, purposive sampling techniques were employed. The researcher make in-depth interviews with six (three in each *kebele*) key informants that were selected purposely. Model households, development agents and chairpersons from these two *kebeles* were key informants. To select participants of FGDs, the researcher obtained information from key informants. Based on this, two FGDs (one from each *kebele*) were included. Regarding to their compositions, eight from Washera and seven from Wolekie were selected for group discussions.

3.2.3. Data sources and data collection techniques

Primary Data Sources

Participants of FGDs, KIs and Survey respondents were the primary data sources for this study. Structured interview, key informant interview, FGDs and direct observations were the tools used to collect the primary data.

Structured interview: A total of 181 questionnaires were distributed and 180 questionnaires were returned, one questionnaire in the *Woina Dega* zone was not correctly filled and hence excluded from the analysis. The numbers of questionnaires returned were thus, 121 from Washera *(Woina Dega)* and 59 from Wolekie *(Kolla)*. The researcher has prepared closed-ended questions which cover various issues: socio-economic and demographic characteristic of respondents; level of household participation, factors that affect households' participation in watershed management; perceptions about watershed management and types of watershed management activities which practice in the district. The questionnaires were translated into Amharic language, local language. For administering the questionnaire, four enumerators (2 from each *kebele*) were selected and they received training for five hours. The training was focused on how to present and explain each question to the respondents.

Key Informant interview: Semi-structured and flexible checklists were prepared which include households' participation in watershed management, challenges to practice watershed management, present conditions of watershed management, major types of watershed management activities, perception of households towards watershed management activities, credit services and trends of watershed management in the study area. Interviews were held around the homesteads. By creating awareness for these key informants, the researcher used tape recorder to get time to listen what they said.

Focused Group Discussion: It helps to supplement data that obtained from key informants with regard to the household level of participation in watershed management. As mentioned before, two FGDs (one from each *kebele*) were selected for this study to get detail information about watershed management trends, availabilities of technologies for watershed management, perception and feelings of households in watershed management. In order to guide these discussions, checklists related to the previous and current attempts made by the community to manage watershed management practices, problems of watershed management activities and households perception towards watershed management activities were prepared by the researcher. During the discussion, the researcher took short notes and with their permission, tape recorder.

Observation: Some of the phenomena that were directly observed by the researcher are natural resource degradation, coverage of forests, grasses, terracing and other different watershed management activities and grazing lands. In direct observation, the researcher was used photo camera to capture and record the phenomena.

Secondary Data Sources

Ministry of Agriculture (MoA), regional, district and *kebeles* annual reports on natural resources management, research reports by individuals or organizations, Official government statistics such as Central Statistical Agency of Ethiopia and international organizations such as FAO were used as secondary data sources for this study.

3.2.4. Data analysis

The combinations of qualitative and quantitative methods were employed for data analysis. The qualitative data**,** which were generated from different sources, were analyzed using narrations, texts and pictures to provide evidences and to support the quantitative data presentations. On the other hand, the quantitative data were edited, coded, and entered into statistical package for social science (SPSS version 21) and analyzed using descriptive and inferential statistics. Chi square test was employed to show the relationship between households' participation in watershed management with sex, age, family size, farm equipment, marital status, level of education, distance and farmland size of households.

Binary logistic regression model was used to determine the factors affecting household participation in watershed management. The dependent variable is households participation in watershed management was a dummy variable and coded as 0=yes and 1=no.

The independent variables for the model include farmland size, sex, age, agro ecology, distance from the homesteads, training on watershed management, availability of credit and farm equipment.

Checking the goodness fit of the model

The null hypothesis that the model fits the data against the alternative hypothesis was tested using Hoemer- Lemeshow Test. Hoemer – Lemeshow's goodness of fit test indicates that the predicted frequency and observed frequency should match closely (Alemu, 2007). This goodness-of-fit of the model statistics was helped for the researcher to determine whether the model adequately describes the data. The significance of the model checked by p-value. Since the p-value greater than 0.05 (which is 0.197), the model was fitted. The prediction power was checked using classification table. The classification table shows the practical results of using the logistic regression model.

Checking multicollineraity

Some of the statistical techniques, which are employed to examine the model of adequacy, include multicollineraity, tolerance and variance inflation factor (VIF). In this study multicollinearity diagnostic test was used to identify the situation whether the correlations among and between explanatory variables are strong or not. Thus, variance inflation factor (VIF) is used for testing the existence of multicollinearity problem among and between continuous variables.

Table 3.2 Summary of independent variables with their code, category and hypothesis

Variables	Descriptions	Hypotheses
Sex of households	(a dummy variable where 1=female, 0=male)	Negative (-) significant
Agro climatic zone	(a dummy variable where 0= *Woina Dega,* 1= *kola*)	Positive (+) significant
Age of household heads	(a continuous variable)	Have not significant relationship
Farm land size	(a continuous variable)	Positive (+) significant
Availability of farm equipment	(a dummy variable where 0= Yes, 1= No)	Have not significant relationship
Training	(a dummy variable where 0= No, 1= Yes)	Positive (+) significant
Credit	(a dummy variable where 0= No, 1= Yes)	Positive (+) significant
Distance of farm land from the home	(a continuous variable)	Negative (-) significant

Chapter Four

Result and Discussion

4.1. Demographic Characteristics of the Respondents

4.1.1. Sex of respondents

As shown in Table 4.1, 87.2% were male- headed and the rest were female-headed households. Akreman (1995) argue that in most of sub-Saharan countries women major role is in household and child care activities, while men make decision concerning field work activities, in yield increasing agricultural technologies, like soil and water conservation measures. In line with this, GKDADO (2016) indicated that participation of females in watershed management works is less than males. To see the relationship between sex of households and participation of watershed management, chi square-test was employed. The result showed that there was statically significant relationship between sex of households and participation of watershed management (X^2 =14.844; P < 0.01) (Table 4.1).

Table 4.1. Respondents response in participation of watershed management

Sex of respondent	Households watershed management status					
	Participants		Non participants		Total share	
	Frequency	%	Frequency	%	Frequency	%
Male	88	56.1	69	43.9	157	87.2
Female	3	13	20	87	23	12.8
Total	91	50.6	89	49.4	180	100
X^2=14.844; p= 0.000						

Source: Household survey (2017)

4.1.2. Age of household heads

Age of farmers was one of the demographic characteristics which influence watershed management. The minimum, maximum and mean age of the sample households were 23, 70 and 44.76 respectively. As the survey data revealed that majority of participant household heads were found in the age categories 41-50 and 51-60 (Table 4.2). Farmers in these age groups have a good understanding of watershed management (Sagni, 2015). The same author indicated that farmers in this age group are more interested in watershed management practices. The share of elderly households is very low (9%). This age group has troubles with practicing in watershed management on their fields (Kibemo 2011 cited in Sagni, 2015). However, these farmers especially the elderly age groups usually implement and accepted watershed management technologies because of having access to money for hire labor with the young age group (Addisu, 2011). Contrary to this, Wagayehu and Drake (2002) in their study indicated that there was negative association between existence of conservation structure and old age of house hold heads.

To see the relationship between age of households and participation of watershed management, chi square-test was employed. The result showed that there was statically significant relationship between age of households and participation of watershed management (X^2 =45.809; P < 0.01) (Table 4.2). This finding is supported by Getachew (2014) which says that age of household increases, they can acquire more knowledge and experience and pre-assume vulnerability and risk condition of food insecurity and the chance of household to became more food secure increase through watershed management particularly soil and water conservation practices. Thus, age of house hold heads affect the watershed management practices status positively.

Table 4.2. Age of households and participation in watershed management.

Age of household heads	Households watershed management status				
	Participants		Non participants		Total share
	Frequency	%	Frequency	%	%
20-30	3	12	22	88	14
31-40	14	31.8	30	68.2	24
41-50	29	70.7	12	29.3	23
51-60	41	75.9	13	24.1	30
61-70	4	25	12	75	9
Total	91	50.6	89	49.4	100
X^2 =45.809; p= 0.000					

Source: Household survey (2017)

4.1.3. Family size of household heads

The average family size for the surveyed households was 5.54 with a standard deviation of 2.12. The family size of the study area was higher than the national average 5.1 and the regional average 4.6 (CSA, 2013). As shown in Table 4.3, 61 (34%) of the respondents has family size between seven and twelve, while 82 (45.5%) of households lies on one up to two family members and the rest is 37 (20.5%). Family is one of the social institutions that has vital role in the process of socialization and performing collective work (Sagni, 2015). As clearly known watershed management activities is labor intensive, households with larger household size make decision to retain structures/other watershed management technologies. This study revealed that households with large family have better participation in watershed management than small size households (Table 4.3). The same study conducted by Habtamu (2006) in Hadiya zone on adoption of physical soil and water conservation structure indicates that farmers with large family size practiced different conservation structures. The cross-tabulation of households with family size of 7-12 and 1-6 against participation in watershed management showed that most participants were households with 7-12 family size (Table 4.3). The difference in the distribution of participants and non participants of integrated watershed management with family size is also statistically significant (X^2=*58.302; p* < 0.001) (Table 4.3).

Table 4.3. Family size and households' participation in watershed management

Family size of household head	Households' watershed management status					
	Participants		Non participants		Total share	
	Frequency	%	Frequency	%	Frequency	%
0-3	4	10.8	33	89.2	37	20.5
4-6	34	41.5	48	58.5	82	45.5
7-12	53	86.9	8	13.1	61	34
Total	91	50.6	89	49.4	180	100
X^2 =58.302; p= 0.000						

Source: Household survey (2017)

4.1.4. Marital status of household heads

Among the total 180 sample households about 78 % are married and the rest are single, divorced and widowed household heads (Table 4.4). The study revealed that married households were more participants on watershed management activities than the other group. This study is consistent with Aysheshim (2015) in his study married households have better participants on watershed management than single, widowed and divorced households. To see the relationship between marital status and participation of watershed management, chi square-test was employed. The result showed that there was statically significant relationship between marital status and participation of watershed management (df=3, X^2 =25.280; $P < 0.01$) (Table 4.4).

Table 4.4. Marital status of household heads and watershed management

Marital status of households	Households watershed management status					
	Participants		Non participants		Total share	
	Frequency	%	Frequency	%	Frequency	%
Married	85	60.3	56	39.7	141	78.3
Single	0	0	3	100	3	1.7
Divorced	3	23.1	10	76.9	13	7.2
Widowed	3	13	20	87	23	12.8
Total	91	50.6	89	49.4	180	100
df=3X^2 =25.280; p= 0.000						

Source: Field survey, 2017

4.1.5. Households level of education

As shown in Table 4.5 more than half 113 (62.8%) of the total sample household heads were illiterate, only 2.2% of the sample households were completed elementary school and there is no respondent who finished secondary school (Table 4.5). Majority of the respondents (97.8%) do not have formal education. This would have its own impact on the households' participation on watershed management activities. Consistent to this result, Habtamu (2014) argued that educated farmers have better information on watershed management than uneducated farmers. Discussion with development agents in both agro ecologies indicated that educational status has a great value for watershed management practices. Participants further stated that literate households understand the benefit of watershed management after managing compared to illiterate households. So as educational status of a household head increases, it is assumed to increase the transfer of relevant information and as a result increase farmers' knowledge about the watershed problems and causes, watershed management practices (Badal *et al.,* 2006). Education enables farmers to tackle watershed problems and causes using various ways of watershed management practices, traditional and introduced soil conserving technologies (Tadesse *et al*., 2013). To see the relationship between level of education and participation of watershed management, chi square-test was employed. The result showed that there was statically significant relationship between level of education and participation of watershed management (df=2, X^2 =92.172; P < 0.01).

Table 4.5. Households' level of education and participation of watershed management.

Households level of education	Households watershed management status					
	Participants		Non participants		Total share	
	Frequency	%	Frequency	%	Frequency	%
Can't read and write	26	23	87	77	113	62.8
Read and write	61	96.8	2	3.2	63	35
1-8	4	100	0	0	4	2.2
Total	91	50.6	89	49.4	180	100
df=2, X^2 =92.172; P = 0.00						

Source: Field survey, 2017

4.1.6. Respondents land holding size

The average land holding size for the surveyed households was 1.05 with a standard deviation of 0.06. This shows that the average land holding size of households in the watershed is greater than the country's average which is 1.04 ha (MoFED, 2012).

As shown in Table 4.6 households participation in watershed management increases with an increasing of farmlands. Consistent to this result, Sagni (2015) indicated that farmers who have better land holding were participated more than small land holders. According to the FGD those with large farm size are positive toward watershed management activities while those who are holding small size of farm have negative attitudes towards it. In line with this, study conducted by Wogayehu and Drake (2002) showed that the relationship between land holding and practice of watershed management activities is positively associated. Aklilu and Graaff (2006) similarly found that farmers who have a larger size of farm land are more likely to participate in watershed management because they have the capacity to do so. In addition to this, Habtamu (2014) argued that farmers that have larger plots are more flexible in their decision making; greater access to discretionary resources, more opportunity to use new practice of SWC structures and have more ability to deal with the risk takes place on their farm land. The Pearson chi-square test also evidenced that there was statistically significant relation (at p < 0.001) (Table 4.6).

Table 4.6. Land in hectares and households participation in watershed management.

Farmland size	Agro ecology				Participants in watershed management	Non-Participants in watershed management
	Woina dega		*Kola*			
	Freq	%	Freq	%	%	%
0-1	61	50.4	28	47.5	17	83
1.01-2	47	38.8	15	25.4	82.3	17.7
2.01-3	13	24.8	14	23.7	85.2	14.8
3.01-4	0	0	2	3.4	100	0
df=3, X^2=80.277; p= 0.000						

Source: Household survey (2017)

4.1.7. Distance of farm lands from the homestead

Farmers having land a distance of 0-25 minutes were more participants than the others (Table 4.7). Development agents informed that, farmers having land far from their homestead do not visit to their farmland frequently except during harvesting and planting season. That is, the distance from residence to farmland restricted some farmers' to practice watershed management activities frequently. In relation to this, Tilahun (2015) argued that distance of farmers from their residences to farmland is one of the factors that influence households' participation on watershed management. The same author added that farmland from homestead was found to influence negatively the practice of households' participation on watershed management. The Pearson chi-square test also evidenced that there was statistically significant relation (at $p < 0.001$) (Table 4.7).

Table 4.7. The relationship between distance of farm land and participation of watershed management.

Households level of education	Households watershed management status					
	Participants		Non participants		Total share	
	Frequency	%	Frequency	%	Frequency	%
0-25m	74	80	18	20	92	51
26-50m	14	22.6	48	77.4	62	34.5
51-90m	3	11.5	23	88.5	26	14.5
Total	91	50.6	89	49.4	180	100
X^2=68.103; p= 0.000						

Source: Household survey (2017)

4.2. Appropriate Watershed Management practices

There are different types of watershed management technologies. According to ANRSADB (2011), these watershed management technologies are divided in to three major groups; physical soil and water conservation technologies, biological watershed management technologies and improved and effective ways of crop production and soil content conservation.

4.2.1. Physical soil and water conservation practices

4.2.1.1. Check dam

The survey data revealed that about 46% of the respondents were participated in the construction of check dam (Table 4.8). Out of these more than 62% of the households were participated in communal lands. In *Woina Dega* and *Kola* the proportion of the households' participation on check dam is 43% and 51% respectively. This shows that in *Kola* agro ecology the participation of respondents on check dam is greater than those participated in *Woina Dega* agro ecological zone. This is because of the availability of construction materials. As KIs in *Kola* agro ecological zone informed that there are better materials for the construction of check dam. In line to this, Belay (2016) indicated that availability of construction materials were factors for the construction of check dam. On the other hand 57%, 49% and 54% respectively in *Woina Dega*, *kola* and in both agro ecologies, the respondents were not participated in the construction of check dam. This result does not confirm to the finding of Daniel (2005) and he noted that only 20% farmers did not recognize the effectiveness and productivity of ponds and check dam conservation measures. The study shows that there are five major challenges/reasons to participate on check dam. Among these the dominant challenges are the proportion of households who said lack of budget/ materials/equipment to practice (55.1%) and require large labor/machine (43%) (Table 4.8). Getachew (2014) evidenced that physical conservation measures like check dam requires high labor force.

Table 4.8. Households' participation on check dam

Type of land	Households response (%) on participation of check dam		
	woina dega	*Kola*	Average
Private land	6.6	6.8	6.2
Communal land	30.6	22	28.8
Both lands	5.6	22	11
I didn't participate	57	49	54
Reasons of respondents (%) why they didn't participate on check dam			
Challenges			%
Lack of know how to apply			8.16
Lack of land/ Reduce farm land size			1.02
Lack of budget/ materials/equipment to practice			55.1
Require large labor/machine			43.8
Difficulty of topography			8.16
Total			54

Source: Household survey (2017)

Likewise, KIs informed that lack of materials, lack of labor, difficulty of topography, lack of budget (highly gully and degraded areas needs external support like local governments and other institutions) and the level of understanding/know how are the major challenges to construct check dam. In addition to this, FGDs discussion indicated that in both agro ecological zones the role of local government and NGOs were insignificant to construct and rehabilitate those gully areas in the watershed. In line to this, NBI (2012) confirmed that in the Ethiopian highlands, gullies are particularly severe and widespread covering large tracts of areas. The same document indicated that land degradation due to soil erosion, particularly gully erosion by water is the main threat in the Amhara Region.

4.2.1.2. Cut-off drains

The survey data indicated that 43.9% of the sample households were participated on cut off drain (Table 4.9). The study shows that about 37.8% of the participants were participated on communal land. So the coverage of cut of drains is very low because the households' participation on private land which has large proportion is 1.1% (Table 4.9). In *woina dega* and *kola* the proportion of households' participation on cut off drains is 42.2% and 47.5% respectively (Table 4.9). This indicated that in kola the households' participation is slightly greater than in woina dega agro ecology. This is because in kola agro ecology as one KIs informed households were got training on how cut off drains are constructed. On the other hand majority of the respondents in each agro ecology were not participated on this watershed management activity.

Table 4.9. Households' participation on cut off drains

Type of land	Households response (%) on participation of cut off drains		
	woina dega	*Kola*	Average
Private land	1.6	0	1.1
Communal land	37.2	38.9	37.8
Both lands	3.3	8.47	5
I didn't participate	57.8	52.5	56.1
Reasons of respondents (%) why they didn't participate on cut off drains			
Challenge	%		
Lack of know how to apply	33.6		
Lack of land/ Reduce farm land size	48.5		
Lack of budget/ materials/equipment to practice	38.6		
Require large labor/machine	9.9		
Total	56.1		

Source: Household survey (2017)

The study shows that there are four major challenges to participate on this watershed management activity (Table 4.9). Among these lack of land/ reduce farm land size is the dominant challenge to manage the watershed. In relation to this, KIs particularly in *Woina dega* agro ecology informed that perception of households towards cut off drains is very low. The result is consistent with Simeneh and Getachew (2016) and they indicated that the perception of households perceived that cut off drains reduce farm land size. Cut off drains in the study area was constructed during *Bega* season (Figure 4.1).

Figure 4.1. Cut of drains that are constructed by the community in the study area.

4.2.1.3. Stone bund and soil bunds

The survey data indicated that more than 52% of the households were participated on both soil and stone bunds (Table 4.10). This study is supported by Meaza (2015) which says 78.8% of the local households in Adwa were participated in soil and stone bunds. Likewise, Kebede (2015) in his study indicated that about 50% of farmers were participated in stone bunds. The study revealed that about 55% respondents in Woina *Dega* and about 48% in *Kolla* zone participated on stone bund during the survey (Table 4.10). However during the summer season as FGDs discussed in both agro ecologies these constructed bunds were damaged /narrowed by the owner of the land.

Table 4.10. Households' participation on Stone bund/soil bunds

Type of land	Households response (%) on participation of Stone bund/soil bunds					
	woina dega		*Kola*		Average	
	Stone bund	Soil bund	Stone bund	Soil bund	Stone bund	Soil bund
Private land	21.5	31.4	13.5	25.4	18.9	29.4
Communal land	26.4	9.9	7.43	11.9	22.8	10.6
Both lands	7.4	3.3	18.6	38.9	11.1	15
I didn't participate	44.6	55.3	52.5	23.7	47.2	45

Reasons of respondents (%) why they didn't participate on Stone bund/soil bunds	
Challenge	%
Lack of land/ Reduce farm land size	31.7
Lack of budget/ materials/equipment to practice	75.2
Require large labor/machine	58
Lack of good species of grass/forest	1.1
Total	45

Source: Household survey (2017)

In the study area there are four obstacles/ challenges of households to participate on stone bund/soil bud. The most dominant challenges for practicing stone/soil bunds were lack of budget/ materials/equipment (75.2%) and lack of land/ reduce farmland size (45.7%) (Table 4.10).

As KIs in both agro ecological zones informed farmers in the study area perceived as stone bunds/soil bunds decrease farmland. Kebede (2015) indicated that farmers do not like having stone bunds built close to their houses as they tend to be good snake habitat. On the other hand, MoARD (2005) stated that lack of interest in treating the hillside, disputes over use rights, and different opinions on what measures to apply on the hillsides and access to labor opportunities were the challenges to practice soil bunds. In the study area soil and stone bunds were constructed mainly on farm lands (Figure 4.2)

Figure 4.2. Soil and Stone bunds which are constructed by the community in the study area

4.2.1.4. Terracing

The survey data revealed that 99.4% of the respondents were participated on terracing (Table 4.11). The study also indicated that about 70% of the respondents were participated terracing on both lands during the survey. In all cases the proportion of participants on both private and communal lands is more than 70%. This shows that participants were participated on large areas of the watershed. As a result terracing is the most dominant watershed management activities in the district. This is because the KIs in both agro ecologies informed that in this watershed management activity, there are watershed management committees who are organized by the *kebeles* to perform this activity very well. However these committees are organized to perform activities for temporarily (commonly from January 1 to February 30). On the other hand FGD participants indicated that among the three types of terrace the communities mostly participated on contour terrace. As they discussed that there is no participation of households on bench terraces, which is very important in steep slope and highly degraded areas (ANRSADB, 2011).

Table 4.11. Households' participation on terracing

Type of land	Households response (%) on participation of terracing		
	woina dega	*Kola*	Average
Private land	9.1	3.38	7.2
Communal land	18.9	10.2	16.7
Both lands	70	86.4	75.5
I didn't participate	0.8	0	0.6

Source: Household survey (2017)

FGDs indicated that lack of finance, equipment/materials and trainings are also the major challenges to participate on bench terrace which is coasty and difficult to construct on lands that are not giving service/highly eroded and degraded in the watershed. In addition to this, during researcher’s observation terraces were constructed without plan/professional/engineer (Figure 4.3B). In line to this, Habtamu (2006) stated that proper use of any conservation measures requires a high degree of technical skill in engineering. On the other hand, Addisu (2011) indicated that level of net farm income was expected to affect bench terrace because farmers with higher net income are less likely to be financially constrained to adopt soil and water conservation measures.

Figure 4.3. A. Community participation on terracing

Figure 4.3.B. Tachbaye area, narrowed terrace that was constructed without professional/engineer and appropriate standard in the watershed. As the figure shows the terrace was constructed with wrong ways. This structure partially removed and did not curb the impact of soil erosion in a meaningful and sustainable manner.

4.2.2. Methods of soil conservation

4.2.2.1. Mulching/Manure

The survey data indicated that about 43.9% of the respondents in the watershed were participated on mulching/manure activities (Table 4.12). Out of this, households in both agro ecologies mainly participated on private land. As shown in Table 4.12, lack of budget/ materials/equipment to practice (96%) and lack of know how to apply (67%) were the major challenges to participate practically. Consistent to the result, Habtamu (2014) found out that the major constraint which was raised in the issue was the shortage of animal dung and transfer of compost from one hole to the other untimely (after compost was expired), since the largest portion of it used as source of fuel. Likewise, Belay (2016) on his study indicated that income level, labor and education level, farming experience, conservation attitude and family size are factors which influence adoption of mulching/manure.

Table 4.12. Households' participation on mulching/manure

Type of land	Households response (%) on participation of mulch/manure		
	woina dega	*Kola*	Average
Private land	31.4	64.4	42.2
Communal land	1.6	0	1.1
Both lands	0.8	0	0.6
I didn't participate	66.1	35.6	56.1
Reasons of respondents (%) why they didn't participate onmulch/manure			
Challenge			%
Lack of know how to apply			67
Lack of land/ Reduce farm land size			0.99
Lack of budget/ materials/equipment to practice			96
Total			56.1

Source: Household survey (2017)

Scoones (2001) also supplemented that natural factors (climate soil parent material, land cover and or vegetation as well as topography), and human induced factors (land use, management and degradation) were the dominant factors to practice and utilize mulching/manure. On the other hand, KIs informed that there are households who have not know how to apply/participate on mulching/manure. FGD participants in their part evidenced that the perception of households towards mulching or manure is very low. Households were not well to utilize the remnants' of plants and cow dung rather they collect and through it.

4.2.3. Biological watershed management practices

4.2.3.1. Agro forestry

The study revealed that in both agro ecologies, majority of the participants (62.8%) were not participated on agro forestry activities (Table 4.13). This result is supported by Tolera (2011) which says about 23% of farm households were participated on agro forestry activities. However, Joas (2015) revealed that the most dominant watershed management activity (52%) used by farmers were agro forestry. In *woina dega* agro ecological zone the proportion of participation of sample respondents is 43%, while in *kola* it is 25.4% (Table 4.13). This shows that participation of households in *woina dega* is greater than kola agro ecology. As RK DAs informed this variation is the result of adaptation of plant species. They noted that in *woina dega*, there is better adaptation of different species of plants than in Kola agro ecology.

Table 4.13. Households' participation on agro forestry

Type of land	Households response (%) on participation of agro forestry		
	woina dega	*Kola*	Average
Private land	19	16.9	18.3
Communal land	23.9	8.47	18.9
I didn't participate	57	74.6	62.8
Respondents response (%) why they didn't participate on agro forestry			
Challenge	%		
Lack of know how to apply	14.1		
Lack of land/ Reduce farm land size	73.4		
Lack of budget/ materials/equipment to practice	1.8		
Lack of good species of grass/forest	54		
Total	62.8		

Source: Household survey (2017)

Challenges not to use agro-forestry were assessed and lack of land for growing of trees was the dominant, which accounted for about 73% (Table 4.13). KIs and FGDs in their own part informed that the local government was not able to distribute enough amounts of species of plants for the communities who are residing in the watershed. As a result, many areas in the watershed are highly degraded and prone to erosion (Figure 4.4. B). Consistent to these results, Destaw (2010) added that shortage of land and absence of different species of trees were the most critical problems for practicing agro forestry activities in the watershed.

Figure 4.4. Areas covered with forest (**A**) Barren land prone to severe erosion (**B**)

4.2.3.2. Area enclosure/management/ grazing enclosures

The survey data revealed that about 58.66% of the sample respondents were participated on area enclosure (Table 4.14). This result is in agreement with the works of Getachew and Malke (2015) which say majority of the community members (75.7%) participated in the effort to establish the enclosed areas as well as in the decision making process for site selection (94.6%). Likewise, Tefera *et al.* (2005) indicated that most people participated in protecting and maintaining their enclosures in their current form (87%). The study revealed that in both agro ecologies, 80.95% of the respondents were participated on communal land. The field survey data showed that in *kola* agro ecology the proportion of participation (93.2%) is by far greater than *woina dega* agro ecology which was 42. 2% (Table 4.14).

Table 4.14. Households' participation on area enclosure

Type of land	Households response (%) on participation of area enclosure		
	woina dega	*Kola*	Average
Communal land	41.3	59.3	47.49
Both lands	0	33.9	11.17
I didn't participate	57.8	6.8	41.34
Respondents response (%) why they didn't participate on area enclosure			
Challenge		%	
Lack of know how to apply/practice		29.7	
Lack of land/ Reduce farm land size		74.3	
Lack of budget/ materials/equipment to practice		1.3	
Require large labor/machine		10.8	
Difficulty of topography		1.3	
Lack of good species of grass/forest		2.7	
Total		41.34	

Source: Household survey (2017)

Challenges not to practice area enclosure were assessed and lack of farm land was the dominant, which accounted for about 74% (Table 4.14). FGDs in their own part informed that the perception of households towards area enclosure was very low. As a result many areas in the watershed are highly degraded. Consistent to these result, Betru *et al*. (2005) added that lack of farmland is the most critical problems for practicing grazing enclosures. Area enclosures in the watershed were practicing by local households mainly on degraded common lands (Figure 4.5).

Figure 4.5. Area enclosures/management/ Grazing Enclosures in *Woina Dega* (A) and *Kola* (B and C) agro ecologies.

4.2.3.3. Road side plantation

In the watershed there are three major roads. According to the survey data, about 61% of the sample respondents were settled along on these roads. However, only 20.18% of the households were participated on road side plantation (Table 4.15). Contrary to this, Marta *et al*. (2016) indicated that majority of local community were participated on road side plantation activities. In *woina dega* the proportion of participation (32.76%) is greater than in *kola* (5.88%). As RKA DAs informed that this variation is the result of adaptation of different species of plants.

Table. 4.15. Households' participation on road side plantation

Type of land	Households response (%) on participation of road side plantation		
	woina dega	*Kola*	Average
Private land	18.96	5.88	12.84
Communal land	13.79	0	7.34
I didn't participate	67.24	94.12	79.82
Reasons of respondents (%) why they didn't participate on road side plantation			
Challenge	%		
Lack of know how to apply	45.9		
Lack of land/ Reduce farm land size	27.5		
Require large labor/machine	4.8		
Difficulty of topography	3.4		
Lack of good species of grass/forest	96.5		
Total	79.8		

Source: Household survey (2017)

Challenges not to practice road side plantation were assessed and lack of good species of forest was the dominant, which accounted for about 96.5% (Table 4.15). KIs and FGDs in their own part informed that low perception of communities about the advantage of road side plantation was the other challenge. They added that lack of species of plants was the other challenges to grow trees along the roads. Consistent to these results, Marta *et al.* (2016) added that scarcity of different species of trees is the most critical problems for road side plantation.

4.2.4. Households Participation on Integrated Watershed Management practices

As the survey data indicated about 50.6% of the sample households responded that they had participated on integrated watershed management activities (Table. 4.16). The rest 49.4% of the sample respondents were not participated. In *kola* agro ecological zone about 62.7% of the respondents were participated on integrated watershed management activities. This shows that in *kola* agro ecology households have better integrated participation on watershed management activities than *Woina dega* agro ecology (44.6%). This is because in *kola* agro ecology the perception of households towards watershed management was slightly greater than that of *woina dega* agro ecological zone (Table 20). The FGDs in both agro ecologies indicated that majority of the households in the watershed were not participated on all activities in an integrated way rather they were concentrated on the common watershed management activities like physical soil and water conservation activities. Likewise, ENTRO (2006) indicated that most of watershed management activities in Africa are still based on conventional approach emphasizing physical planning without attention other watershed management activities. Tadesse *et al.* (2013) also added that watershed management was focused only on soil and water conservation. In line to this, Woldeamlak (2003) observed that the majority of SWC work was construction of physical structures, mainly *fanya juu* bunds, in cultivated fields. However, integrated watershed management practices comprises not only soil and water conservation but also considering socio-economic and cultural aspect of human beings in the area, understanding the way of animals life with respect to feeding systems, design considerations of some structures such as climate, degree of slope, soil texture and propose future use of structures.

Table 4.16. Households' participation on integrated watershed management activities.

Households watersed management status	Respondents response % in each agro ecology		
	Woina dega	*Kola*	Total
	%	%	%
Adopters	44.6	62.7	50.6
None adopters	55.4	37.3	49.4
Total	100	100	100

Source: Household survey (2017)

4.2.5. Households' Participation in Stages of Watershed Management practices

The survey data indicated that the proportion of participation of the households in pre planning discussion of the watershed management, during planning of the watershed management, during implementing of the activities in the watershed management and monitoring and evaluation of activities of the watershed management are 23.3%, 53%, 100% and 29% respectively (Table

4.17). In both agro ecologies the participation of households during Implementing of the activities in the watershed management is very higher than the other procedures of watershed management activities. In addition to this, as KIs and FGD participants informed that community participation in watershed management was existed more during implementation of the activities but less during other stages of participations. The result is consistent with the works of Yalew (2010). According to both agro ecology FGDs during implementation of the activities, households were enforced to participate on the watershed management, but there is no enforcement in any other stages of watershed management activities. Contrary to this, one KIs from kola agro ecological zone informed that local farmers have not willingness to participate in any other activities except in implementation activities. Likewise Woldeamlak (2003) indicated that the majority of the farmers considered SWC activities that were underway in their communities to be mandatory development works in which the village administration and DAs forced them to participate. This suggested that the practice did not respect participatory principles and was thus a conventional top down type. As a result all households were not participated in each stage of watershed management.

Table. 4.17. Participation of the communities in Zema watershed management

Stages of participation in watershed management	Response % of the respondents in each agro ecology		
	Woina deda	*Kola*	Total
	%	%	%
Pre-planning discussion of the watershed	26.4	17	23.3
During Planning of the watershed	52	56	53
During Implementing of the activities in the watershed	100	100	100
Monitoring and evaluation of activities	34	19	29

Source: Household survey (2017)

The survey data indicated that in pre-planning discussion of the watershed management almost all (97.6%) participants have low level participation (Table 4.18). With regard to agro ecology, in *kola* medium level participants were greater than *Woina Dega* agro ecology. In planning of the watershed management activities in both agro ecology there was no high level of participants and 67% of the participants were participated in medium level participation. Even in the implementation stage, majority of the participants (54%) have medium level participation. However in this stage of watershed management activity, the level participation is better than the other stages. Regarding to the monitoring and evaluation stage of watershed management, few participants were participated in high level. In general the levels of participation of households are relatively high in implementation stage of watershed management activities. This indicated that participant households in Zema watershed didn't participate very well from Pre-planning up to monitoring and evaluation stages.

Table 4.18. Households level of participation in watershed management procedures

Procedures of participation in watershed management	Level of participation	Level of participation in each agro ecology		
		Woina dega	*Kola*	Total
		%	%	%
Pre-planning discussion of the watershed	High	0	0	0
	Medium	0	10	2.4
	Low	100	90	97.6
During Planning of the watershed	High	0	0	0
	Medium	82.2	39.4	67
	Low	17.7	60.6	33
Implementing of the activities in the watershed	High	38.8	17	32
	Medium	52	58	54
	Low	9.09	25	14
Monitoring and evaluation of activities	High	2.44	0	1.9
	Medium	52.2	90.09	60
	Low	46.3	9.09	38

Source: Household survey (2017)

4.2.6. Effective Watershed Management practices in the Watershed

The survey data revealed that in both agro ecological zones, terracing (95.6%), contour ploughing (91%) and area enclosure/grazing enclosures (41%) are the most effective watershed management activities in the watershed (Table 4.19). Debebe *et al.* (2013) evidenced that physical soil conservation measures were the most effective watershed management technologies (soil bund, *fanya juu* cut-off drain, and eyebrow basin). The same authors indicated that soil bunds and stone bunds are the most effective watershed management activities. Similarly, in the same study area Tilahun (2015) evidenced that the most effective structural soil conservation measure was soil bunds. Likewise, FGDs indicated that the most effective watershed management activities in the watershed were contour ploughing, terracing (stone and soil bund), area enclosure and planting trees. Related study conducted by Gebreslassie and Tamirat (2015) in south western Ethiopia noted that the most common and effective watershed management activities are soil bund, *fanya juu* bunds and Dip trench in areas with high erosion risk. The other study in northern Ethiopia conducted by Gebremedihin (2004) noted that area enclosure was the most effective watershed management activity. On the other hand the least effective watershed management activities in the study area were mulching/manure (8.3%) and cultivate crops without plowing/no-tillage (10%). As shown in Table 4.19, the effectiveness of watershed management activities varies from one agrological zone to the other. For example in *woina dega* 38.8% of the respondents said that planting trees was effective watershed management, while in Kola only 5.36% of the respondents reported that it was effective. Contrary to this, in Kola agro ecology about 52.5% of respondents perceived that area enclosure/grazing enclosures was the effective activities, while in *Woina dega* 24.4% of the households perceived that it was effective ways.

Table 4.19. Households' response (%) on effectiveness of watershed management practices.

Types of effective watershed management technologies	Responses of households on the effectiveness of watershed management activities		
	Woina dega	*Kola*	Total
	%	%	%
Soil bund	33.88	42.37	36.67
Stone bund	38.84	32.2	36.67
Cut off drainage	13.89	11.86	17.78
Area enclosure/mgmt	24.44	52.54	41.16
planting trees	38.88	5.36	24.44
Terracing	94.21	98.3	95.56
Cultivate crops without plowing/no-tillage	8.33	5.08	10
Contour plowing	91.74	89.83	91.11
Mulching/manure	6.61	11.86	8.33

Source: Household survey (2017)

4.3. Perception of Respondents towards Watershed Management

The study revealed that 92.8% of households' were participated in watershed management activities on their own will (Table 20). The remaining 7.2% of households asserted that they were forced to do so by other bodies. As DAs informed that in the belief of many of the later group, the watershed management activities were not for the sake of watershed management, but to meet demands of the Government's plan. In such a circumstance the majority felt forced to participate, it becomes clear that the work was not based on participatory principles. KIs and FGDs in their own part added that there are households who are not volunteer to participate on watershed management activities in the watershed. Similarly, Simeneh and Getachew (2016) found that even though farmers have willingness to adopt the newly introduced watershed management technologies, they are reluctant to practice these measures on their farm lands. The same authors noted that the main reasons of households to resist participating in SWC work were: the work sites far from their home because of this they spent much of their time by journey and some community members also disappointed by output of their work. The other factor for unwillingness of participation on watershed management was unfamiliarity with technology (Gebreslassie and Tamirat, 2015). The related study by Woldeamlak (2003) which showed that the major cause of disinterest shown by most of the farmers towards the SWC activities is their perceived ineffectiveness of these technologies.

Table 4. 20. Ways of participation of households (%) in watershed management

Ways of participation of households in watershed management	Agro ecology		
	Woina Dega	Kola	Total
	%	%	%
Voluntary	92.56	93.22	92.78
Forced	7.44	6.78	7.22
Total	100	100	100

Source: Household survey (2017)

As shown in Table 4.21, there are different degrees of agreements of households towards watershed management. Based on this, in all contribution of watershed management activities more than 51% of the respondents perceived they are important for income generation, enable us better utilization of natural resources, employment opportunity and increase productivity. The KIs informed that majority of households in the community perceived that watershed management activities can create income generation, enable us better utilization of natural resources, employment opportunity and increase productivity. The result is consistent with the works of Alemayehu (2007) which revealed that the majority of households perceived watershed management activities increased soil fertility, improved moisture status and increased crop yield. Brkalem (2015) evidenced that about 92% of the household respondents had perceived watershed management technologies increase productivity. The study conducted by Nyssen *et al.*

(2006) in northern Ethiopia showed that 75.4% of the farmers were in favor of stone-bund building on their land, which is a clear indication that the local community perceives this conservation measure as beneficial. A related study by Woldeamlak (2007) showed that 94% of the interviewed farmers in northern Ethiopia believe the physical SWC measures have the potential to improve cropland productivity, and lead to increased crop yield. Likewise, study conducted by Simeneh and Getachew (2016) evidenced that all of the respondents believed watershed management technologies had the potential to improve land productivity. Similarly, Simeneh (2015) indicated that more than 50% of households perceived watershed management activities have multipurpose advantages for their local communities. Likewise, Nerkar *et al*. (2016) indicated that majority of farmers perceived that an integrated watershed management activities are important for rehabilitating the degraded land. Another survey in Hagere Selam, Tigray by (Esser *et al*. 2002, cited in Kebede *et al.,* 2013) showed that 80% of farmers perceived that SWC activities are profitable. Gebeyanesh (2017) added that majority of the farmers perceived the introduced soil and water conservation (SWC) practices increase yield.

Table 4.21. The perception of households on advantage of watershed management

Agreement on the contribution of watershed management activities	% Response of respondents				
	Strongly agree	Agree	Disagree	Strongly disagree	Neutral
Create income generation activities	12.2	40	43.33	3.9	0.6
Creates local rules/institution to protect &manage natural resources in the watershed	10	51.1	38.3	0.6	0
creates employment opportunity and reduce dependency	15	43.9	33.3	7.8	0
Increase productivity	40.6	44.4	11.1	3.3	0.6

Source: Household survey (2017)

4.4. Determinants in the use of Watershed Management in the Study Area

The binary logistic regression model was used to establish the relationships between the use of watershed management and a set of predictor variables. It was selected as it can be used with continuous, discrete and dichotomous variables mixed together (Alemu, 2007). Eight predictor variables were selected to explain the dependent variable (watershed management). Out of the total predictor variables, six variables were significant at 1% and 5% probability levels (Table

4.22). The omnibus test of model coefficients has a Chi-square value of 151.5 on 8 degrees of freedom, which is strongly significant at $p < 0.001$ indicating that the predictor variables selected have a high joint effect in predicting the status of household management of watershed. The predictive efficiency of the model showed that out of the 180 sample households included in the model, 160 were correctly predicted. The sensitivity (correctly predicted non adopters of watershed management) and specificity (correctly predicted adopters of watershed management) were found to be 94.4% and 83.5%, respectively. The multicollinearity among independent variables was checked and no significant violations occurred. The fitness of the regression model was assessed using model summary (R^2) and ANOVA. The R^2 result showed that 75.9% of the variance was predicted by the combined independent variables. The ANOVA result also indicated that the combination of the independent variables significantly predicted the dependent variable at $p < 0.001$.

The binary logistic results showed that as farmland size increases the participants of households in integrated watershed management increases. As farmland size increased by one unit, the odds of being participate in watershed management increased by a factor of 0.374, which is significant at $p < 0.05$ (Table 4.22). The result is consistent with the works of Sagni (2015) which says farmers who have better land holding were participated more than small land holders. Sex of the household heads was hypothesized as one of the factors determining households' participation in integrated watershed management. Female-headed households are less participants than male-headed households by the odds ratio of 21.91 and it is significant at $p < 0.05$. The result is similar with the reports made by GKDADO (2016). As hypothesized, agro climatic zone was found to be an important factor in participation of integrated watershed management. In *kola agro* climatic zone participation of households' in watershed management are increased as compared to *woina dega* agro-ecology by the odds of 0.160 and it is significant at $p < 0.01$. As it is shown in Table 4.22, other variables being constant, as distance of farmland from homestead increases by one unit, the odds of a household being participate in watershed management decreases by the odds ratio of 1.046 (at $p < 0.01$). The result is consistent with the works of Tilahun (2015) which says distance of farmers from their residences to farmland is the major factor that influence households' participation on watershed management.

Table 4.22. Factors affecting households' participation in integrated watershed management practice.

Predictor variable	Categories	Coeff.(β)	S.E.	Wald	Sig.	Odds ratio
Agro climatic zone	*Woina Dega (RF)*					
	Kola	1.831	.586	9.757	.002***	.160
Sex of households	Male (RF)					
	Female	-3.090	1.296	5.689	.017**	21.976
Age of households		.013	.026	.248	.618 NS	1.013
Farmland size		.982	.498	3.896	.048**	.374
Distance of farm land from the home		-.045	.016	7.694	.006***	1.046
Availability of farm equipment	Yes (RF)					
	No	-.763	.766	.993	.319 NS	.466
Credit	No (RF)					
	Yes	3.449	1.330	6.725	.010**	31.457
Training	No (RF)					
	Yes	2.116	.939	5.081	.024**	8.300
Constant		-1.821	1.306	1.944	.163 NS	6.177

Source: Household survey (2017)

** at $p < 0.05$ significance level , *** at $p < 0.01$ significance level, *NS* = not significant

Being other variables constant, those who took credit are more likely to adopt watershed management as compared to those who did not take credit with the odds ratio of 31.457 and significant at $p < 0.05$ (Table 4.22). The result is consistent with Huria (2014). As hypothesized, training of household heads was found to be an important factor of households' participation in watershed management. Other variables held constant, those who got training are more likely to participate in watershed management as compared to who did not got training with the odds ratio of 8.3 and significant at $p < 0.05$. The result is consistent with the works of Brkalem (2015) in her study farmers who have got training were participated more than others.

Chapter Five

Conclusion and Recommendation

In this section, highlight on the general points and major findings of the study are initially presented. The possible solutions or suggestions for implication of the existing situation are dealt with following the concluding remarks.

5.1. Conclusion

This study was conducted with a general purpose of understanding households' participation in watershed management in Zema watershed of Gonji Kolela district, Amhara National Regional State, Ethiopia. The study revealed that 50.6% of the sample households were participated on integrated watershed management activities. With regard to agro ecological zone, the proportions of participants in *kola* and *woina dega* agro ecologies were 62.27% and 44.6% respectively. In *kola* agro ecology the perception of households towards watershed management was also slightly greater than that of *woina dega* agro ecological zone.

Based on the findings of this study, more than 51% of households in the watershed perceived that watershed management practices are important for income generation, enable better utilization of natural resource, employment opportunity and increase productivity. However, except in implementation stage of watershed management the level of participation in each stage of watershed management activities was very low.

The findings of the study showed that terracing, area enclosure and soil and stone bunds were the most dominant and effective watershed management practices which were practicing in the watershed. So watershed management practices in the watershed were focused on physical soil conservation measures. Even these watershed management practices were seasonal in the district in general and particularly in the watershed (commonly from January 1 to February 30). During the summer season the constructed structures were narrowed and sometimes disappeared by land owner farmers. Households participation on other watershed management practices like agro forestry, mulching/manure/compost, minimum tillage, grass strip and road side plantation was invisible. The major challenges to practice these activities were lack of know how to apply, lack of land/ reduce farm land size, lack of budget/ materials/equipment to practice, require large labor/machine and lack of good species of grass/forest.

The study recognized that agro climatic zone, sex, age of households, farmland size, distance of farmland from the homestead and availability of credit were determinant factors for households' participation in watershed management.

5.2. Recommendation

The survey showed that there is limited understanding about various aspects of watershed management practices**.** Based on the major finding of the study and conclusion drawn with respect to households' participation in watershed management activities the following recommendations are suggested.

- Different stakeholders particularly Agricultural and Rural development office/experts should encourage households to participate on both private and communal lands with different watershed management practices.
- To rehabilitate the degraded areas, the district administration office should allocate budget, distribute different species of plants and grasses, and encourage the model participants in watershed management activities.
- Besides the district Agricultural and Rural Development Office, other sectors should identify the major factors that hinder households' participation on integrated watershed management activities on their land and then tried to minimize these factors.
- Labor intensive and expensive technologies/watershed management practices like bench terracing needs other external bodies. So the local government should announce these highly degraded areas for district or zone level governments or NGOs and should ask additional support.

Generally to achieve the objective of sustainable watershed management, applying integrated watershed management practices are important. To apply integrated watershed management practices, practical participation of households' with different watershed management practices should be implemented at local levels.

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Appendix I. Questionnaire survey

1. **Background information of the respondents**

Please give the required information by writing appropriate answer from the given blank space and encircle appropriate choice in the given alternatives.

1. Name of Region____________Zone__________woreda___________Kebele__________

2. Sex 1. Male 2. Female

3. Educational background of the household head

1. Can't read and write 2. Read and write 3. 1-8 4. 9-12

4. Age: __________________

5. Marital status of the respondent 1. Married 2. Single 3. Divorce 4. Widow

6. Number of permanent household members:________________________

2. Socio economic related Information

2.1. Do you own land? 1. Yes 2. No

2.2. If your answer in Q# 2.2 is yes, how many hectares of land do you have_______ha.

2.3. How much the average estimated distance of your land from your home in hrs/minutes?_____min/hrs

3. Information related to watershed management activities and households participation in watershed management

3.1. Did you participate in watershed management activities in an integrated way?

1. Yes 2. No

3.2. If your answer Q#3.1 is yes, in which part did you participate? Multiple responses are possible

Stages of watershed management	Tick X on the appropriate response	Rank (say high/medium/low)
Pre-planning discussion of the watershed		
During Planning of the watershed		
During Implementing of the activities in the watershed		
Monitoring and evaluation of activities		

3.3. How are you participating in the watershed management activities currently underway in Zema watershed?

1. Voluntarily 2. Forced to participate 3. Not involved

3.4. Do you know the existence of improved watershed management activities? 1. Yes 2. No

3.5. If your response in Q#3.4 is yes, which of the following watershed management technologies are appropriate to practice on your private/ communal/both lands of the watershed? If it is appropriate how do you participate?

Type of watershed management activity	Is it appropriate for your area?		If the response is yes in which land do you have participate?			Even if it is Appropriate for the area I didn't participate both on private and communal land (X)
	Yes	No	Private land	Communal land	Both lands	
Check dam						
Cut-off drain						
Stone bund						
Soil bund						
Terracing						
Mulching/manure						
Agro forestry						
Area enclosure/mgmt						
Grass strip						
Road side plantation						

3.6. In your experience, which types of watershed management technologies are more effective in your areas? Multiple responses are possible.

1. Soil bund 2. Stone bund 3. Cut off drains 4. Area enclosure/mgmt 5. Planting trees/grasses 6. Terracing 7. Cultivate crops without ploughing8.Contour plowing 9.Mulching/manure 10. other (specify)____________________

3.7. What are the challenges/factors/reasons if your response in Q# 3.5is even if it is appropriate for the area I didn't participate both on private and communal land? Multiple responses are possible.

Type of watershed management activity that you are not participating	Challenges/factors affecting households participation in watershed management write (X) on the appropriate response					
	Lack of know how to Apply	Lack of land/ Reduce farm land size	Lack of budget/ materials/ equipment to practice	Require large labor/ Machine	Difficulty of Topography	Lack of good species of grass/forest/ Vegetation
Check dam						
Cut-off drainage						
Stone bund						
Soil bund						
Terracing						
Mulching/manure						
Agro forestry						
Area enclosure/mgmt						
Grass strip						
Roadside plantation						

3.8. Is there an availability of credit to practice watershed management? 1. Yes 2. No

3.9. Do you have enough farm equipment to practice watershed management activities?

1. Yes 2. No

4. Information related to the awareness and perception of watershed management activities of respondent

4.1. Do sustainable watershed management help you to provide the following activities? Answer by saying strongly agrees /agree/disagree/neutral/strongly disagrees.

Issues	Response				
	Strongly agree	Agree	Disagree	Strongly disagree	neutral
Creates income generation activities to invest on watershed management					
Creates local rules/institution to protect &manage natural resources in the watershed					
creates employment opportunity and reduce dependency					
Increase productivity					

4.2. Do you get training on watershed management technologies? 1. Yes 2. No

Qualitative checklists

A. In-depth interview with key informants (household interview)

Background Information of the interviewees

Name of Kebele ---

Name of Respondent ---

Sex_____age_____marital status______family size_____educational Status_______

1. How do you rate the level of participation in watershed management?

2. How do you get credit services from the surrounding micro finance to manage watershed?

3. Have you conducted/ participated in trainings, community forums, discussions with respect to watershed management practices? In which types of activities?

5. From your point of view what are the main challenges when you work with community in watershed management activities?

6. How do you describe the knowledge, attitude and watershed management technologies in your area?

B. Interview with KA chairpersons

1. How households are participating in watershed management?

2. How do you describe the challenges to practice watershed management in your area?

3. Are there institutions, Rules, Regulations/Sanctions on resource use, NRM? How can you describe their roles?

4. What are the activities that the government performs related to watershed management?

5. What are the activities that the government did not performs on watershed management?

C. Interview with development agents (DAs)

1. Is there natural resource degradation in your area? What measures have been taken to overcome these problems?

2. How can you describe the present conditions of watershed management?

3. What are the major challenges of households' participation in watershed management?

4. What are the major types of watershed management activities that are practiced in your kebele?

5. How did you perceive the attitudes of households towards watershed management?

6. How is the trend of households' participation in watershed management in the area?

8. What is the status and trends of natural resources (forestland, water bodies, arable land, wildlife. etc.), possible cause of NR degradations, efforts made to manage, and threats for sustainable NRM…..?

9. Do you think that NR is used in sustainable manner in the watershed?

D. Checklist for focus group discussion

1. What is the current and previous attempt made by your community to manage natural resource? What do you think about watershed management?

2. What is the trend of participation of households in watershed management in your area?

3. What are the major watershed management activities/ technologies that are implementing in your area?

4. Do you believe the existing watershed management activities are Appropriate and sustainable?

5. How can local community be involved in watershed management?

6. How can you anticipate households' participation in watershed management in the future?

7. Do you think that the government is doing hard to alleviate the problem of watershed management in the area? How?

Appendix II. FGD participants’photo