Households' Participation in Watershed Management in Gonji Kolella District of the Amhara National Regional State, Ethiopia

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Abstract

Land and water degradation threaten food security for many of the poorest and most food insecure living in South Asia, Africa and Latin America. Local community participation in watershed management is critical to minimize and to prevent environmental degradation in a sustainable manner. Hence, this study examined households' participation in watershed management practices in Zema watershed, Gonji Kolela district of the Amhara National Regional Sate, Ethiopia. The researchers employed mixed methods research design for the study. Simple random sampling method was used to select the two rural kebele administrations for the study. A total of 180 households were sampled using proportional stratified systematic sampling technique. Key informant interview, survey questionnaire and non-participant observation were the primary data collection instruments for the study. Descriptive and inferential statistics were employed to sort and analyze the data. Binary logistic regression model was employed to identify variables affecting households' participation in watershed management. The study showed that about 51% of the respondents participated in integrated watershed management practices. Terracing, area enclosure, and soil and stone bunds were imperative watershed structures in the study area. The study revealed that watershed management activities are important source of income, enable better utilization of natural resources, create employment opportunity, and increase productivity. The binary logistic regression result indicated that agro ecological zone, farm size, sex of household heads, trainings and distance of farmland from the homestead were determinant factors for households' participation in watershed management. The study found out that the efforts made to construct watershed management and the results obtained so far were not encouraging. This is due to the limited awareness of the farmers about the project mandate, and from lack of trust in xy and frustration of farmers that it consumes their farmland. The study recommended policy makers and local governments to give due attention in changing the behavior of the farmers through continuous trainings for the sustainable use of the watershed management. More importantly, farmers have to be empowered in planning and decision making to develop a sense of ownership rather than urging top down approach.

Keywords: Households, participation, watershed management, Gonji Kolela district

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1. Introduction

At present, billions of poor and marginal farmers in the world rely on degraded land and water resources. For sustainable use of these degraded resources, watershed management is imperative. Watershed management is the integrated use of land, vegetation and water in a geographically discrete drainage area (Darghouth *et al*., 2008). Likewise, Seesomonn (2010) indicates that watershed management deals with issues such as soil, water, forest, human resource and integrated knowledge in management of the resources. Yalew (2010) reveals that participatory watershed management is considered as a management strategy aiming at reducing poverty, conserving natural resources and promoting good institutions, social linkage and economic returns. It has emerged as a new paradigm for sustainable rural livelihoods and it occupies the central-stage of rural development in the fragile and semi-arid environments of the developing countries (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). It is the pipeline for prosperity of the people bridging the gap between poverty line and per capita income (Swami *et al.,* 2012). As Tesfaye (2011) indicates, integrated and sustainable watershed management has been suggested as an effective way to address complex water and land resource challenges as well as food security.

However, the development of mechanical and biological treatment prevents the formation of collaborative management in watersheds (Safa, 2016). As it was described by the same author, without the participation of the people environmental sustainability could not be possible. This showed that community participation in watershed management is a major determinant factor for the success or failure of the program. But the factors which make participation efforts successful still remain 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). 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 many developing countries (Mireku *et al.,* 2015).

In Ethiopia, watershed management has focused on soil and water conservation measures (Tesfa and Tripathi, 2015). Woldeamlak (2003) reveals that majority of watershed management practices in Ethiopia relied on construction of physical structures, mainly *fanya juu* bunds. According to Yalew (2010) watershed management is the integrated management of institutional, social, economic, technical, technological, environmental and physical aspects. However, by exclusively focusing on the challenges and opportunities of integrated watershed management, these studies fail to address households' participation on watershed management activities using agro-ecological dimension. Gadisa (2016) indicates that

participatory community-based watershed management has resulted in 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. Biele (2014) reveals that in Amhara region effective soil and water conservation structures are important for sustainable utilization of natural resources however, the study fails to address the socio economic activities of the watershed.

This study is focuses on a specific site (case study approach) which is environmentally degraded and prone to erosion, namely Gonji Kolela. The case study allows for an in-depth investigation of a situation than meso scale studies. Though, community participation in watershed management is found to be significant, the program in many cases is not successful as Bagherian et al. (2009) indicated. Hence, investigating this mystery will help for sustainable use of the project. More importantly, watershed management in the study area is implemented as a top-down and participatory approaches. Which approach is successful for sustainable watershed management (Bouma *et al*., 2005) could be investigated for policy recommendation. The Amhara National Regional Sate (ANRS) where this study's site is located, launched the new integrated participatory watershed management activity in different parts of the region, however, the effectiveness of these activities were not yet examined (Lemma *et al*., 2016). Hence, this study is intended to fill these gaps and add knowledge to the existing literature focusing on site specific watershed management practices. The general objective of the study was to examine households' participation in watershed management of Zema watersheds, Gonji Kolela district of the ANRS. The specific objectives of the study include: (i) investigating the practices of watershed management at household level in the study area; (ii) assessing the contribution of watershed management for the livelihood of households in the study area; and (iii) identifying major factors that determine households' participation in watershed management.

Conceptual Framework

As shown in Figure 1, a number of factors affect households' participation in watershed management. Among others, physical factors, demographic factors, institutional and socio-economic factors are some to mention.

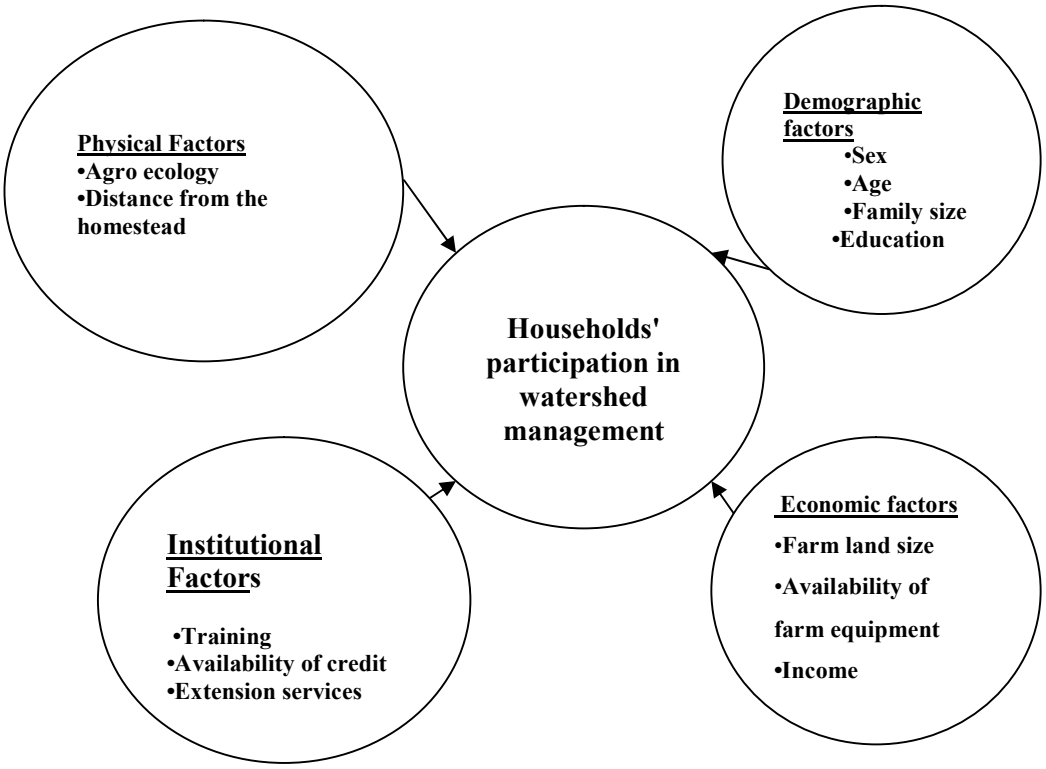

Figure 1: The relationship between households' participation in watershed management and predictor variables.

2. Description of the Study Area

Zema watershed is located in Gonji Kolela district of West Gojjam Zone, Amhara National Regional state (ANRS). The district town, Addis Alem is located 72 Km far from Bahir Dar – the Region's capital. Gonji kolela district 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, and Yilmana Densa in the north and northwest (Figure 1). According to Gonji Kolela District Agricultural and Rural Development Office (GKDADO) (2016) the total area of the district is about 662,236 hectare. Out of this,34,336 heactare is arable land; 29,846 heactare is grazing land; and 677 heactare is covered by forest. The topography of Gonji Kolela district, like the other districts in the zone, comprises mountains, plains, mountain ridges and deep gorges. It has wide variations of altitude ranging from 1372 to 2998 masl.

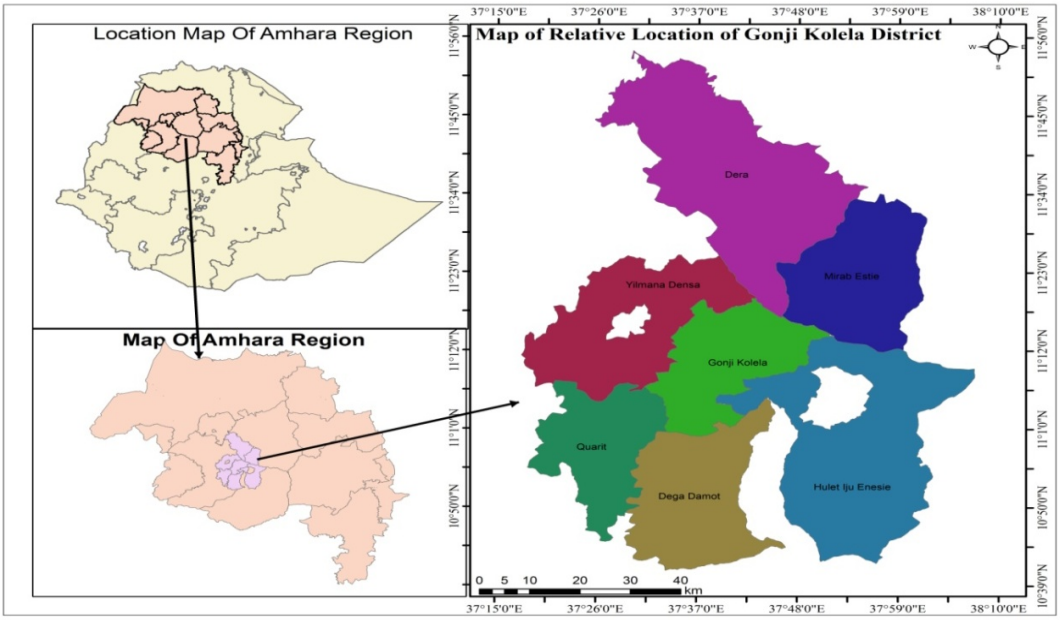

Figure 2. The relative location of Gonji Kolela district in the Amhara Region

The total population of the district was 121,447 of which 61,133 were males and 60,314 were females (GKDADO, 2016). The majority of the inhabitants practiced Ethiopian Orthodox Christianity (98.19%) while Islam followers accounted for 1.76%. Agriculture is the mainstay of economy. About 92% of the area is predominantly used for crop production and the population livelihood depends on mixed farming activities (Tibebu, 2014).

3. Research Methodology

Mixed methods research design was employed for the study. Both quantitative and qualitative data analysis techniques were also employed. The information collected from key informant interviews and focus group discussions was documented and transcribed textually to substantiate the structured questionnaire. Upon completion of the quantitative data collection, the data were entered into the statistical package SPSS version 22 and were presented using descriptive statistics such as frequencies, percentages and tables.

There are four major watersheds in the district: Zema, Yita, Yezat and Awurafengel (GKDADO, 2016). Among these, Zema watershed was randomly selected for this study (Figure 1). The sample *kebeles (*the smallest unit of administration in Ethiopia) were selected in a cluster sampling approach where all the *kebeles* in the watershed are clustered into two major agro-ecological zones (*Kolla* and *Woina-Dega).* Accordingly, Washera (*Woina Dega*) and Woleke (*Kolla*) *kebeles* were selected in random sampling techniques. The total households for these two *kebeles* were 1252 and 608, respectively (Gonji Kolela District Communication Offices, 2016). To determine the sample size for survey questionnaires, Kothari's (2004) formula was employed.

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

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, it was assumed that *p* =.02
e=margin of error considered is 2% for this study.
Z =1.96 (as per table of area under normal curve for the given confidence level of 95.5%).

Finally, using proportional stratified systematic sampling techniques, 180 household heads were selected to fill the questionnaire (Table 1). Among these, 91 households were participating in watershed management whereas the rest were non-participants.

In the selection of qualitative participants, purposive sampling techniques were employed. Key informant participants were model households, development agents and chairpersons from these two *kebeles*. Two focus group discussions (FGDs) (one from each *kebele*) were held. Regarding their compositions, eight from Washera and seven from Wolekie were selected purposively for group discussions.

Table 1. Summary table of sample household heads of the study area.

		Kebele name				Total sample in both *kebeles*
Sex of household	Watershed management	Washera		Wolekie		
		Total HHs	Sample HHs	Total HHs	Sample HHs	
Male	Participants	545	53	364	35	88
	Non participants	556	54	156	15	69
	Total	1101	107	520	50	157
Female	Participants	10	1	20	2	3
	Non participants	141	14	68	7	21
	Total	151	15	88	9	24
Total	Participants	555	54	384	37	91
	Non participants	697	67	224	22	89
	Total	1252	121	608	59	180

Source: Washera and Woleke *kebeles* administration office (2016)
HHs = Household heads

Structured questionnaire, key informant interviews, FGDs and direct observations were the instruments used to collect the primary data. The questionnaire survey focused on socio-economic and demographic characteristic of respondents, level of household participation, challenges of households' participation in watershed management and perceptions of

households about watershed management practices. Key informant interviews and focused group discussions were conducted to indentify experiences and challenges to practice watershed management, perception of households towards watershed management activities, the government's role in managing the watershed and the trends of watershed management in the study area with the help of checklists.

Inferential statistics (such as Chi-square test) was used to reveal the associations between categorical variables, while a binary logistic regression model was used to identify determinant factors affecting household participation in watershed management. Such kind of model is suitable when the dependent variable is dummy in this case, those households who participate in watershed management is coded as 1= yes and 0= otherwise. The predictor variables that determine households' participation in watershed management were grouped into demographic, socio-economic, institutional and natural factors as shown in the conceptual framework. As can be seen in Table 2, positive signs indicate participation in watershed management and negative signs denote that a household is less likely to involve in watershed management. For instance, a female who is the head of a household (as a response variable) is less likely to participate in watershed management as compared with a male student (reference category). Assumptions such as multicollinarity and outliers were checked. The goodness fit of the model were also checked using Hosmer and Lemeshow Test, Omnibus tests for model coefficients and classification table.

Table 2. Expected sign of the explanatory variables

Variable name	**Variable description**	**Expected sign**
Sex	1= female 0 = male	-
Age	continuous	+
Education	Dummy (1 = literate, 0 = illiterate)	+
Family size	continuous	+
Training	Dummy (1 = yes, 0= otherwise)	+
Access to credit	1 = yes 0 = No	-
Farm size	Continuous	+
Slope of the cultivation field	Categorical (1= flat (RF) 2 = Gentle 3 = moderately sloppy 4 = steep slope	+
Distance of farm land	Dummy (1 = yes, 0 otherwise)	-
Livestock holding	Continuous	+
Extension services	Dummy (1 = yes, 0 otherwise)	+

4. Results and Discussion

4.1. Demographic Characteristics of the Respondents

The study revealed that 87.2% were male headed while the rest were female-headed households. Male participants in watershed management were 56% against 13% female headed households. In relation to this, GKDADO (2016) indicated that participation of

females in watershed management works is much less than that of males. The chi square result also evidenced that it was statistically significant at P < .01. (X^2 =14.844; P = 0.000).

As shown in Table 3, majority of participant household heads in watershed management were found in the age categories of 41to 50 and 51to 60. Consistent with this, Sagni (2015) contends that farmers in these age groups have better understanding of watershed management. The result of the Chi square test showed that there was statistically significant relationship between a household's age and participation in watershed management at P < 0.01 (X^2 =45.809; P = 0.01). 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). This study revealed that households with large family size have better participation in watershed management than households with small family size (Table 3).

Similarly, Habtamu's (2006) research on the adoption of physical soil and water conservation structure in Hadiya zone indicates that farmers with large family size practiced different conservation structures. The difference in the distribution of participants and non participants of integrated watershed management with family size is also statistically significant at P < 0.01 (χ^2 =58.302, p < 0.001).

Table 3. Age and family size of households

Age of household heads	**Households watershed management status**				
	Participants		Non participants		Total
	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
$\chi^2(4)$ *=45.809; p= 0.000*					
Family size of household head	Frequency	%	Frequency	%	%
0-3	4	10.8	33	89.2	20.5
4-6	34	41.5	48	58.5	45.5
7-12	53	86.9	8	13.1	34
Total	91	50.6	89	49.4	100
$\chi^2(2)$ ***=58.302; p= 0.000***					

4.2. Educational Characteristics of Respondents

As shown in Table 4, about two-third (63%) of the total sample household heads were illiterate and none of the respondents completed secondary school. Majority of the respondents (97.8%) do not have formal education.

Table 4. Educational level of respondents

Households watershed management status	Households level of education						
	Cannot read and write		Read and write		Primary and above		Total
	Freq	%	Freq	%	Freq	%	%
Participants	26	23	61	96.8	4	100	50.6
None participants	87	77	2	3.2	0	0	49.4
Total	113	100	63	100	4	100	100

χ^2 (2)= 92.172; P = 0.00

This would have its own impact on the households' participation in watershed management activities. In relation to this, Habtamu (2014) argues that educated farmers have better information on watershed management than households who could not read and write. Discussion with development agents in both agro ecologies also indicated that educational status has an impact on watershed management and following their involvement in literate households are more likely to appreciate the benefit of watershed management as compared to illiterate ones.

4.3. Farm Size of the Households

The average land holding size for the surveyed households was 1.05 with a standard deviation of 0.06 which is more or less similar to the country's [Ethiopia] average which is 1.04 ha (MoFED, 2012). As shown in Table 5, households' participation in watershed management increases with an increasing size of farmlands. Consistent to this result, Sagni (2015) indicates that farmers who have better land holding size have participated more than small holder households. This result is also in line with the focus group discussions. Habtamu (2006) and Aklilu and Graaff (2006) also reached similar conclusions that farmers that have larger plots are more flexible in their decision making; and have greater access to discretionary resources, more opportunity to use new practice of SWC structures and more ability to deal with the risk takes place on their farmland. The Pearson Chi-square test also evidenced that there was statistically significant relation at $p < 0.001$.

Table 5. 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.	%	%	%
0-1.0	61	42.4	28	47.5	17	48
1.01-2.0	47	32.8	15	25.4	32.3	27.7
2.01-3.0	13	24.8	14	23.7	45.2	14.8
3.01-4.0	0	0	2	3.4	6.8	10.5

χ^2 (3) =80.277; p= 0.000

4. 4. Watershed Management Practiced in the Study Area

Cut-off drains: The survey data indicated that 43.9% of the sample households participated on cut off drain. The study showed that about 37.8% of the participants participated on communal land. In Woina Dega and Kolla the proportion of households' who did not participate on watershed management were higher (57.8% and 52.5%, respectively with a slight increase in Kolla agro ecology) (Table 6). This is because in Kolla agro ecology, according to a key informant, households had received training on how to use and how to construct cut off drains.

Table 6. Households' participation on cut off drains (% respondents)

Type of land	Agro-ecology		
	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 did not participate	57.8	52.5	56.1
Total	100	100	100
Reasons why they did not participate in watershed management			
Lack off awareness about how to apply the method		33.6	
Cut of drains reduce farmland		48.5	
Lack of practice and equipment materials		38.6	
Scarcity of labor		9.9	

As shown in Table 6, the belief that cut off drains reduce farmland was the main challenge adversely impacting the watershed management in the study area. This result is consistent with the works of Simeneh and Getachew (2016) who found out that cut off drains reduce farmland size which is a challenge to implement this technique.

Figure 3. Cut off drains constructed by the community in the study area

Stone bund and soil bunds: The study revealed that about 55% of the respondents in Woina Dega and about 48% in Kolla zone participated on stone bund during the survey **(Table** 7).

However, almost all of the 20 observed bunds have not gained any maintenance and many of them did not have any integration to stabilize the structures. Likewise, Kebede (2015) in his study indicated that about 50% of farmers had participated in stone bunds. The study made by Meaza and Hadush (2015) found a much higher use of stone bunds (78.8%) compared to that of Lemma et el. (2016) which was only 25.3%. As FGDs discussants indicated, the challenge is that many of the stone bunds constructed were damaged by the owner of the land during the summer season due to scarcity of farmland. Further, they indicated that top-down approach without full participation of the community and weak intuitional mechanisms do not help to develop trust in what they constructed during the dry season. Lemma, Gonfa and Alemayehu (2016) also report that the structures are slowly decaying and may have no sustainability. As shown in Table 7, the prevailing challenges for practicing this technology were households' lack of awareness about the long-term benefit of the method for the future (75.2%) and their belief that it reduces size of farmland (45.7%). This was supplemented by key informants (stone bund decreases farmland and becomes a store house of insects/rodents). Kebede (2015) in his part indicated that farmers do not like having stone bunds built close to their houses as they tend to be good habitat for snake and other insects. The paradox is, about 80% of respondents perceived that soil erosion is a serious problem on their farmland. Though they perceived that soil erosion reduces crop production and productivity, land shortage/reduction of farm size inhibit the construction of bund structures.

Table 7. Households' participation on stone bund/soil bunds and the challenges faced (% of respondents)

	Agro-ecology					
	Woina Dega		*Kola*		Average	
Type of land	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 did not participate	44.6	55.3	52.5	23.7	47.2	45
Reasons why they did not participate in constructing stone /soil bunds in the study area						
Reduce size of farmland					31.7	
Lack of awareness the importance of the method					75.2	
Scarcity of labor					58	
Lack of good species of grass/forest					1.1	

Figure 4. Soil and stone bunds constructed by the community in the study area

Terracing: The study found out that about 76% of the respondents were participating in terracing on both lands during the survey (Table 8). As is the case throughout the Region, terracing is the dominant watershed management activity in the district. According to key informants (KIs) in both agro ecologies there are watershed management committees who run the activity very well. Among the three types of terraces, the community mostly participates in contour terracing however, the construction of bench terraces, which is so vital in steep slope/highly degraded areas is overlooked by the farmers (ANRSADB, 2011). FGD discussants indicated that lack of financial resources, tools and materials and the extra effort required to construct on steep and degraded land were the major challenges that inhibited them from participating in bench terracing. Besides, key informants mentioned lack of technical knowledge and skills to construct the terrace as additional challenges. In relation to this, Habtamu (2006) underscores that proper use of any conservation measure requires a high degree of technical skill in engineering.

Table 8. 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

Figure 5.A. Community participation on the making of terracing

4.4.1. Biological Watershed Management Practices

***Agro-forestry*:** The study revealed that in both agro ecologies, majority of the participants (62.8%) were not participating on agro-forestry activities (Table 9). This result is supported by Tolera (2011) who reported that about 23% of farm households participated in agro forestry activities.

Table 9. Households' participation in agro forestry (% respondents)

Type of land	Agro-ecology		
	Woina Dega	*Kolla*	Average
Private land	19	16.9	18.3
Communal land	23.9	8.47	18.9
I did not participate	57	74.6	62.8
Reasons why they did not participate in agro-forestry (% respondents)			
Lack of know how to apply		14.1	
Reduces size of farmland		73.4	
Lack of materials		1.8	
Lack of improved species/trees		54	

However, Joas (2015) reported that the most dominant watershed management activity used by 52 % of the farmers was agro-forestry. As can be seen from the Table 9, the number of households who did not participate on agro-forestry was higher in Woina Daga than that in Kolla.

Figure 6. Areas covered with forest

Challenges for not using agro-forestry were assessed and lack of land for growing of trees was the dominant, which accounted for about 73% (Table 9). KIs and FGDs in their own part stated that the local government was unable to distribute enough amounts of plants and seedlings that the can adapt in the watershed. As a result, many areas in the watershed are highly degraded and prone to erosion. Consistent to these results, Destaw (2010) indicates that the scarcity of farmland and the absence of different species of trees were the most critical problems for practicing agro-forestry activities on the watershed.

4.5. The contribution of watershed management for the livelihood of the households

More than 51% of the respondents perceived that watershed management is a source of income generating activities. It also allowed for a better utilization of natural resources, created employment opportunity and increased productivity. In this regard, KIs stated that majority of households in the community recognize that watershed management activities can create income, conserve natural resources from rampant soil degradation, and serve as sources of animal fodder and fire wood. Alemayehu (2007) supplements that watershed management activities improve soil fertility and increase moisture status and crop yield. Brkalem (2015) reports that about 92% of the respondents had perceived watershed management technologies increase land productivity. Nyssen et al (2006), on the other hand, state that about 75% of the farmers in their study area were in favor of stone-bund building on their land, which can imply that the local community recognizes the benefits of conservation efforts. Various studies (see, Woldeamlak (2007), Simeneh (2015), Simeneh and Getachew (2016), Kebede et al. (2013), Gebeyanesh (2017), Nerkar et al. (2016) evidence that the physical soil and water conservation (SWC) measures have the potential to improve cropland productivity, rehabilitate degraded land, and lead to increased crop production per hectare.

4.6. 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. This model was selected because 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 10). 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 high joint effect in predicting the status of household management of watershed. Hosmer and Lemeshow Test of 0.57 showed that the model is fitted. The predictive efficiency of the model showed that out of the 180 sample households included in the model, 160 (88.7%) were correctly predicted. The sensitivity (correctly predicted none adopters of watershed management) and specificity (correctly predicted adopters of watershed management) were found to be 94.4% and 83.5%, respectively. The multi-collinearity among independent variables was checked and no significant violations occurred. The fitness of the model was also assessed using pseudo R^2 and about 75.9% of the variance was explained by the combined independent variables.

The binary logistic results showed a positive relationship between farmland size and integrated watershed management. Other variables held constant, a unit increase of farmland increases watershed management by the odds of 1.374. It was also significant at $p < 0.05$ (See Table 10). The result is consistent with the works of Sagni (2015) that farmers who have better land holding participated more than small land holders. The sex of the household heads was hypothesized as one of the factors determining households' participation in integrated watershed management. Other variables adjusted for, being female headed households is less likely to increase watershed management with the odds ratio of 0.91 as compared to male headed households. It is also significant at $p < 0.05$. As hypothesized, agro climatic zone was found to be an important factor in determining participation in integrated watershed management. Other variables adjusted for, a household residing in *Kolla* agro-ecological zone is more likely to participate in watershed management as compared to that in *Woina Dega* zone.

Table 10. Factors affecting households' participation in integrated watershed management practice.

Predictor variable	Description	Coeff.(β)	S.E.	Wald	P-value	Odds ratio
Agro ecological zone	*Woina Dega (RF)*					
	Kolla	1.831	0.586	9.757	0.002***	1.160
Sex of households	Male (RF)					
	Female	0.090	1.296	5.689	0.017**	0.976
Age of households	continuous	0.013	0.026	1248	0.618	1.103
Farm size	continuous	0.982	0.498	3.896	.048**	1.374
Distance of farmland	continuous	0.451	0.016	7.694	0.006	1.046

Availability of farm equipment	Yes (RF)					
	No	-0.763	0.766	0.993	0.319	0.466
Credit	No (RF)					
	Yes	3.449	1.330	6.725	0.010**	31.457
Training	No (RF)					
	Yes	2.116	0.939	5.081	0.024**	8.300
Constant		-1.821	1.306	1.944	0.163	6.177

Note: ** significant at p< 0.05, *** significant at p< 0.01

Other variables constant, a unit increase of distance of farmland from homestead increases participation of watershed management by the odds ratio of 1.046. The result is consistent with the works of Tilahun (2015) that distance of farmers from their residences to farmland is the major factor that influences households' participation on watershed management.

5. Conclusions and Recommendation

This study was conducted with a general objective of examining households' participation in watershed management in Zema watershed of Gonji Kolela district, Amhara National Regional State, Ethiopia. The study showed that 50.6% of the sample households participated on private and communal watershed management activities. With regard to agro ecological zone, the proportion of participants in *Kolla* and *Woina Dega* agro ecological zone were found to be 62.27% and 44.6%, respectively. The implication behind this result is that more awareness creation has been given in this region as compared to *Woina Dega* agro-ecological zone. The findings of this study reaffirmed that watershed management practices are important for income generation, enable better utilization of natural resources, provide employment opportunity and increase productivity. From the study it was learnt that terracing, area enclosure, soil and stone bunds were the dominant and efficient watershed management practices in the study area. The watershed management in the study area was found to be seasonal lead by ad hoc committee which endangers the sustainability of the technology. More troubling is the finding that whatever constructed in the dry season is damaged during the rainy season due to the lack of community trust for the project and the scarcity of farmland. The binary logistic regression result revealed that agro ecological zone, sex, farmland size, distance of farmland from the homestead and availability of credit were determinant factors for households' participation in watershed management. It is recommended that before embarking on watershed management, farm households have to be convinced of the importance of the technology in rehabilitating the degraded ecosystem. Policy makers and local governments need to listen to farmers and ensure that farmers are engaged in planning and decision making process from the beginning to the end. Hopefully when this is the case, the sustainability of watershed management activities, which is a serious problem at present, would not be a major development issue.

References

Aklilu, A., & Graaff, J. (2006). Farmers' Views of Soil Erosion Problems and their Conservation Knowledge at Beressa Watershed, Central Highlands Ethiopia. *Agriculture and Human Values,* 23 (1), 99-108.

Alemayehu, A. (2007). Impact of Terrace Development and Management on Soil Properties in Anjeni Area, West Gojam. Master thesis, Addis Ababa University, Ethiopia.

Alemu, S. (2007). Determinants of Food Insecurity in Rural Households in Tehuldre Woreda, South Wollo of the Amhara Region. Master Thesis, Addis Ababa University, Ethiopia.

ANRSADB. (2011). Soil and Water Resources Conservation and Utilization: Principles.

Bagherian, R., Samah, B.A., Samah, A.A., & Ahmad, S. (2009). Factors Influencing Local People's Participation in Watershed Management Programs in Iran.

Biele, M. (2014). Evaluation of Soil and Water Conservation Measures in Dejiel Watersheds, Choke Mountains, East Gojjam Zone of Amhara Region, Ethiopia. Master Thesis, Addis Ababa University, Ethiopia.

Brkalem S. (2015). Econometrics model on determinants of adoption and continued use of improved Soil and Water Conservation practices: the case of Boloso-Sore Woreda of Wolaita Zone, Ethiopia. *Scholarly Journal of Scientific Research and Essay*, 4(2), 35 -42.

Darghouth, S., Ward, C., Gambarelli, G., Styger, E., & Roux, J. (2008). Watershed Management Approaches, Policies, and Operations: Lessons for Scaling up.

Destaw, M. (2010). Assessment of Forestry and Agroforestry Extension Pakage Implementation Trends in Amhara Region: The Case of Farta District, South Gondar. Master Thesis, Addis Ababa University, Ethiopia.

Gadisa, C. (2016). Historical Perspectives and Present Scenarios of Watershed Management in Ethiopia. *International Journal of Natural Resource Ecology and Management,* 1(3), 115-127.

GKDADO. (2016). Gonjikolela District Agricultural and Development Office: Annual Report on Natural Resource Management.

Gonji Kolela District Communication Office. 2016. Annual Report on Status of Gonji Kolela.

Habtamu, E. (2006). Adoption of physical soil and water conservation structures in Anna Watershed, Hadiya zone. Master Thesis, Addis Ababa University, Ethiopia.

Joas, T. (2015). Effects Of Soil and Water Conservation Techniques on Soil Productivity and Bean Grain Yield in Nyamasheke District, Rwanda. Master Thesis, Kenyatta University.

Kebede, W. (2015). Evaluating Watershed Management Activities of Campaign Work in Southern Nations, Nationalities and Peoples' Regional State of Ethiopia. *Environmental Systems Research,* 6*,* 4-16.

Kenge, J.G. (2009). Participatory Watershed Management to Decrease Land Degradation and Sediment Transport in Kagera and Nyando Catchments of Lake Victoria Basin. Doctoral Dissertation, Linköping University, Sweden.

Kothari, C.R. 2004. *Research Methodology, Methods and Techniques*. Second Edition. New Delhi: New Age International Publisher.

Kumar, D.S., & Palanisami, K. (2009). An Economic Inquiry into Collective Action and Household Behaviour in Watershed Management. *Indian Journal of Agricultural Economics*, *64*(1), 108-123.

Lemma, Tiki, Gonfa Kewessa and Alemayehu Wudneh. (2016). Effectiveness of watershed management interventions in Goba district, southeastern Ethiopia. *International Journal of Agricultural Sciences,* 6 (9), 1133-1140.

Meaza, H., & Hadush, M. (2015). The Role of Community Based Watershed Management for Climate Change Adaptation in Adwa, Central Tigray Zone. *International Journal of Weather Climate Change Cons Res*, 1, 11-35.

Mireku, P. Acheampong, M., & Adu-Boahen, M. (2015). Institutionalising Community Participation in Watershed Management: A Study of the Inchaban Watershed in the Western Region of Ghana.

MoFED. (2012). Development And Poverty Profile of Ethiopia Based on 2011/12 Household Income. Consumption and Expenditure and Welfare Monitoring Surveys. Addis Ababa, Ethiopia.

Nyssen, J., Poesen, J., Desta, G., Vancampenhout, K., Daes, M., Yihdego, G., & Govers, J. (2006). Interdisciplinary On-Site Evaluation of Stone Bunds to Control Soil Erosion on Cropland in Northern Ethiopia. *Soil Tillage Res*, 94, 151-163.

Safa, S. (2016). Study Patterns of Public Participation in Integrated Watershed Management. *American Journal of Environmental Protection*, *3*(6), 187-192.

Sagni, W. (2015). Community Based Soil and Water Conservation Practice: The Case of Guliso Woreda, Western Wellega Zone, Oromia Regional State me recommend that it be accepted as fulfilling the thesis requirement. Master Thesis, Haromaya University, Ethiopia.

Seesomonn, K. (2010). Participatory Watershed Management Process: A Case Study of Huai Mae Di Noi WAtershed. Ban Rai District, Uthai Thani Province, Kasetsart University.

Simeneh, D. (2015). Perception of Farmers Toward Physical Soil and Water Conservation Structures in Wyebla Watershed, Northwest Ethiopia. *Academic Journal of Plant Sciences* 7 (3): 34-40.

Simeneh D., & Getachew, F. (2016). Perception of Farmers towards Physical Soil and Water Conservation Structures in Wyebla Watershed, Northwest Ethiopia. *World Journal of Agricultural Sciences,* 12 (1), 57-63.

Swami, M.V., Kulkarni, M.S., Kumbhar, M.S., & Kumbhar, M.V. (2012). Participatory Watershed Management in South Asia: A Comparative Evaluation with Special References to India. *International Journal of Scientific and Engineering Research*, *3*(3), 1-9.

Tesfa, W., & Tripathi. (2015). Watershed Management in Highlands of Ethiopia: A Review. *Open Access Library Journal*, *2*(6), 1-10.

Tesfaye, H. (2011). Assessment of Sustainable Watershed Management Approach Case Study Lenche Dima, Tsegu Eyesus and Dijjil Watershed. Master thesis, Cornell University.

Tibebu, C.(2014). Characteristics, Classification and Agricultural Potential of Soils of Upper Yezat Micro Watershed, North Western Highlands of Ethiopia. Master Thesis, Addis Ababa University, Ethiopia.

Tilahun, A. (2015). Farmer's Perception on the Use Of Structural Soil Conservation Measures in Gonjikolela District, Ethiopia. Master Thesis: Bahir Dar University.

Tolera, M. (2011). Assessing the role of Traditional Land Management Practices in Improving Cropland Productivity: The Case of Diga Woreda, Oromia. Master Thesis, Ambo University, Ethiopia.

Woldeamlak, B. (2003). Towards Integrated Watershed Management in Highland Ethiopia: The Chemoga Watershed Case Study. Doctorial Dissertation, Wageningen University.

Woldeamlak, B. (2007). Soil and Water Conservation Intervention with Conventional Technologies in Northwestern Highlands of Ethiopia: Acceptance and Adoption By Farmers. *Land use policy*, *24*(2), 404-416.

Yalew, A. (2010). Integrated Watershed Development from Sustainable Livelihood Perspective; The Case of Terri Watershed in Delanta Woreda, Master Thesis: Addis Ababa University, Ethiopia.

Yoganand, B., & Tesfa, G. (2006). Participatory Watershed Management for Sustainable Rural Livelihoods in India. A Research Paper.