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LEVEL OF COMMUNITIES' PARTICIPATION IN THE WATERSHED DEVELOPMENT AND MANAGEMENT PRACTICES IN THE CENTRAL HIGHLANDS OF ETHIOPIA

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Watershed resource degradation significantly threatens agricultural development and rural livelihood, making degradation problems more prominent in the Ethiopian highlands. In response to the negative impacts of land degradation, the government of Ethiopia, non-government organizations, and the community have implemented watershed development and management practices (WDMPs). Community participation is essential to make the watershed development and management program successful. Thus, the study assesses households' participation level and its determinant factors in different phases of WDMPs in the central highlands of Ethiopia. Descriptive and inferential statistics were employed to examine the data. The results of the overall peoples' participation index on WDMPs were computed as 65 per cent, meaning a moderate level of household participation was exhibited in the study area. An ordered logistic regression model's findings showed that households with older members, higher educational attainment, a more significant proportion of workers, higher incomes, ownership of more extensive tracts of agricultural land, and membership in various social organizations showed higher levels of involvement. Overall, key findings suggest that to curb the negative factors, the government and other concerned stakeholders need to consider, give the role and

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promote the local community to participate in all phases of watershed development and management programs.

***Keywords*:** land degradation, community participation, watershed management, rural livelihood

1. INTRODUCTION

In Ethiopia, agriculture is the primary sector supporting the population (Pareek, 2023). It is vital in improving economic development, enhancing food security, and alleviating poverty. Nevertheless, environmental degradation, as exhibited in land and water resource degradation and biodiversity loss, remains a key development challenge for Ethiopian agriculture. With more than 85% of the country's land in varying states of deterioration, land degradation is a significant issue in Ethiopia (Wassie, 2020). According to recent estimates based on satellite images, land degradation hotspots have covered nearly 23% of the nation's territory during the past three decades (Gebreselassie et al., 2016). Central highlands are one of the areas experiencing persistent declines in the potential productive capability of watershed resources, which is caused by diverse reasons (Ahmed, 2019, Alemu, 2015, Tizale, 2007).

The costs of land degradation, which has been going on for centuries, have been severe to the extent that it has affected environmental sustainability and agricultural productivity and contributed to poverty in the country (Yesuf et al., 2005, Hurni et al., 2015). The significant factors that have contributed to this, among others, are poor watershed development and management practices (Agidew and Singh, 2018, Gamo et al., 2021). Since the early 1980s, the Ethiopian government has launched a significant soil conservation and rehabilitation program with assistance from numerous foreign organizations. Since then, both the government and donors have created large-scale soil conservation programs that implement a variety of conservation measures such as terraces, bunds, tree planting, and closure of grazing areas to reduce the episodes of land degradation (Adimassu et al., 2014, Wolka et al., 2021).

Since it addresses many of these issues, the watershed development and management program is seen as a helpful instrument. It is also acknowledged as one of the potential factors in deciding food, social, and economic security and offers essential services to rural residents (Wani et al., 2008, Gashaw, 2015, Argaw et al., 2023). Watershed-based local development planning started in Ethiopia in the early 1980s. It gradually passed through different initiatives, and in 2005,

experiences were captured in the comprehensive Community-based Participatory Watershed Development Guideline developed by the then Ministry of Agriculture and Natural Resources Development. The government of Ethiopia and non-governmental organizations are attempting to apply this Guideline in implementing watershed development and management activities (Gebregziabher et al., 2016, Bewket, 2003).

Rural households in different parts of the country realize the intimidation of watershed degradation and apply further watershed development and management practices. An assortment of types of terraces, area closure, and other soil and water conservation structures has been practised on individual and communal lands. Despite some promising advances, many watershed development and management measures have been familiar with combating watershed degradation; nonetheless, implementing these practices still needs to be improved (BALTA et al., 2022, Medema et al., 2016). Even if many conservation campaigns were undertaken throughout the country, community participation was found subservient, but the efforts did not bring significant changes as expected (Teshome et al., 2016, Abera et al., 2020). This suggests that the level of communities' participation in watershed development initiatives determines their sustainability, which calls for effective planning, implementation, and evaluation. (Meshesha et al., 2015, Agidew and Singh, 2018, Tiki et al., 2016).

Community participation is essential to any development program, as watershed development and management programs in the study area. Participating in the process lets stakeholders jointly negotiate how to define their interests, set priorities, evaluate alternatives, and implement and monitor outcomes. The community involvement method starts from identifying the local area to problem analysis and monitoring and assessing the watershed development program (Lakew et al., 2005, Das, 2022, Chadha, 2001, Teressa, 2018). In the study area, varied watershed development and management practices have been practised by rural households as a result of the advocacy of the government of Ethiopia and non-governmental organizations in the nation. The community has been introduced and practised soil bunds, check dams, stone bunds, micro-basins, water ponds, waterways, area closure, crop rotation, strip cropping, mulching, crop residue, compost, tree plantation and other bio-physical soil and water conservation practices in the study area. Even if the community has implemented the measures mentioned, the results fell below expectations. They could not be free from the severity of soil erosion and socio-economic factors.

Several factors affect the success of watershed development and management; the lack of adequate community participation was the pioneer.

Community participation in planning, implementation, and evaluation is critical for the successful and continued use of watershed conservation practices that lead to mitigate land degradation and enhance the livelihoods of the rural poor (McDonald and Brown, 2000, Haregeweyn et al., 2012, Indrawati et al., 2022). With these problems at hand, there needs to be research conducted in this area related to household participation in watershed development and management practices. Therefore, this study explores the watershed development and management practices in the study area, examines the extent of the community's participation and finally identifies factors that affect the community's involvement in the successful implementation of land degradation mitigation.

2. MATERIALS AND METHODS

Study area

The study was conducted in the *Becho woreda, Oromia* regional state, Ethiopia. Specifically, the study was conducted in two selected watersheds: *Shankur-Tereqo* watershed (treated) *and Mende-Tufesa* (untreated) watershed originating in the central highlands of Ethiopia. The watersheds have a total area of 4358 ha, of which *Mende-Tufesa* watershed contains about 2210 ha, whereas *Shankur-Tereqo* watershed contains the remaining 2148 ha (Figure 1). *Shankur-Tereqo and Mende-Tufesa* watersheds exhibited altitude ranges from 2286-2773 m and 2247–2755 m above sea level. Geographically, the selected watersheds are between 8°32′25″ - 8°36′45″ N and 38°7′40″ - 38°12′20″ E (Tadese, 2020, Hailu et al., 2022).

Research design

A mixed research design was employed through which the primary quantitative data were collected via a household survey. In contrast, the qualitative data were sourced through focus group discussions, key informant interviews, and transects walk. Both primary and secondary data were used. The primary data used in the study came from a detailed open and closed-ended household survey, field observation, key informant interviews (KII), and focus group discussions (FGDs). KII and FGD were conducted with community elders, development agents, experts and non-government actors involved in the watershed development and management program. The secondary data were collected from government reports and available literature.

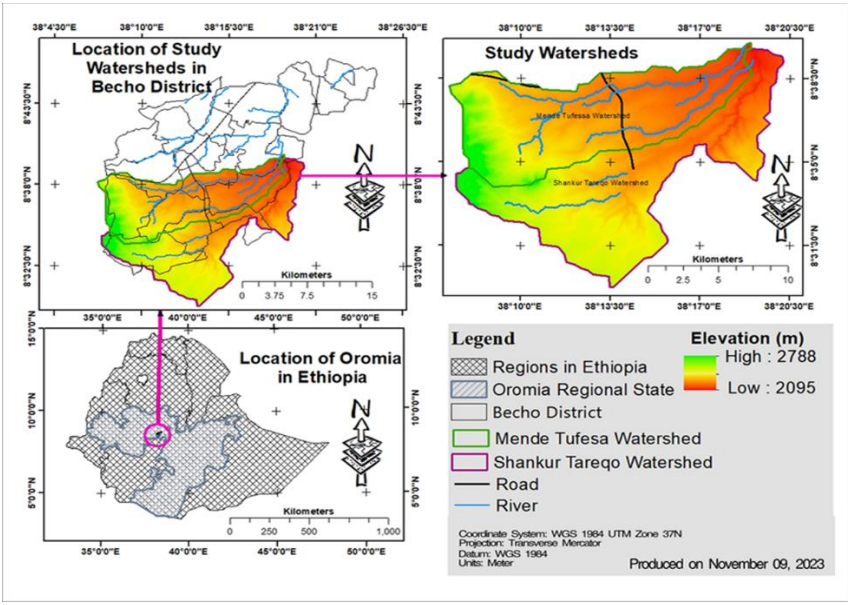

Figure 1 Map of the study area *(Source: Developed based on Ethio GSI produced on November 09, 2023)*

Sample size

Systematic random sampling approaches were used to identify households in the research area. The survey was administered to the heads of each sample household. The total number of household heads in the selected watershed was 1636, with 801 from *Shankur-Tereqo* and 835 from *Mende-Tufesa*. The sample size at the selected watershed sites was determined using a proportional random sampling technique. According to the formula the study involved 312 households, with 153 from *Shankur-Tereqo* and 159 from *Mende-Tufesa*.The sample size was determined by the (Kothari, 2004) formula, which is described as follows;

$$n = \frac{Z^2 p * q}{e^2}$$

where Z is the Z score value at a 95% confidence level of 1.96, n is the sample size, e is the sampling error at 5%, and p is the maximum population variability at 50%. q = 1-p is equivalent to 0.5, or (0.5).

Data analysis

Combinations of methods were used to achieve the objective of the research. Quantitative data analysis was undertaken using the Stata software (Stata version 12.0) and MS Excel. People's participation index was used to find out households' participation level at each phase of WDM (planning, implementation, and monitoring and evaluation). On a five-point Likert scale, the respondents' responses were recorded as never, seldom, sometimes, often, and frequently, with scores of 1, 2, 3, 4, and 5, respectively. An examination of Cronbach's alpha coefficient of reliability was conducted to assess the assertions' internal consistency chosen to measure the construct "level of participation." The Cronbach's alpha result was 0.804 for all 13 statements about levels of participation indicators. Finally the study uses an ordinal logistic regression model to identify determinant factors.

Peoples' Participation Index

People's participation index (PPI) was used to measure the extent of people's participation in WDMP. It was a widely applied index (Das, 2022, Bagdi and Joshi, 2018, Mondal et al., 2020, Mengistu and Assefa, 2020, Roba Gamo et al., 2022)developed by (Bagdi, 2002) given below:

Equation 1

$$\text{PPI} = \frac{\text{Mean Participation Score (P)}}{\text{Maximum Participation Score}} \text{x } 100$$

Equation 2

$$P = \frac{\sum_{i=1}^{N} P_i}{N}$$

Equation 3

$$P_i = \sum_{j=1}^{K} \left(PP_j + PI_j + PM_j \right)$$

where N is the overall number of responses, PPI is the People's Participation Index, PP_j = Total points earned by a respondent as a result of involvement in program planning; PI_j = Total scores attained by a respondent as a result of involvement in program execution; PM_j = Total points a respondent has earned as a result of taking part in program monitoring and evaluation; K is the overall number of statements to which respondents' responses were tallied; P_i is the sum of a respondent's participation scores in the planning, implementation, and maintenance phases.

The calculated overall PPI values were categorized into three categories based on the average distribution curve values. The normal distribution curve and standard deviation (SD) of marks were used to separate participants into low, moderate and high levels of participation.

Table 1 Categorization of people's participation from the normal distribution curve values

Normal distribution curve range	PPI value range category	People's participation
< Mean – SD	0 to 34.13	Low level
Mean – SD to Mean + SD	34.14 to 68.26	Moderate level
> Mean + SD	68.27 to100	High levels

Source: Bagdi, 2002

Econometric model

The ordinal regression model is a logistic regression model used to analyze ordinal dependent variables. When the outcome variable is in the ordinal scale, the ordinal regression model is a favored modeling technique that needs the assumption of parallel lines across all levels of the result variable rather than normalcy or constant variance (Liu, 2009, Williams and Quiroz, 2020). Due to the ordered nature of the study's dependent variable, this model was applied. The model was employed to analyze significant factors that determine households' level of participation**,** having three distinct categories. These are low, medium and high participation categories. The models were estimated using 14 explanatory variables including household heads' gender, household heads' age, educational status, household heads' size, number of laborers, income, household heads' number of income, distance to watershed structure, livestock size, availability of credit, agricultural land size, agricultural land size, training, and social organization membership.

The functional form of the ordinal logit model is defined based on (Liao, 1994, Breen et al., 2018, Greene and Hensher, 2010) as follows:

Equation 4

$$y^* = \sum_{k=1}^{k} \beta_k + \varepsilon$$

where y^*= is unobserved and thus can be considered the underlying tendency of an observed phenomenon, ε = is assumed to follow a particular symmetric distribution with zero means, such as standard or logistic distribution.

What is observed is

Equation 5

$$y = 1 \; if \; y^* \leq \mu_1$$
$$y = 2 \; if \; \mu_1 < y^* \leq \mu_2$$
$$y = 3 \; if \; \mu_2 < y^* \leq \mu_3$$
$$y = j \; if \; \mu_{j-1} < y^*$$

where j-ordered categories contain observations of y (0, 1, and 2 are the level of participants categories coded as 0 = low level of participation, 1 = moderate level of participation, and 2 = high level of participation), $\mu_s$are undefined threshold parameters separating the adjacent categories to be calculated with β_s

The general form of the probability that the detected y falls into category j and μ_s and the β_s are to be evaluated with an ordinal logit model is

Equation 6

$$Prob\ (y = j) = 1 - L\left(\mu_{1-1} - \sum_{k-1}^{k} \beta_k x_k\right)$$

where, L denotes the cumulative logistic distribution in this sentence. The odds ratio on each participation phase is estimated by

Equation 7

$$\frac{\delta\ prob\ (Y = j)}{\delta\ x_k} = \left[f\left(\mu_{1-1} - \sum_{k-1}^{k} \beta_k x_k\right) - f\left(\mu_{1-1} - \sum_{k-1}^{k} \beta_k x_k\right)\right]\beta_k$$

where, f represents the probability density function.

3. RESULTS AND DISCUSSION

Socio-economic and demographic characteristics

The study involved 312 households, primarily male-headed was 94.77% in WDM practitioner households and 88.68% in non-practitioner households, and found a 10% gender difference in household heads between practitioner and non-practitioner households. Only 9.15% and 12.95% of the household heads in practitioner and non-practitioner households, respectively, were reported as having secondary education and above, while the majority of the household heads (75.96%) had no formal education. Over 90% of the participants trekked over 10 kilometers to get to the closest market from their residence. The study found that most households in the study area have single income sources and earn less than 50,000 ETB ($958) annually, with no significant difference between practitioner and non-practitioner households.

The results indicated that most of the households in the study area were small-scale farmers with access to fertile land; however, the majority of these households' agricultural lands were smaller than one hectare. Additionally, at a 1% significant level, the results showed that the size of agricultural land exhibits a statistically significant difference in watershed development and management practices.

Levels of community participation in different phases of WDMPs

Communities participate in watershed development and management during planning, implementation, monitoring, and evaluation. The program's success depends on study area households' participation.

Table 2: The participation level of WDM practitioner households in the study area

	Statements	Mean score	St. Dev.
Planning phase	Suggest an idea during the identification and prioritization of problems	**2.90**	**19.16**
	Suggest an idea during committee selection/ reformation		
	Suggest formulation of by-laws or norms		
	Suggest during decisions on village resource management agreement		
Implementation phase	Participation in the WDMPs	**3.30**	**18.75**
	Provide any material during the construction of structures		
	Contribute money for WDMPs		
	Participate in training programs about WDMPs		
Monitoring and evaluation phase	Prevent the entrance of animals into the protected area	**3.11**	**18.96**
	Protecting and maintaining the WDMPs		
	Visiting or supervising the WDMPs		
	Sharing information about the WDMPs		
	Attending meetings on how to undertake monitoring activities		

(Source: Field surveys, 2022)

Levels of community participation in the planning phase

Following the survey findings in Appendix 1, 67% of practitioner households participated in the planning phase, while about 50% of non-practitioner did. Only 4% of practitioners and 50% of non-practitioners never participated in identifying and prioritizing the problems, participating in committee selection and reformation, formulating by-laws or norms, and deciding

on village resource management agreements. Table in Appendix 2 showed that during committee selection and reformation, only 39% were experienced. This indicates that community participation regarding committee selection and reformation could be much higher.

The non-practitioner and practitioner households' participation during the planning phase resulted in 51% and 67%, respectively, categorizing the involvement of people rendering to standard distribution curve value; both households are on a moderate level of participation in the first phase. During this particular phase, there is a reduced level of interaction between both households, compared to other phases of participation. Consequently, the implementation of the majority of plans was undertaken by either governmental or non-governmental entities. This finding was consistent with the studies conducted by (Pandey and Singh, 2016, Teressa, 2018, Wasihun et al., 2014, Mengistu and Assefa, 2020, Bagdi and Joshi, 2018).

Table 3: The participation level of non-practitioner households in the study area

	Statements	Mean score	St. Dev.
Planning phase	Suggest an idea during the identification and prioritization of problems	**1.96**	**20.08**
	Suggest an idea during committee selection/ reformation		
	Suggest formulation of by-laws or norms		
	Suggest during decisions on village resource management agreement		
Implementation phase	Participation in the WDMPs	**2.33**	**19.72**
	Provide any material during the construction of structures		
	Contribute money for WDMPs		
	Participate in training programs about WDMPs		
Monitoring and evaluation phase	Prevent the entrance of animals into the protected area	**2.22**	**19.82**
	Protecting and maintaining the WDMPs		
	Visiting or supervising the WDMPs		
	Sharing information about the WDMPs		
	Attending meetings on how to undertake monitoring activities		

(Source: Field surveys, 2022)

Levels of community participation in the implementation phase

The result in the Appendix 1 revealed that 78% of practitioner households participate in the implementation phase. In the other way, almost 66% of non-practitioner (as indicated in Appendix Table 2) households participated in the implementation phase. According to the average distribution curve values (Table 1), practitioners were classified as having a high level of involvement. In contrast non-practitioners were classified as having a moderate level of participation. During the implementation phase, non-practitioner households exhibited greater involvement across all measures, despite their relatively low levels of participation in comparison to prior stages. The findings derived from interviews with key informants and focus group discussions revealed that the successful outcomes of the implementation phase were primarily attributed to the geographical characteristics of the study area and the interventions carried out by both governmental and non-governmental organizations. Furthermore, the level of understanding and familiarity among the community about various soil and water conservation methods were considerable. This result was consistent with the studies conducted by (Sisay, 2015, Teressa, 2018)

Levels of community participation in the monitoring and evaluation phase

The findings depicted in Appendix 1 indicate that 68% of practitioner households actively partake in the monitoring and evaluation phase. According to the findings presented in Appendix 2, a majority of non-practitioner households, specifically 58%, engaged in the monitoring and assessment phase. Even if practitioners have a relatively higher level of involvement in this stage, according to the standard distribution curve value (Table 1), both households have a moderate level of participation in the monitoring and evaluation phase. This result was in line with the studies conducted by (Mengistu and Assefa, 2020).

Overall community participation level in watershed development and management programs

During the planning phase, 59% of the community actively engaged in the process. In the subsequent implementation phase, 72% of the community had direct involvement (Table 4). Lastly, during the monitoring and evaluation phase, 63% of the community participated in the activities. According to the standard distribution curve of the values developed by (Bagdi, 2002), people's participation in the planning, monitoring and evaluation phase was moderate. Participants were most active during implementation. The practitioner households participated more at the implementation stage (78%), followed by the monitoring

and evaluation (68%) and planning stage (67%). Similarly, non-practitioner households participated more at the implementation stage (66%), followed by the monitoring and evaluation (58%) and planning stage (66%) (Table 4). This study conforms to the study by (Pandey and Singh, 2016, Mengistu and Assefa, 2020, Tesfaye et al., 2018)

Table 4: The participation level of overall households in the study area

Participation Phases	Intensity Indexes		
	WDM Non-Practitioners (Mende Tufesa)	WDM Practitioners (Shankur Tereqo)	Overall PPIs
Planning phase	51%	67%	59%
Implementation phase	66%	78%	72%
Monitoring and evaluation phase	58%	68%	63%
Overall PPI (%)	58%	71%	65%

(Source: Field surveys, 2022)

Determinants of households' level of participation among the farming households

The households' levels of participation in the watershed development and management program at different stages were influenced by various demographic, socio-economic and institutional factors. Independent factors were used to determine households' participation in the study area, and fourteen explanatory variables were postulated to estimate the models based on literature and study area observations. Seven factors greatly affected households' watershed development and management practices. These household heads' age, educational status, number of laborers, income, and distance to watershed structure, agricultural land size, and social organization membership statistically affected household involvement. Various post-estimation tests were conducted to ensure the ordered logistic regression model was correctly specified, fit, and robust. Variance inflation factors (VIF) were conducted to test for multicollinearity among the predictors, and the results in Table 5 showed that they were all below the threshold value of 10, with an average value of 2.532. The pseudo-r-square result reads 0.905, and the chi-square is 704.668 with a p-value of 0.00, suggesting that the model's fitness was good.

Table 5: Ordered logistic regression results

Variables	Coefficient (P-value)	Marginal effects (dy/dx)			
		Low level	Moderate level	High level	VIF
HH_GENDER	-0.83420	0.0268	-0.0363	-0.0131	2.965
	(0.116)	(0.004241)	(0.000586)	(0.000853)	
HH_AGE	1.9279**	-0.0653	-0.0965	0.0857	3.553
	(0.032)	(0.00247)	(0.000852)	(0.000857)	
HH_EDU	1.2584***	-0.06651	-0.0128	0.0857	1.952
	(0.005)	(0.000507)	(0.000963)	(0.000852)	
H_SIZE	-0.4658	0.0657	-0.0628	-0.0088	2.015
	(0.272)	(0.000720)	(0.000411)	(0.000089)	
H_N_LABOR	1.8246*	-0.03859	0.08585	0.08934	3.86
	(0.068)	(0.000858)	(0.000856)	(0.00015)	
DISTAN_WTRSTRUC	-0.0208*	0.028	-0.0059	-0.0071	2.933
	(0.087)	(0.00199)	(0.000109)	(0.000489)	
HH_N_INCM	-0.5239	0.0654	-0.0742	-0.0285	1.152
	(0.552)	(0.000951)	(0.000873)	(0.000919)	
HH_INCM	0.8109***	-0.0398	0.0305	0.0381	3.695
	(0.001)	(0.000877)	(0.000729)	(0.000861)	
LIVSTOK_SIZ	0.00692	-1.81924	1.20547	1.11078	2.252
	(0.557)	(0.001852)	(0.0008502)	(0.0005371)	
CRDIT_AVIL	0.3285	0.0208	-0.0091	-0.0028	1.982
	(0.621)	(0.00431)	(0.000691)	(0.006123)	
AGRI_LAND_ACC	-0.7815	0.0492	-0.0315	-0.0209	1.06
	(0.2209)	(0.00856)	(0.000684)	(0.000367)	
AGRI_LAND_SIZE	1.0925*	-0.185	-0.099	0.173	3.267
	(0.092)	(0.000697)	(0.000785)	(0.001094)	
TRAINING	-0.0218	0.0099	-0.0085	-0.0073	1.638
	(0.607)	(0.00853)	(0.00234)	(0.000341)	
SOCIAL_ORGN_MEMBR	1.2857***	-0.01983	0.01899	0.01098	3.128
	(0.007)	(0.00284)	(0.000336)	(0.00219)	
cut1:_cons	11.085***				
	(3.507)				
cut2:_cons	23.223***				
	(4.821)				
Mean VIF	2.532				
Mean dependent var	0.851	SD dependent var		0.281	
Pseudo r-squared	0.905	Number of obs		312	
Chi-square	704.668	Prob > chi2		0.000	
Table 5. Continuation					
Akaike crit. (AIC)	101.852	Bayesian crit. (BIC)		141.525	
Log-likelihood	-11.95	Prob > chi2		0.0000	
LR chi2(14)	209.80				

Source: Own field survey, 2022. Notes: Standard errors are in parentheses, **** p<.01, ** p<.05, * p<.1*

Household head's age (HH_AGE):

At 5% significance, household head age positively influenced household involvement. According to the model, families' participation in watershed development for high participation groups grows by 8.57% per year of respondent age. In comparison, low and medium participation dropped 6.53% and 9.65%, respectively. The results matched with the findings of (Debara and Gebretsadik, 2017, Mengistu and Assefa, 2020, Bishaw, 2022, Alemu et al., 2021).

Household head's educational status (HH_EDU):

This variable had a statistical significance of less than 1%, boosting household participation. Increasing a household's head's education decreases low and medium category involvement by 6.65% and 1.28%, respectively, suggesting that other variables remain constant. However, high category participation rises 8.57%. The positive calculated coefficient of households' participation in watershed development shows that families with higher education are more likely to participate. Roba Gamo et al. (2022) affermied that individuals with higher education tend to have more extensive social networks and rich social capital, enhancing their integration into their living environment and involvement in community activities. The outcome was consistent with the results of (Moges and Bhat, and 2020, Alemu et al., 2021).

Household number of labor (H_N_LABOR):

At 10% probability, the ordered logit model shows a positive connection with household laborers. The model output shows that households with more laborers are 3.85% less likely to be in the poor categories. Still, it boosts household involvement in medium and high categories by 8.58 and 8.93%, respectively. The study indicated that households with more laborers are more likely to join the watershed program and participate more in higher categories. The result is consistent with the findings of (Wordofa et al., 2020, Agidew and Singh, 2018, Mengistu and Assefa, 2020, Oyetunde-Usman et al., 2021).

Household's distance to watershed structure (DISTAN_WTRSTRUC):

The ordered logit model's outcome shows that the household's length to watershed facilities significantly influences members' participation at a 10% probability level negatively. As the average distance from watershed structures to the respondent's home increases, the household's participation level would decrease. Families who are relatively nearer to the watershed site participate more. This is because the proximity allows members to participate easily since travel

requires less time and cost. In addition, it helps households to know more about the benefits of watersheds. An increase in the distance of the households from the watershed site increases the probability of members' participation in the low participation category by 2.8%. However, it reduces the participation level for the medium and high categories by 0.59% and 0.71%, respectively. The result is consistent with the findings of (Moges and Taye, 2017)

Household income (HH_INCM):

The result from the ordered logit model reveals the significant and positive relationship between members' participation and their income level at a 1% probability level. The implication is that households with the highest income actively participate in watershed development. The result is not astounding since households with higher incomes can better afford to purchase materials and technologies to promote WDM practices, on top of that ability to hire additional labour to implement the conservation measures. If other variables remain constant, a unit increase in household income decreases the probability of households' participation in a low category by 3.98%. It increases the likelihood of members' involvement in medium and high categories by 3.05% and 3.81%, respectively. The financial potential of household income, in turn, encourages investment in watershed conservation practices. This result is consistent with the findings of (Oyetunde-Usman et al., 2021; Sileshi et al., 2019; Demelash and Stahr, 2010; Mengistu and Assefa, 2020).

Household's agricultural land size (AGRI_LAND_SIZE):

The result from the ordered logit model reveals the significant and positive relationship between members' participation and the size of the agrarian land respondents at a 10% probability level. Households with larger farm plots are more likely to be able and willing to participate in WDM measures to reduce land degradation problems in fields located in sloppy areas. If other variables remain constant, a unit increase in a hectare of farm size decreases the probability of households' participation for low and medium categories by 18.5% and 9.9%, respectively. The same increase in the hectare of farm size increases the probability of members' participation for high categories by 17.3%. The result is consistent with the findings of (Agidew and Singh, 2018; Moges and Bhat, 2020; Wordofa et al., 2020; Alemu et al., 2021).

Household membership in any social organization (SOCIAL_ORGN_MEMBR):

This explanatory variable is correlated with the probability of households' participation being positive and significant at a 1% probability level. As the respondents have access to being a member of any further social organization, the probability of households' participation in the low participation category decreased by 1.98%, while the likelihood in the medium and high categories increased by 1.89% and 1.09%, respectively. This result is consistent with the findings of (Roba Gamo et al., 2022, Alemu et al., 2022, Amare and Simane, 2017, Mengistu and Assefa, 2020, Mekuriaw and Amsalu, 2022)

Generally, the lesson learned from this study indicated that, community involvement in planning, implementation, monitoring, and evaluation were acknowledged, but practitioners face challenges in ensuring practice stability and sustainability. As shown in this study, there needs to be more effective and genuine community participation at different phases of planning, implementation monitoring and evaluation. Tesfaye et al. (2018) emphasizes the need for local agricultural authorities to train, promote ownership, and recognize the long-term benefits of participation in watershed development and management. The study by Wani et al. (2008) underscores the importance of community engagement in successful watershed development and management for long-term natural resource conservation and livelihood enhancement.

4. CONCLUSION AND RECOMMENDATION

Watershed development and management has become Ethiopia's primary intervention for managing natural resources and promoting rural development. As the study watershed was confronted with acute land degradation problems, diversified watershed development and management measures were implemented. People's engagement is increasingly acknowledged as vital to watershed development and management success. As a result, the study evaluates household involvement and its determinants at various stages of WDMPs.

The overall extent of participation by the rural households in WDMP in the study area was computed as 65%. This showed that the level of community participation in the study area falls within the moderate-level category. As calculated from the average of the three phases, the community works well regarding watershed development and management practices in the study area with the collaboration of local government and non-governmental organizations. The practitioner households participated more than the non-participant households in all participation phases.

Both practitioners and non-practitioners interacted more in the implementation phase than in other participation phases. The initial community awareness of the cost of land degradation, combined with the efforts of governmental and non-governmental officials, is critical in enhancing the implementation of natural resource conservation interventions during watershed development and management programs. On the contrary, practitioners and non-practitioners in the study area reported a need for more community participation in the planning phase compared to earlier participation phases. This is because it is improbable that both federal and regional governments and non-governmental organizations were in charge of everything throughout the planning phase of the watershed development and management program. Such actions frequently need to meet the demands of the local community and accomplish the WDMP's primary objective.

Different household participation factors in watershed development and management were assessed using an ordered logistic regression model. The model outcome discovered that the following variables: household head's age, household head's educational status, household number of labour, household income, distance to watershed structure, household's agricultural land size, and household's membership in any social organizations were measurable significant and had a statistically significant influence on the participation of the families.

Finally, the study concludes that watershed development and management activities can only be successful with active community participation in the planning, implementation, controlling and monitoring phases.

The study's conclusions led to the following recommendations: 1) the government and other concerned stakeholders are expected to give due attention to empowering households' capacity by strengthening and establishing formal and informal education and budding farmers' training centers. Creating and promoting a campaign about the overall importance of watershed development and management is needed. (2) To curb the negative factors, the government and other concerned stakeholders need to consider, give the role and promote the local community to participate in all watershed development and management programs. Furthermore, (3) for a sound understanding of effective resource management, the government and other concerned stakeholders must consider country-level specified watershed development and management policy.

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6. APPENDICES

Appendix 1 - The participation level of *Shankur Tereqo* households

	Statements	WDM practitioners (*Shankur Tereqo*)						
			Never	Rarely	Sometimes	Often	Frequently	% of the max (153*5)
Degree of participation in the planning phase	Suggest an idea during the identification and prioritization of problems	F	58	14	21	28	32	95
		P	38	9	14	18	21	
	Suggest an idea during committee selection/ reformation	F	54	14	18	37	31	99
		P	35	9	12	24	20	
	Suggest formulation of by-laws or norms.	F	47	15	20	37	34	106
		P	31	10	13	24	22	
	Suggest during decisions on village resource management agreement	F	46	14	17	40	37	107
		P	30	9	11	26	24	
	PPI (%)	P	34	9	13	23	22	67
Degree of participation in the implementation phase	Participation in the WDMPs	F	34	6	20	64	29	119
		P	22	4	13	42	19	
	Provide any material during the construction of structures	F	40	5	24	46	38	113
		P	26	3	16	30	25	
	Contribute money for WDMPs	F	32	6	28	60	28	121
		P	21	4	18	39	18	
	Participate in training programs about WDMPs	F	29	9	23	63	29	124
		P	19	6	15	41	19	
	PPI (%)	P	22	4	16	38	20	78
Degree of participation in the monitoring and evaluation phase	Prevent the entrance of animals into the protected area	F	55	5	20	28	46	98
		P	36	3	13	18	30	
	Protecting and maintaining the WDMPs	F	52	6	23	29	43	101
		P	34	4	15	19	28	
	Visiting or supervising the WDMPs	F	55	6	14	32	46	98
		P	36	4	9	21	30	
	Sharing information about the WDMPs	F	44	6	17	35	50	109
		P	29	4	11	23	33	
	Attending meetings on how to undertake monitoring activities	F	47	6	21	26	52	106
		P	31	4	14	17	34	
	PPI (%)	P	33	4	12	20	31	68

Appendix 2 - The participation level of *Mende Tufesa* households

	Statements	Non-practitioners (*Mende Tufesa*)						
			Never	Rarely	Sometimes	Often	Frequently	% of the max (159*5)
Degree of participation in the planning phase	Suggest an idea during the identification and prioritization of problems	F	70	28	24	15	22	56
		P	44	18	15	9	14	
	Suggest an idea during committee selection/ reformation	F	98	32	17	3	9	39
		P	62	20	11	2	6	
	Suggest formulation of by-laws or norms.	F	81	44	20	5	9	50
		P	51	28	13	3	6	
	Suggest during decisions on village resource management agreement	F	68	43	35	10	3	57
		P	43	27	22	6	2	
	PPI (%)	P	50	23	15	5	7	51
Degree of participation in the implementation phase	Participation in the WDMPs	F	54	30	28	24	23	66
		P	34	19	18	15	14	
	Provide any material during the construction of structures	F	68	45	25	9	12	58
		P	43	28	16	6	8	
	Contribute money for WDMPs	F	42	65	21	18	13	73
		P	26	41	13	11	8	
	Participate in training programs about WDMPs	F	55	39	35	18	12	66
		P	35	25	22	11	8	
	PPI (%)	P	35	28	17	11	10	66
Degree of participation in the monitoring and evaluation phase	Prevent the entrance of animals into the protected area	F	58	26	25	28	22	66
		P	36	16	16	18	14	
	Protecting and maintaining the WDMPs	F	64	30	37	20	8	60
		P	40	19	23	13	5	
	Visiting or supervising the WDMPs	F	68	40	26	15	10	56
		P	43	25	16	9	6	
	Sharing information about the WDMPs	F	63	41	28	16	11	61
		P	40	26	18	10	7	
	Attending meetings on how to undertake monitoring activities	F	75	40	21	12	11	53
		P	47	25	13	8	7	
	PPI (%)	P	43	24	18	10	6	58