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Re-visiting community based participatory watershed management: Challenges, opportunities and its linkage with smallholder farmers' ecosystem service awareness in Southern Ethiopia

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Abstract

Ethiopia is endowed with abundant natural resources and valuable biodiversity. However, natural resource degradation and biodiversity losses in response to unwise management have been challenging and creating critical economic and social problems in Ethiopia. Previous efforts to curb the problems have not been successful as expected. Most often, physical works have received major emphasis, while the human components are mostly overlooked. To assess and re-visiting the challenges and opportunities of community-based participatory watershed management (CBPWM) and its linkage with smallholder farmers' ecosystem service awareness, five districts (Wonago, Abaya, Dilla Zuriya, Yirgachefee, and Kochere) were selected. A cross-sectional survey design with two sampling stages was used. Likert with three scales (agree, neutral, disagree) was used. A purposive sampling technique was used to select kebeles from the five districts. A stratified sampling technique was also used (based on agro-ecological zone: Humid, Semi-humid & Semi-arid) to assess the linkage of smallholder farmer's ecosystem service (ES) awareness with CBPWM. Three hundred (300) farmer respondents were selected using simple random sampling techniques from the selected AEZs, Districts, and Kebeles. The result shows that farmer's perception of change in environmental conditions has improved over the decades since the start of CBPWM. Their understanding of the environmental condition has also improved the benefits earned from CBPWM like increasing household income, social ties and security, women empowerment, and skill development. The result also shows that farmers had limited access to CBPWM plan preparation, training, evaluation, and monitoring activities in their local area. Moreover, there is a limitation of adequate resource allocation (in terms of materials, labor, and finance) and application of appropriate and site-specific technologies at each kebele level where active CBPWM works exist. Though there are challenges, almost all respondent farmers had a good awareness of ecosystem services (ES), whose livelihood depends on. Almost in all agro-ecological zones, ES has shown declining trends in the study area. To restore declining ES in the study area, different agro-ecological zone-based measurements have been applied. The result implies that CBPWM work needs serious attention from all stakeholders to achieve its envisaged mission of building a climate-resilient green economy in Ethiopia. Moreover, conservation and participation-based land management is a means to obtain ecosystem goods and services sustainably.

Keywords/Phrases: Challenges, Opportunity, Ecosystem service, Awareness, Participatory, Southern Ethiopia

1 Introduction

Since antiquity, agriculture has been the mainstay of most people in Ethiopia (German *et al.*, 2007). Even though different governmental regimes have come up with different policy perspectives to improve the agricultural sector, more than 80% of the population entirely depends on it (Gebrehaweria *et al.*, 2016; German *et al.*, 2007). For more than two and half decades, "agricultural development led industrialization" (Mellor and Dorosh, 2010) that has been implemented, emphasizes improving the people's livelihood (Gebrehaweria *et al.*, 2016; Wolancho, 2015) and strengthening the natural resource bases using restoration and conservation techniques. Indeed, this policy has played a significant role in economic transformation and the reduction of poverty in the country (Mellor and Dorosh, 2010). The sector (agriculture) contributes approximately 42% to the gross domestic product (GDP) of the country. Despite its huge contribution, it is highly constrained by spatial and temporal climate variability and watershed degradation, which has negative implications on the livelihood of the people (German *et al.*, 2007; Habtamu, 2011). Sustainable livelihood and boosted food production in an agricultural-based developing country like Ethiopia require the availability of sufficient water and fertile land (Habtamu, 2011; Wolancho, 2015). Recurrent drought in the past has resulted in crop failure in lowlands, while high rainfall intensity in highlands results in low water infiltration and high run-off, causing severe soil erosion and land degradation (German *et al.*, 2007; Habtamu, 2011; Wolancho, 2015; Gebrehaweria *et al.*, 2016). Watershed degradation in the form of soil erosion, low water infiltration (high run-off), and reduction in soil fertility is a critical challenge to agricultural productivity and economic growth. Currently, soil fertility and freshwater degradation take the lead among degrading watershed resources and pose a significant socio-economic, ecological, and environmental threat, especially for developing countries, including Ethiopia, where a traditional agricultural-based economy is the dominant (Habtamu, 2011; Vogl *et al.*, 2017). This state of affair has spurred the Ethiopian government to launch an extensive watershed management program in the country (German *et al.*, 2007; Habtamu, 2011; Wolancho, 2015).

Watershed management in Ethiopia, which began in the early 1970s (Wolancho, 2015) in different parts of the country, to some extent has improved the multiple environmental and social benefits provided by watersheds (Bewket, 2003; Wolancho, 2015). However, most of the benefits were tailored towards minimizing soil erosion rather than enhancing agricultural production at individual and national levels. Between 1970 and the 1990s, high priority was given to engineering measures with minimum emphasis on the compatibility of the watershed works with the day-to-day activities of the farmers (Gebrehaweria *et al.*, 2016; Miheretu and Yimer, 2017a). Moreover, the watershed management approach was government-led (with some concerted efforts with NGOs), top-down, and incentive-based, where beneficiaries had less stake in watershed decision-making (Miheretu and Yimer, 2017a). Despite the concerted efforts of government and NGOs, the adoption rate for improved technology by the farmers remains less at the time. For this lower adoption rate, demographic, socioeconomic, institutional, and biophysical are the main contributing factors or challenges affecting watershed management.

Post-1991 is a period the regime has given due emphasis to poverty reduction and natural resource management using a watershed approach. Cognizant stakeholders have tried to review the concerted efforts made so far and lessons learned and come up with concrete solutions for watershed problems (Gebrehaweria *et al.*, 2016; Miheretu and Yimer, 2017a). Among the solutions, community-based participatory watershed management is the major means to achieve natural resource management and livelihood improvement objectives within the prevailing agro-ecological and socio-economic environment (Azene and Kimaru, 2006; German *et al.*, 2007). This new approach has given prior attention to bottom-up information flow, and farmers principally play their role in planning, implementing, monitoring, and evaluating watershed works. However, with its limitation, the approach requires active involvement and contribution of local people (Wolancho, 2015), and this improves the productivity of natural resources in an ecologically and institutionally sustainable way where the community has a strong stake in decision-making (Gebrehaweria *et al.*, 2016). In general, community-based participatory watershed management creates an opportunity for reclaiming degraded land, increasing agricultural production, water resource development, improving soil fertility, improving market access, off-farm activities, and diversifying income sources, where the benefits are realized at household and community level (Perkins, 2011; Wolancho, 2015; Gebrehaweria *et al.*, 2016; Miheretu and Yimer, 2017a). However, some scholars (for instance, Perkins 2011) argue that "participation" in community-based participatory watershed management sometimes hides, perpetuates, and exacerbates social and political inequalities, especially existing along gender.

Currently, community based participatory watershed management is widely applied in all parts of the country pertaining to the policy known as "*climate resilient green economy*"*. For the accomplishment of this stretched policy, watershed management has been considered as a milestone following the sectoral and watershed approach (Economy, 2011). The government understands the essence of this approach as evidence from successfully implemented pilot projects appears to be promising, though there are many things to be amended during at planning, implementation, monitoring and evaluation phases of watershed works in the country. Considerable efforts have been invested to replicate the successful history of woredas and kebeles† community-based participatory watershed management to areas with less experience and ineffective in implementing the approach (Bewket, 2003; Habtamu, 2011; Wolancho, 2015; Gebrehaweria *et al.*, 2016). As a major component of the efforts made to replicate success history of watershed management to other areas, in the last seven years a nationwide 30 day free labor public watershed work has been launched and, with its some shortcomings, encouraging results have been obtained throughout the country. However, the achievements made so far are not as envisaged or expected in terms of social, economical and environmental issues. Moreover, different complaints are coming out from the participants that watershed works are neither fully voluntary based as it was explained by the government body nor participatory/bottom up in actual prevailing situation. Furthermore, the success in one watershed may not be a solution for other watersheds, or the application of similar packages for all watersheds with minimum attention to local differences did not bring the sought positive changes. Site-specific watershed works have been given less attention. Despite different encouraging results that have been obtained within these seven years of watershed public work campaign, as a matter of chance, little effort has been exerted to identify existing challenges that retard watershed works behind and the use of these challenges as an opportunity to make sure the sustainable existence of ecosystem services derived from the watershed. Therefore, this study aimed to assess the challenges, opportunities, achievements, and ES improvements since the start of community-based participatory watershed management in the Southeastern Rift Valley escarpment of Ethiopia.

2 Materials and Methods

2.1 Description of the Study Area

The research was conducted in five districts (Wonago, Abaya, Dilla Zuriya, Yirga Cheffee, and Kochere) of Southeastern escarpments of the Ethiopian rift valley. Hydrologically, the area is located under the Gidabo watershed. The upper-lying area of the watershed is the source of many perennial rivers that usually feed Abaya-Chamo Lake. The altitude of the area ranges from 1400-1800m asl. Geographically, it extends between $6^0$15'N to $6^0$26'N latitude and $38^0$10'E to $38^0$12'E longitude.

The area is characterized by a bimodal rainfall distribution with a maximum between March and July and relatively between minimum August and October (Ketema and Yimer, 2014). The mean annual rainfall and temperature of the study area ranges from 1200mm to 1800mm and from 15.10^{0}C – 22.5^{0}C, respectively.

* ***Climate Resilient Green Economy (CRGE)****: It is a strategy that contains Ethiopia's vision to achieve a middle income country status by 2025 while developing a green economy through providing key targets for reducing emissions and increasing climate resilience in 8 key sectors.*

† ***Kebele****: It is the smallest administrative unit of Ethiopia, similar to a word, a neighborhood or a localized and delimited group of people.*

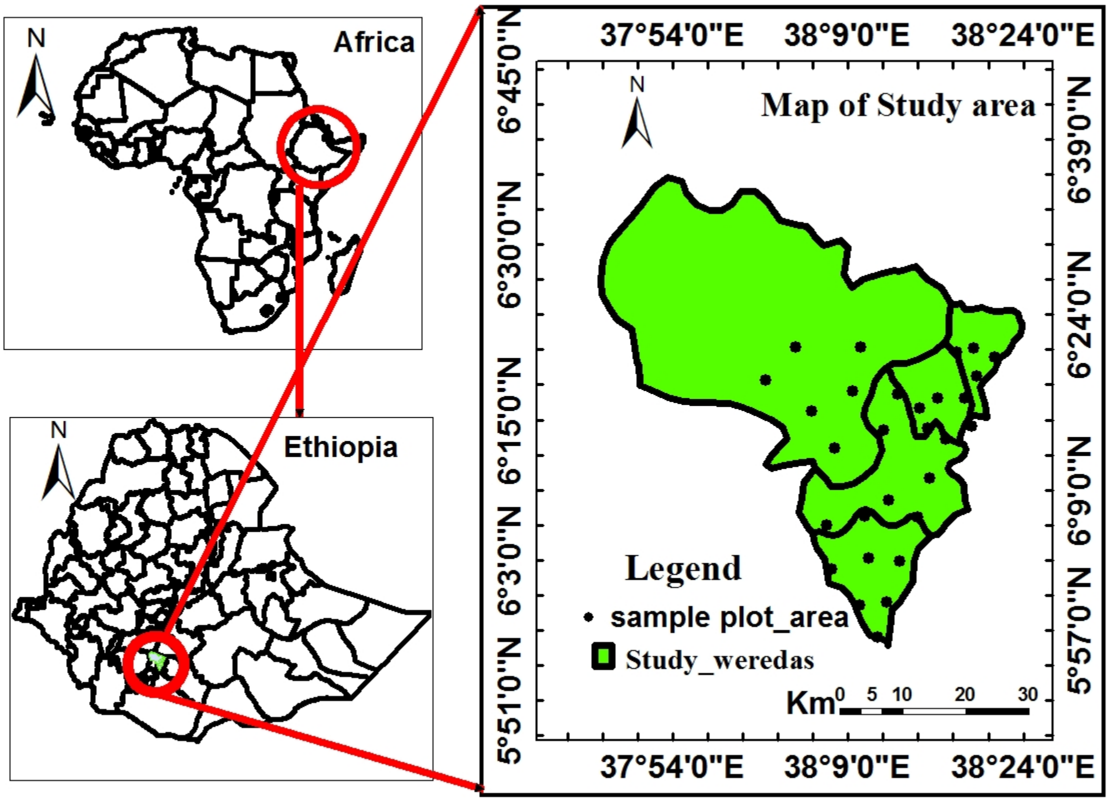

Figure 1. Map of the Study Area

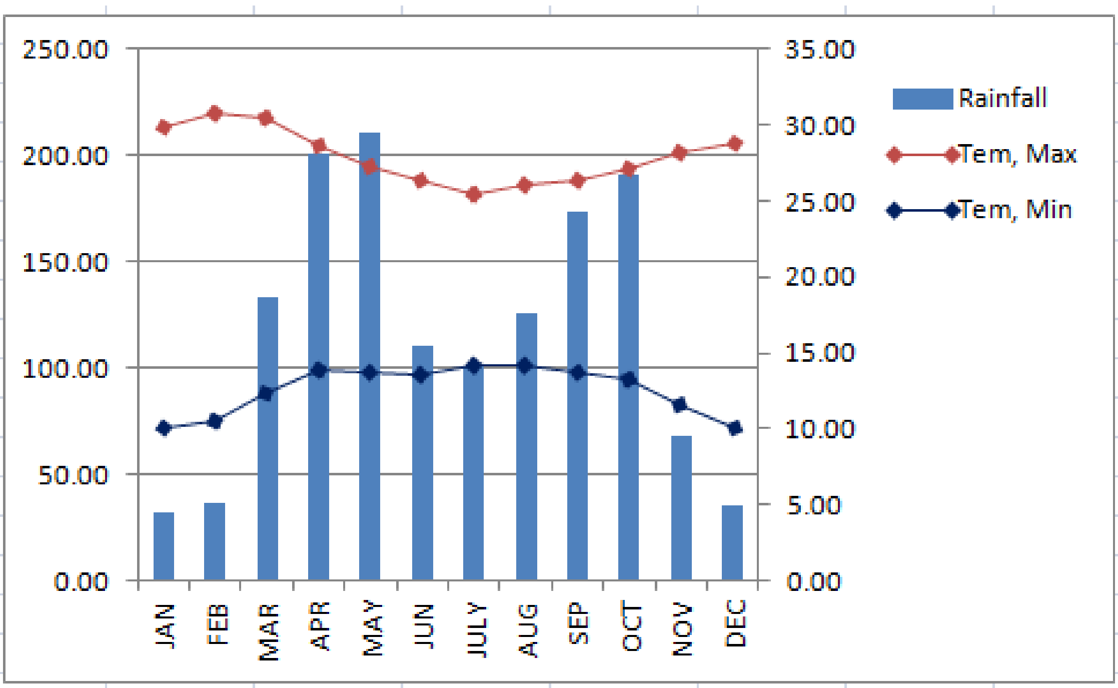

Figure 2. Mean monthly Rainfall (mm) and Temperature (^{0}C). (Source: National Meteorological Services Agency (NMSA) of Ethiopia, 2009 E.C)

The land use system of the area is not only purely crop farming, but also it is a combination of crops, shade trees, and fruit trees with a generic name known as agroforestry system (Kanshie, 2002; Temesgen *et al*., 2018). This type of land use is commonly seen in the semi-humid part or the coffee belt of the study area. The local farmers, especially those found in the humid and semi-arid agro-ecological zone (AEZ), produce cereals using traditional farm equipment known as "*Maresha*" (Ketema and Yimer, 2014). The plowing system is simple and shallow tilling up to a soil depth of 15 cm on average. This traditional tillage implement is commonly drafted by oxen (Gebregziabher *et al*., 2006). The local farmers had an experience of repeatedly tilling (2-3 times per season) their land with any two consecutive tillage operations carried out perpendicular to each other. As a result, the soil is pulverized, resulting in weak soil structure and compact formation (Ketema and Yimer, 2014).

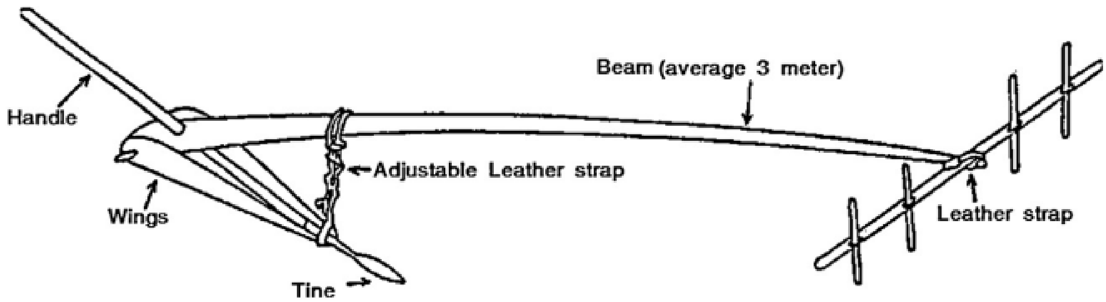

Figure 3. Traditional plowing equipment by oxen)

On the other hand, since land tilling using "*Maresha*" is not suitable and appropriate in the agroforestry system, the local farmers commonly use "*hand hoe*" (Figure 4). Hand hoe is traditional farming equipment commonly used in the semi-humid AEZ with the concepts of minimum tillage practices.

In the semi-humid AEZs, the agroforestry system is well known for its being traditional and a way of life for the local people. Perennial trees (such as *Millettia ferruginea*, *Ficus vasta*, and *Erythrina abyssinica*) and annual crops exist intermingled mostly in mutual co-existence. The local farmers leave weedy herbaceous on top of the soil with the objectives of mulching and addition of organic matter into the soil system. Therefore, nutrient cycling and soil protection from erosive forces and inducing rainwater to percolate into the soil is an advantage derived from the system. In the semi-arid AEZs, livestock production and cultivation of crops (through agricultural investment) are some of the mainstays of the farmers for their livelihood.

The dominant soil of the study region is chromic luvisol (Kanshie, 2002) around Wonago, Dilla Zuriya, Abaya, and Yirga cheffee districts. However, Nitisols are common in the highland parts of Wonago, Dilla Zuriya, Yirga cheffee, and in the whole parts of Kochere districts. However, Chromic Luvisol is common and has good agricultural potential in the study area. It is characterized by Argillic B horizon due to the accumulation of clay in the sub-surface (Ketema and Yimer, 2014; Negasa *et al*., 2017). Clay is the dominant textural fraction in the study area.

Figure 4. Traditional hand hoe tool used in agroforestry system. (Source: authors' field photo, 2017)

2.2 Research Design, Data Collection and Analysis

The data was collected using a cross-sectional design with two stages. These are: (**1**) after identification of kebeles from selected districts using purposive sampling techniques, on-site in-depth interview and discussion were carried out to understand farmers' awareness about existing challenges and opportunities of CBPWM[‡] in the area. From five districts, we selected 300 individual farmers using simple random sampling techniques. The interview lasted 1:00 -1:30 hours per interviewee and was focused on the bonds that existed between the farmers' household and CBPWM for the last seven years. Farmer's household characteristic was also given due emphasis during the interview. The data was collected with three Likert scale (agree, neutral, disagree). (**2**) Ecosystem service awareness and changes, its trends and potential restoration measures that have been perceived and sensed by farmers since the start of community-based participatory watershed management (CBPWM) were assessed using group interview techniques. From the five districts (Wonago, Abaya, Dilla Zuriya, Yirga Cheffee, and Kochere), 300 individuals were selected based on agro-ecological zones (humid, semi-humid, and semi-arid AEZs) using stratified sampling techniques.

‡ CBPWM, community based participatory watershed management

Table 1. Definition of key terms

CBPWM	Description
Challenges	Insufficiency in terms of technologies, institutions, resources (material, finance & labor) and plan preparation for effective community based participatory watershed management (CBPWM).
Opportunities	Conducive environments (both internal and external) or facilities for implementation of CBPWM.
ES awareness and changes	Farmer's awareness and changes that is observed since CBPWM has been implemented.

Descriptive statistics was used for data analysis. The scores given to Likert scale were taken as measure on a continuous scale. SPSS version 20.0 for windows was used for analysis.

3 Result and Discussion

3.1 Respondent characteristics and their environmental perceptions

Farmers who participated in community-based participatory watershed management (CBPWM) have an average age between 40 and 50 years (50%) with greater than 20 years of farming experience. The field survey result indicates that out of 300 sample household respondents, the majority (60%) were males, and the remaining (40%) were females with the marital status of married (88%), Unmarried (7%), and Divorce (5%) in the area. Women-headed households were highly burdened with CBPWM work since they were responsible for watershed work in the campaign and the household activities. Moreover, the majority of the respondents had an educational level of 1-6 (61%) grade with an average family and farm size of 4.72 people to a household and 0.3 ha (60.33), respectively. Almost all respondents rely on mixed farming and off-farm activities for their livelihoods. In addition, the land tenure system of the respondents was categorized as direct ownership (83.67%) and tenancy (16.33%).

Table 2. Respondent characteristics

Characteristics	Category/number (proportion)
Sex	Male (60), Female (40)
Age	25-30 (5), 31-40 (34), 40-50 (50), >50 (11)
Marital Status	Married (88), Unmarried (7), Divorce (5)
Educational Level	1-6 (61), 7-8 (26.33), Illiterate (12.67)
Years of Experience	5-10 years (14.33), 11-15 years (20.33), 16-20 years (30.33), >20 years (35)
Average Family Size	4.72 people to a household
Average Farm Size	<0.25 ha (25.33), 0.25-1 ha (60.33), >1 ha (14.33)
Current Livelihood activity	Mixed farming (cereal farm, coffee, cattle) and off-farm (daily based work)
Land Ownership type	Direct ownership (83.67), Tenancy (16.33)

Over the last decades, community watershed management works through mobilizing farmers have been improved over time (Miheretu and Yimer, 2017b; Moreda, 2018). The improvement was due to watershed degradation problems that occurred on the farmers' farms and communal land in the previous time. Watershed degradation usually manifests in different ways, including soil erosion, the decline in soil fertility, loss of vegetation cover, decline in water resources, and desertification (Andersson *et al.*, 2011; Moreda, 2018). Therefore, halting and reversing watershed degradation has dual benefits for the farmers. First, it improves their land productivity, and second; by making substantial investments in their land, farmers would avoid confiscation of land use rights and strengthen the security of their tenure.

Since the watershed resources are central to farmers' livelihood, its problems provide better insights to observe and understand the local dynamics under which they struggle to meet their livelihood needs. In this respect, the survey results under Table Three portray farmers' perception of changes observed in environmental conditions since CBPWM has been implemented in the area. For instance; the results indicate a generally high perception among farmers that quantity and quality of surface water (34.33%), quality of soil (33.33%), forest resource and its coverage (43.33%), and livestock feeds (50%) of their land has worsened in the last seven years. But a considerable proportion of farmers have also perceived improvements in surface water (26.67%), soil quality (32.67%), and forest resource (33.33%) in their local area. However, the perception of farmers indicated worsened resources, which contradicted government reports. As it has been stated by the government, the objective of CBPWM is to reverse and mitigate the exploitive land use history, focusing on reducing further land degradation and rehabilitating land resources (Azene and Kimaru, 2006; Wolancho, 2015). However, the reality that has been seen on the ground and what is perceived by the farmers diverges from the government's efforts. Moreover, the rainfall variability (46.67%) and micro-climate (42%) also became worsened in the area over the last seven years. Generally, the overall environmental condition of the area has been worsened (35.67%) as perceived by the local farmers during the last seven years.

Table 3. Farmer's perception (%) on change in environmental conditions in the last seven years after CBPWM has been implemented (N = 300)

Environmental Condition	Improved a lot	Improved	No change	Worsened	Worsened a lot
Quantity and quality of surface water	14.00	26.67	13.33	34.33	11.67
Quality of soil resource	11.67	32.67	16.67	33.33	5.67
Forest resource and its coverage	6.67	33.33	11.67	43.33	5.00
Livestock feeds	-	18.33	23.33	50.00	8.33
Rainfall variability	-	5.00	33.33	46.67	15.00
Micro-climate of the area	-	35.00	5.00	42.00	18.00
Overall environmental condition of the area	10.67	30.00	18.00	35.67	5.67

CBPWM = Community based participatory watershed management.
(Source: Author's own survey, 2018).

Even if the environmental condition of the area was worsened, farmers did not deny the overall benefits they gained from CBPWM works in the area. Due to participation in the CBPWM works, farmers have believed that their household income (agree, 44.33%), their social tie (67.67%), and their social security (43%) have improved over time over the last seven years. Household income has increased due to the payment of the productive safety net program (PSNP). PSNP users are expected to provide 3-5 days per week for six months to the CBPWM work schemes. Based on the information obtained from the Zonal agricultural office and field observation, the scale of CBPWM through public work is remarkable. However, the problem is farmers' participation in public work schemes would not have been the same if the PSNP had not been available. During group discussions, farmers explained that free labor was not acceptable since all who were involved in the PSNP were poor. However, non-participant farmers in PSNP were discouraged from participating in CBPWM works. Farmers who were not in the PSNP explained that it was a great disadvantage not to be included in the PSNP in terms of access to different training, credit services, and other opportunities. Based on the abovementioned facts, 34 % (Table 4) of the farmers' households showed disagreement with the assertion that CBPWM works have increased the voluntary participation of farmers.

On the other hand, farmers believed that CBPWM works improved their social ties (agreed, 67.67%) in the community. During public work, farmers come together from different areas to participate in the CBPWM work. This provided opportunities for farmers to exchange ideas and improve their intimacy. It enhanced team spirit within the community and solved conflicts with adjacent farmers (Teshome *et al*., 2016). CBPWM works through a mass mobilization approach increased the number of participants.

Moreover, women empowerment (79.67%) and land management (LM) skills and experience sharing among farmers (65%) improved over time. Women have opportunities to participate actively in the CBPWM works. Off-course, there is a division of labour among the community. For instance, during CBPWM works, women were involved in soil bund compaction and paving the waterways, and men were engaged in digging ditches and the construction of stone terraces, waterways, cut-off drains, and other heavy works. Their active participation improved their decision-making power in making the design and layout of CBPWM work. In addition to LM skill and experience sharing among farmers, the availability of hand tools for CBPWM works was mentioned as an important benefit gained, especially for those poor farmers. Farmers learn from development agents and fellow farmers about theoretical knowledge and practical skills for implementing CBPWM works. Moreover, hand tools were supplied by government and non-government organizations for the construction of SWC measures. Despite these positive aspects, farmers pointed out in group discussions that there was a critical shortage of hand tools at the community level.

On the other hand, conflicts over communal resources among farmers increased (63%) even after the implementation of CBPWM works in the area. The sources of the conflict were not from sole resource limitation but also arose from ethnicity (For instance, conflicts between Gedeo and Guji). According to the zonal agricultural office report, FGD, and field observation, conflicts over grazing land increased over time in the area that needs government attention to halt.

In addition, participation in the CBPWM work improved the social security of the farmers, especially those who were the beneficiaries of PSNP. The benefits gained from public work, either in kind or cash, were used for savings, school, health, and payment for *idir* and *iqub* (informal institutions made by a group of farmers). Concerning the above facts and observations made by the farmers, the government has political inclination or motives towards CBPWM works by giving more attention to area coverage of work rather than quality work. Concerning this, farmers pointed out that CBPWM work served the government in political objectives by ensuring state control over the rural population. Therefore, during the interview, 49.67% of the farmers agreed that the government has a high political inclination or motives towards CBPWM works.

Table 4. Farmer's perceptions on the benefits of CBPWM (N = 300)

Benefits of CBPWM	**Agree**	**Neutral**	**Disagree**
Increase in household income	44.33	26.67	29.00
Increase in social tie	67.67	13.33	19.00
High political inclination	49.67	10.33	40.00
Increase in voluntary participation of farmers	32.67	33.33	34.00
Increase in social security	43.00	37.00	20.00
Reduce conflict on communal resources	25.67	11.33	63.00
Increase in women empowerment	54.67	18.67	26.67
Rehabilitation of degraded land	79.67	10.67	9.67
Development and sharing of land management skill, experience and working tools among farmers	65.00	16.33	18.67

(Source: Author's own survey, 2018).

3.2 Challenges of Community based participatory watershed management (CBPWM)

Practically, all-natural resource management programs are implemented at the watershed level these days because it is repeatedly observed that watersheds are integrated socio-environmental units whose parts are interdependent. For the normal functioning of components, the works of each part of the watershed should be led by an appropriate watershed plan since the well-being of the whole watershed is dependent on the viability of its components. However, in the past seven years, practically, various challenges, constraints, and controversies negatively affected the quality of CBPWM works and its replicability to other areas.

According to the FGD and interviews, which were held with farmers, the accrued challenges of CBPWM works in the last seven years were categorized into four groups (Table 5, 6 & 7).

1. Challenges in terms of CBPWM plan preparation and community participation

Attempts to address watershed problems without consideration of appropriate plans often fail. Appropriate plan preparation and effective participation of the local farmers should also be recognized. According to the interview, over the last seven years, around 69% (Table 5) of the respondents perceived that access to CBPWM plan preparation was not participatory as claimed by the government.

Table 5. Community based participatory watershed management challenges in terms of watershed plan preparation in the village (N=300)

No.	Items	Respondent's Response					
		Agree		Neutral		Disagree	
		No.	%	No.	%	No.	%
1	There is access to participate on kebele level CBPWM plan preparation each year.	69	23	24	8	207	69
2	CBPWM plan preparation is on the basis of bottom-up approach in the village.	54	18	74	24.67	172	57.33
3	There is access for training in the kebele for CBPWM plan preparation	94	31.33	74	24.67	132	44
4	CBPWM plan preparation is not our task based on our previous experience	163	54.33	54	18	83	27.67
5	We have access for monitoring and evaluation of CBPWM plan and works	59	19.67	64	21.33	177	59

The fact on the ground is contrary to the assertion that CBPWM plan preparation was made through the active participation of the local farmers. This practice not only deprives the natural rights of the farmers to participate but also discourages them from investing in their land and encourages them not to strongly feel CBPWM as their work (feel low sense of ownership). On the other hand, as mentioned by the interviewees, access to training (disagree, 44%) and monitoring and evaluation of CBPWM works (disagree, 59%) were not available in an adequate manner in the previous time.

Farmers also mentioned that CBPWM plan preparation was not based on a bottom-up approach. Community-based participatory watershed management plans commonly come from woreda[§] and zonal-level government offices. During FGD, farmers mentioned that there was a quota system to participate in training and plan preparation. They mentioned that they did not remember exactly when they were invited for CBPWM work plan preparation from their kebeles, rather they blessed the plan prepared by Woreda and Zonal level. They explained that there was passive participation of farmers in CBPWM work plan preparation in the study area.

§ Woreda is roughly equivalent to a district and is the next higher administrative division to kebele in the country.

2. Challenges in terms of CBPWM resource allocation

Farmers in the sample also identified the main challenges of CBPWM works (Table 6) about resource allocation. Lack of efficient time usage and labour utilization are the main challenges of CBPWM works in the study area. Before starting the CBPWM work, they reached a consensus with farmers that indicated the starting and leaving time from work. However, as it was observed in the fields during CBPWM works using mass mobilization, some farmers arrived late and left early. In addition, some farmers just came to the field only to fulfill the compulsory free labour requirement. This trend indicated that there was no efficient use of time & human working forces during the implementation of CBPWM works in the study area.

Farmers also mentioned that the CBPWM works lacked fair and adequate sharing mechanisms of watershed goods among farmers based on their free labor contribution each year. For instance, after implementing SWC measures and making closure area, some benefits emerged, such as grass, fuel wood, and others. Therefore, farmers claimed that the allocation of such resources should be based on labour contribution during the campaign of CBPWM work. On the other hand, the contributions of free labour should also be based on the size of holdings. For instance, at the current work norm of CBPWM, farmers with small holdings invested the same amount of time and labour as farmers with larger holdings. Even landless and youth whose means of subsistence were non-farm activities also invested their time and labour for CBPWM works such as SWC activities in their kebele. However, the notion of CBPWM through mass mobilization did not include a mechanism for benefit sharing because it works on the principle that the benefit will be accrued and diffused and cannot be quantified for each farmer separately (Azene and Kimaru, 2006; Teshome *et al*., 2016; Singh, 2017; Moreda, 2018).

Table 6. Community based participatory watershed management challenges in terms of resource allocation in the village (N=300)

No.	Items	Respondent's Response					
		Agree		Neutral		Disagree	
		No.	%	No.	%	No.	%
1	We have taken practical training on how to prepare plan, layout and implement SWC measures in the watershed	124	41.33	24	8	152	50.67
2	There is voluntary participation of farmers in CBPWM at village level	94	31.33	74	24.67	132	44
3	Good experience of sharing watershed goods and services adequately in the village	175	58.33	26	8.67	99	33
4	There is appropriate or sufficient support (financial) from government or NGOs for CBPWM work in the village	14	4.67	94	31.33	192	64
5	Adequate working materials for implementing SWC are available in the village	52	17.33	24	8	224	74.67
6	Efficient use of time & human working forces for implementing CBPWM works	49	16.33	79	26.33	172	57.33

In addition, farmers also mentioned that the shortage of working materials during the CBPWM campaign was another critical challenge since some poor farmers did not have tools for soil-related work. Around 74.67% of the farmers complained about the availability of the working tools. As it was explained by local farmers and observed during the field, some hand tools were supplied by agricultural offices and NGOs for individuals to minimize the shortage of hand tools for making SWC structures. On the other hand, some farmers complained about the fairness of the distribution of the hand tools since some were using their tools for the CBPWM works. In connection with the shortage of working materials and others (such as seeking incentives and prioritizing their work), voluntary participation (disagree, 44%) of farmers in CBPWM work has been under question. However, due to different bylaws (formal and informal), a large number of farmers always participate in the CBPWM works. The existence of bylaws and enforcement might have contributed to a large number of farmers participating in community works (Teshome *et al*., 2016; Miheretu and Yimer, 2017a; Moreda, 2018).

3. Challenges in terms of using appropriate and site specific technology

During FGD and interviews, farmers mentioned that the culture of technology usage and its adaptation to CBPWM work was being improved each year. They showed that there was increased adaptation (50.67%) of technologies, such as the application of different soil and water conservation measures improved over the last seven years in the study area. Due to land degradation problems seen, either on their farmland or communal lands, the willingness (61.33%) of farmers to implement SWC measures in the CBPWM campaign improved over time. Concerning using physical SWC measures in CBPWM work, the habits of integrating biological measures with physical measures were also improved over time in the study area. It was also mentioned that farmers were more reluctant to use SWC measures on their farm plots for two reasons. First, farmers think that SWC measures that were implemented occupied space that was productive for crop production. Second, workability became difficult within the implemented SWC measures since there were lengthy SWC measures that hampered the movements of oxen during farm ploughing. Concerning the abovementioned facts, the local farmers search areas that are not suitable for crop production for implementing SWC measures. In addition, they think that the implementation of SWC on cropland can disintegrate the farm. During FGD in Wonago district, a group of farmers said that:

"*Even if there are soil erosion problems on our land, most of us do not have deep interest to implement SWC measures on our crop land due to space and workability issues; instead we always search areas other than crop land (commonly on communal land) for implementing SWC technologies*".

In principle, depending on the slope, rainfall, and workable soil depth of the area, each SWC measure has specific standards. Appropriate sites must be selected for suitable technologies in the watershed, especially on cultivated land. Wolancho (2015) stated that SWC structures built on cultivated land should be suitable for farming activities, including easy travel across farmland. On the other hand, research findings suggest that structures built below these standards are less effective in controlling soil erosion and ensuring environmental sustainability.

The local farmers (60.67%) argued that little attention was given to selecting appropriate technologies (such as SWC and tree seedlings) for appropriate sites in the research area. Sometimes, SWC measures constructed in the wrong sites become dangerous as they aggravate erosion by collecting the surface runoff and enhancing collective high-volume flow. They plant tree seedlings without giving due attention to the appropriateness of the site (for example, eucalyptus tree), which is also another fact that needs attention. Farmers only consider the benefits earned within a short period. However, due to many influences, such as a decline in crop production due to erosion, the rate of technology adaptation (agree, 50.67%) of farmers improved over time in the study area. In this perspective, even if they have a concern with SWC measures (the issues of space and workability), they showed a strong willingness (agree, 61.33%) to implement different technologies such as SWC on their farm plot to reduce the burden of crop failure due to soil erosion.

Moreover, due to increased awareness and its impact on the water resource, communal land management using SWC measures is also commonly applied in the area. However, as was witnessed by the local farmers (during FGD) in all districts, SWC measures constructed in the farm could not stay a long time (disagree, 54.67%) due to different reasons. Firstly, there is a lack of continuous evaluation and monitoring of SWC measures from the planning to the implementation phase. Even if there is some practice of evaluation and monitoring by the office experts, participation of the local farmers has been very low and, hence, this has made the farmers feel as if the work does not belong to them (less self-belongingness). Secondly, the culture of voluntarily maintaining SWC structures by the farmers is poor. Farmers tend to wait for public campaign work and development agents to take care of the maintenance (Wolancho, 2015). Some farmers ignore the SWC measures after they are damaged by rain and livestock, and others remove the measures during tillage processes. The main reason for this is a lack of awareness and household labour shortage, but the existing situation hampers the long-term defensive function of the SWC structure and challenges the crop productivity of the area.

During FGD in Wonago district, farmers raised that some farmers deliberately destroy SWC structures with the notion to take some incentives (in the form of money or kinds like wheat or cooking oil) while maintaining the structures. Therefore, due to some incentives, especially in the PSNP package, the local farmers showed strong will (agree, 78.67%) to maintain SWC measures each year. The increased willingness is not only for conserving the environment but also for earning money (a major driving force) from maintaining the SWC structures. Thirdly, the appropriateness of the SWC technology for the particular site determines the longevity of the structure in the place. Researchers (for instance, Wolancho, 2015; Miheretu and Yimer, 2017a; Moreda, 2018) explained that the appropriateness of the technologies (such as SWC) for a particular site relates to how these technologies are combined or compatible with the farming system and used. Some of the influencing factors for using appropriate SWC technology for a particular site are affordability, experience, and availability based on the degree of awareness.

In soil and water conservation principles, the physical structures must be integrated with biological measures such as grasses and trees along the contour line in the watershed. In the study area, all in all, farmers have a strong motivation for planting tree seedlings on their farm plots. According to the interview and FGD held in all districts, the higher motivation for planting tree seedlings was due to three important things. First, it is for environmental conservation, such as regulating soil erosion and land rehabilitation. Second, it is for satisfying alarmingly increasing household demand for fuel wood, charcoal, and animal feeds. Third, it is for satisfying the government office workers, politicians, and other NGOs for the sake of getting incentives in the form of money or kind for communal use either at the district or kebele level. The culture of planting seedlings in all study districts was improved over time. According to the respondents, around 56.67% of the interviewees replied that planting trees on their farmland has increased over time. However, tree selection and planting at appropriate sites is still a problem in the study area.

Though culture of planting trees by farmers has increased, vegetation coverage at the national level has decreased over time. A similar situation has also been seen in this research area, where a large number of tree seedlings have been planted each year, but a few have survived. This is connected with the survival rate of the planted tree seedlings that could be affected by many factors such as population growth, animal grazing, high dependency on biomass energy, agricultural expansion, poor governance, policy, and land tenure system of the area. The ambition of the government to build a climate-resilient green economy has played an influential role in mobilizing farmers for watershed works and planting trees on degraded lands. However, even if the culture of planting trees has been improved over time (agree, 53%), still seedling survival is under question in the study area.

As a rule of thumb, the technologies implemented in the watershed as community-based participatory watershed management works must pass through continuous monitoring and evaluation procedures. However, in the study area, as local farmers subjectively responded (disagree, 73%), there was no monitoring and evaluation of technologies implemented in the watershed so far. Due to a lack of continuous follow-up, different watershed works have been malfunctioning in a short period. Field observation carried out by the agricultural office experts in the watershed is rare and does not allow the active participation of the local farmers in monitoring and evaluation of watershed works.

Table 7. Community based participatory watershed management challenges in terms of technology usage in the village (N=300)

No.	Items	Respondent's Response					
		Agree		Neutral		Disagree	
		No.	%	No.	%	No.	%
1	There is appropriate site selection for appropriate SWC measures and tree seedling	94	31.33	24	8	182	60.67
2	High adaptation of technologies by farmers in the village	152	50.67	74	24.67	74	24.67
3	Farmers have strong willing for implementing SWC measures on their farm plot as well as in the communal land.	184	61.33	39	13	77	25.67
4	Any SWC measures constructed by farmers stay for long time in the watershed	56	18.67	80	26.67	164	54.67
5	Farmers have strong will for maintaining SWC measures each year.	236	78.67	17	5.67	47	15.67
6	Farmers have strong motivation for planting tree seedlings on time on her/his farm land and in the common land.	170	56.67	0	0	130	43.33
7	Farmer's habit of planting and caring seedlings has been improved through time.	159	53	39	13	102	34
8	There is continuous monitoring and evaluation of technologies or CBPWM works by farmers	48	16	33	11	219	73

3.3 Opportunities of community based participatory watershed management (CBPWM)

After the CBPWM program was initiated, the output gained by the local farmers from the watershed continued to improve over time and increased their economic and environmental benefits. Many opportunities allowed the implementation of CBPWM works in the study area (Table 8). In the past few years, recurrent drought and population pressure (1000 persons per sq. km) have reduced crop productivity in the watershed. As a result, farmers have shown motivation (55%) to reduce the impact of poverty through managing watersheds. Therefore, the presence of motivated farmers became a milestone for implementing CBPWM works in the country and the study area. Similarly, land degradation in the study area was considered an opportunity (agree, 64.33%) and attracted the attention of the farmers and the local governments. They also indicated that a decline in crop productivity due to land degradation was another case that attracted attention to watershed works.

A high population in the area has created a huge burden on the job opportunity. As a result, inhabitants of the area, especially the youth searching for off-farm jobs outside their area and daily laborers were engaged in watershed work. However, after implementing CBPWM works, some watersheds have been rehabilitated to a position that produces different goods and services for the people. The local people have used the rehabilitated watershed as an opportunity for job creation, such as fattening, beekeeping, and small-scale irrigation.

In Ethiopia, the culture of working together is very strong. Many platforms enable farmers to work together, such as *Debo*, *Jigi*, *Edir*, and *Equb*. Moreover, a public campaign in the form of CBPWM carried out each year for watershed works (agree, 71%) in the study area is one platform that manifests the habits of working together. CBPWM work is believed to improve the existing culture of the farmers working together. During the campaign of CBPWM, they close and experience each other, and this creates a good opportunity for skill and knowledge sharing. One farmer from the Wonago area explained that:

Working together enables individual farmers to share skills and knowledge on the types of work under question. Sharing skills enables them not only in the work they engage in but also in sharing some social life. The volume of work is also far greater than individual efforts.

On the other hand, working together does not always have a positive impact. Sometimes, the groups can be easily influenced by members and politicians, and the output may be strange, which is out of expectation. The presence of indigenous knowledge (IK) in the study area has been considered an opportunity for implementing CBPWM works. More than 50% of the respondents explained that our existing indigenous knowledge is a milestone for today's modern technologies, such as improved SWC practices.

Table 8. Opportunities of Community based participatory watershed management in the village (N=300)

No.	Items	Respondent's Response					
		Agree		Neutral		Disagree	
		No.	%	No.	%	No.	%
1	Presence of Motivated farmers	165	55.00	30	10.00	105	35.00
2	High rate of land Degradation	193	64.33	63	21	44	14.67
3	Presence of Experienced institution	70	23.33	55	18.33	175	58.33
4	Reduced crop land productivity	185	61.67	52	17.33	63	21.00
5	High demand for off-farm job	179	59.67	25	8.33	96	32.00
6	Increased national attention	169	56.33	61	20.33	70	23.33
7	Habits of working together	213	71.00	35	11.67	52	17.33
8	Availability of community indigenous knowledge	160	53.33	65	21.67	75	25.00

Figure 5. Wooden check dams made by the local farmers (Wonago area). Source: Haile, 2017

Researchers portrayed that the majority of the people in the rural area are rich in local knowledge, which they are conserving their environment. In the study area, farmers are well acquainted with traditional agroforestry system management and soil and water conservation measures. Increased attention has been given to indigenous tree species and Enset since they are highly attached to the cultural practices and food system of the area. The transfer of indigenous knowledge from elders to the juvenile generation ensures the sustainability of the system and its contribution to the modern means of conserving the environment. Therefore, it is recommended to seek ways to understand local wisdom and techniques related to environmental management and integrate this with the modern concepts of natural resource conservation.

3.4 CBPWM and ES awareness

As illustrated in table 9, respondents commonly reported an awareness of provisioning, regulating, supporting, and cultural ecosystem services. The majority of the respondents identified the ES based on the AEZs of the area. Thus, higher crop production (except coffee production) ES were observed by respondents in humid areas. Cereal crops (such as wheat and barley) and Enset (*Ensete ventricosum*) were commonly grown in the highland (humid) part of the study area.

In the semi-humid area, where coffee is predominantly grown, around 91.67% of the respondents were observed as provisioning ES services. However, as observed by the respondents, the semi-arid part of the study area has shown less provisioning services for crop production compared with humid and semi-humid areas. According to the respondents, higher raw material (51.67%) provisioning services were observed in the humid area relative to semi-humid and arid AEZs.

Table 9. Percentage of respondents who identified ecosystem service at their local area

Ecosystem Service	Humid (%)	Semi-humid (%)	Semi-arid (%)
Provisioning Services			
Crop production			
Cereals	71.67	10.00	18.33
Coffee	8.33	91.67	0.00
Enset	80.00	16.67	3.33
Raw material	51.67	23.00	25.33
Livestock feeds	26.67	31.67	41.67
Livestock production	28.33	11.67	60.00
Fuel wood	27.33	30.00	42.67
Fresh water	38.33	55.00	6.67
Natural/plant-derived medicines	34.33	36.67	29.00
Regulating & Supporting Services			
Soil Erosion regulation	19.00	70.00	11.00
Water regulation	21.67	69.00	9.33
Micro-climate regulation	26.67	55.00	18.33
Nutrient cycling	24.33	60.00	15.67
Soil formation	25.00	65.00	10.00
Pollination	18.33	61.00	20.67
Habitat/refugee	33.67	21.67	44.67
Cultural Services			
Recreation service	16.33	64.33	19.33
Spiritual value	30.67	32.33	37.00
Cultural practice	31.67	33.00	35.33
Sense of place	21.00	47.33	31.67
Cultural Heritage	27.00	51.00	22.00
Education and Knowledge of system	26.67	46.00	27.33

Farmers who reside in semi-arid areas have observed higher provisioning services of livestock feed (41.67%), livestock production (60.0%), and fuel wood (42.67%) relative to humid and semi-humid areas. However, freshwater (55.0%) and Natural/plant-derived medicines (36.67%) provisioning services in semi-humid areas were higher than in humid and semi-arid areas. Respondent's awareness of regulating and supporting services (Table 9) from ecosystems was low in humid and semi-arid relative to semi-humid areas.

Since agroforestry is the dominant land use type in the semi-humid area, higher amounts of soil erosion regulation, water regulation, micro-climate regulation, nutrient cycling, soil formation, and pollination were observed by the respondents. However, a remarkable number of respondents believed that there were higher services of habitat/refugee (44.67%) in semi-arid parts of the study area. In humid and semi-arid areas, these regulating and supporting ecosystem services were low for two main reasons. These were: (1) there is a continuous expansion of cultivated land at the expense of grazing and forest land uses for a mono-cropping system. (2) Excessive forest cutting for charcoal and timber making.

Respondents in the survey appeared to show and appreciate a spectrum of cultural services derived from ecosystems in different agro-ecological zones. Among these, 64.33%, 47.33%, 51.00%, and 46.00% of respondents appreciated and valued recreation services, sense of place, cultural heritage, education, and knowledge of the system in semi-humid areas. In this area, the higher appreciation of these ecosystem values is due to the presence of an agroforestry system. The area is evergreen and attractive for living. Moreover, the landscape has been in the process of being registered as a World Cultural Heritage on UNESCO for its traditionally managed use of local knowledge. In addition, this culturally managed landscape is becoming the source of education and knowledge systems for many young researchers from different Universities in and outside Ethiopia. A few respondents identified cultural services in humid areas relative to semi-humid and semi-arid areas. On the other hand, a similar awareness level was observed by the farmers (Table 9) residing in humid, semi-humid, and semi-arid areas on spiritual services and cultural practices of ecosystem services. However, relatively a small number of farmers have identified spiritual values (37.00%) and cultural practices (35.33%) in semi-arid areas. In the semi-arid areas, the ethnic Guji Oromo commonly resides, and this ethnic group has a strong attachment to spiritual and cultural exercises near water bodies and under the trees. Of course, the cultural practice under the tree is also common in the semi-humid area, locally called "*songoo*".

3.5 ES change, its trends and potential restoration measures

Respondents reported a declining supply of provisioning services such as raw material, livestock feeds, livestock production, fuel wood, fresh water, and natural/plant-derived medicines in all AEZs of the study area in the last five to ten years. On the contrary, cereal crop production has increased at the expense of other land use types, such as forest in humid, agroforestry in semi-humid and woodland in semi-arid areas due to high demands for food. However, farmers witnessed that coffee production has been expanding towards humid areas, while it is decreasing in both semi-humid and semi-arid areas.

Enset production has shown no change in humid areas, while it has decreased in semi-humid and semi-arid areas due to pest and disease problems. Farmers also indicated a decline in regulating and supporting ecosystem services in humid and semi-arid areas over the last five to ten years. Soil erosion regulation has declined each time due to the expansion of cultivated land and deforestation. Concerning soil erosion, water regulation, nutrient cycling, and soil formation service have been similarly decreased in the area. Despite these declines, actions taken to maintain ecological functions were limited. Moreover, the trend correlated even with the ineffectiveness of some conservation measures built in the area. In semi-humid areas, as reported by the respondents, change was not observed as it was seen in the humid and semi-arid areas. This is due to a traditionally managed agroforestry system in the areas.

Respondents also reported that cultural services of the ecosystem have declined in the area over the last five to ten years. Of course, even if the ecological functions available in the area are sufficient to deliver the service due to different factors such as modernization and religious effects, the exercises carried out by the people have decreased over time in the area. However, according to the respondent's observation in the semi-humid area, cultural services have shown no change over the last five to ten years. This is hopefully due to the effects of the agroforestry system in the area. On the other hand, the potential of the area for education and knowledge services has been increasing over time to understand how the culturally managed agroforestry system contributes to the conservation of natural resources of the area.

Table 10. Trends of ES in the study area

Ecosystem Service	Humid	Semi-humid	Semi-arid
Provisioning Services			
Crop production			
Cereals	↑	↑	↑
Coffee	↑	↑	↓
Enset	↔	↓	↓
Raw material	↑	↓	↓
Livestock feeds	↓	↓	↓
Livestock production	↓	↓	↓
Fuel wood	↓	↓	↓
Fresh water	↓	↔	↓
Natural/plant-derived medicines	↓	↓	↓
Regulating & Supporting Services			
Soil Erosion regulation	↓	↔	↓
Water regulation	↓	↔	↓
Micro-climate regulation	↓	↔	↓
Nutrient cycling	↓	↔	↓
Soil formation	↓	↔	↓
Pollination	↓	↔	↓
Habitat/refugee	↓	↔	↓
Cultural Services			
Recreation service	↓	↓	↓
Spiritual value	↓	↓	↓
Cultural practice	↓	↓	↓
Sense of place	↓	↑	↓
Cultural Heritage	↓	↔	↓
Education and Knowledge of system	↑	↑	↑

Note: ↑ = Increase, ↓ = Decrease and ↔ = No change

3.6 Measure to restore changes and maintain ES

Ecosystem service changes that have occurred in the study area are due to different sources. Some changes are emanated because of changes in livelihood, while others are due to nature. However, to whom the changes are concerned or emanated, the actions taken to curb and maintain ecological functions appeared to be very limited in the study area. Concerning the specific measures, enacting bylaws and enforcement to regulate access and users is common in areas where communal lands exist to control the behavior of the local farmers in resource consumption. Local bylaws are essential for restoring and maintaining ES by controlling the behavior of the local people. In the study area, almost more than 75% of the local farmers in all AEZs are aware of the importance of bylaws for the sustainability of ecosystem services. A large number of farmers (N=118) in the humid AEZ have been applying sustainable land management (SLM) compared with semi-humid (N=123) and semi-arid (N=59). In Humid AEZ, farmers are experiencing land degradation, so to curb this problem; they have been applying SLM projects with the help of government offices and NGOs. In the semi-humid area, where agroforestry is dominant, many farmers (N= 161) have used integrated soil fertility management on their farmland to boost crop production. In semi-arid AEZ, since crop cultivation is highly limited to adequate rainfall, applying integrated soil fertility management is almost uncommon for local farmers. On the other hand, technologies like water harvesting, planting multipurpose trees (fast and ecologically friendly), and planting early maturing trees and crops with the capacity to tolerate drought were used by the local farmers in all AEZs with some degree of implementation variations. Farmers in semi-arid AEZ (N=200) were aware of their environment and planted drought-tolerant crops. For soil and water conservation measures, only 39.67% of farmers in humid, 11.67% in semi-humid and 48.67% in semi-arid EAZs practiced to regulate water and promote crop productivity in the area. In semi-humid AEZ, since the area is covered by a traditionally managed agroforestry system, it is uncommon to apply physical SWC measures in a biologically managed environment.

Table 11. Local measures for restoring and maintaining ecosystem service (N=300)

No	Measures	Humid	Semi-humid	Semi-arid
1	Enact bylaw to regulate use or access	90	95	115
2	Water harvesting	88	103	109
3	Use of sustainable land management	118	123	59
4	Integrated soil fertility management	116	161	23
5	Planting fast growing and ecologically friendly trees	110	97	93
6	Planting of early maturing crops and trees	100	100	100
7	Drought tolerate crop variable	45	55	200
8	Applying soil and water conservation	119	35	146

4 Conclusion and Recommendations

The concepts and application of watershed management have been improved through time and have become the main solution for countries challenged by climate change impacts. It is an essential measure for rehabilitating or recovering deteriorated environments, especially in developing countries. For good practical application of watershed management, training, and awareness creation are vital for community mobilization. Based on this, farmers in all study areas were given training and made aware of their problems, such as land degradation, soil erosion, deforestation, soil fertility, etc.

In most surveyed districts, improper land use has affected soil productivity on individually owned lands; communally owned lands were severely degraded and demanded intensive land investment to restore it. Community-based participatory watershed management (CBPWM) aims to rehabilitate degraded land use types where watershed goods and services are not satisfying the demands of society. To alleviate the mentioned problems, the government has mobilized the community each year through a community campaign to implement different watershed management measures, such as site-specific soil conservation structures. The survey result revealed that farmers changed their perception towards change in environmental conditions since the start of CBPWM. Moreover, their attitude toward the benefits of CBPWM changed significantly over time. This research has identified the main challenges that have limited the successful accomplishment of CBPWM in the study districts. In all districts, there were problems with plan preparation and community participation through understanding the potential capacity of the kebele and woreda. Moreover, there were also challenges in terms of allocation and selecting appropriate and adequate resources for the CBPWM campaign. In addition, the research also identified limitations/challenges in terms of using appropriate and site-specific technologies, such as soil and water conservation measures in all sample districts. In most districts, soil and water conservation (SWC) structure selection, design, construction, and spacing were considered the major problems. Some major errors in SWC measures were the poor stone foundation, bunds with narrow berms, shallow channel depth, and long bund lengths for land users and their animals, such as oxen movement across the farmland. In addition, the effort to repair the broken/sediment-filled structures was poor in all districts and needs attention, which influences the long-term fate of these structures.

On the other hand, the efforts made to support the physical measures with biological measures with tree seedlings and fodder grasses on bunds and degraded lands can be considered excellent land management lessons that have motivated the farmers to participate voluntarily in such labor-intensive tasks each year. On the contrary to the above, the research has also revealed that the CBPWM campaign provided some concrete opportunities to the local farmers, such as motivation of farmers, gaining experience and lessons, increased national attention, and creation of job opportunities for the local farmers (off-farm jobs). The existing culture of farmers working together and their indigenous knowledge have played a tremendous role in making the CBPWM campaign effective, though some problems (such as training, plan preparation, resource allocation, and technology usage) persistently exist.

CBPWM has a positive contribution to the understanding of ecosystem service for the farmers. Based on this, the research has revealed that farmers found in different agro-ecological zone had different awareness levels. Farmers residing in humid areas have a higher awareness of ES, such as crop production (cereals and Enset production) and minimum awareness about coffee production. On the other hand, farmers in the semi-humid areas had more experience in coffee production than cereal crop production. Similarly, farmers in semi-arid areas had higher ecosystem service awareness of livestock production than coffee production. Farmers have witnessed that after watershed management was implemented, watershed goods and services were improved in the area. However, with some inappropriate management, such as cutting trees and lack of continuous maintenance and modernization), there were changes in the ecosystem services production(provisioning, regulating, supporting, and cultural services) and usage in the study area. Even if CBPWM has been carried out each year, ES (provisioning services such as crop production, raw material, livestock feeds, livestock production, fuel wood, fresh water, and natural/plant-derived medicines) has shown a declining trend over the last seven years in the study area. Similarly, the declining trends of provisioning ecosystem services have also influenced the regulating, supporting, and cultural services of ecosystems in the study area. Restoration of ecosystem services using different methods is different at different agro-ecological zones. Restoration measures such as water harvesting, planting fast-growing trees, early maturing, and drought-tolerant crops are more relevant to semi-arid agro-ecological zones. Similarly, applying SWC measures and using sustainable land management techniques were more relevant for humid agro-ecological zones.

Finally, the voluntary participation of farmers is mandatory for the sustainable management of watersheds and the continuous production of ecosystem services in the study area. Watershed plan preparation should be based on understanding the potential of the area, scheduling appropriate training for farmers, and allocating adequate resources (money, human, and technological) for effective watershed plan implementation requires continuously blending and relying on local farmers' knowledge and scientific measures. This enhances the collaboration between local communities and the scientists. This, in turn, enhances the efficiency of land use management activities and reduces disconnects between the local community and the researchers.

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Conflict of Interest

The authors declares that there is no conflict of interest.

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