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Socio-Economic Analysis of Sub-watershed Development Impacts: A Case Study from Ethiopia

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Abstract

Watershed development improves the economic, social, and environmental status of rural communities, and mainly the lives of rural poor people. Our study identified the household level socio-economic factors influencing sub-watershed development impacts in Ethiopia. A household survey was conducted to collect data from 1,080 respondents in nine districts in southern Ethiopia. The results revealed that age, educational status, and land size of respondents statistically significantly influenced the economic, social, and environmental impacts of sub-watershed development in their community. Those respondents who were older, with more completed years of education, and had relatively larger land size, perceived more sub-watershed development impacts. Social position of the respondents also influenced the economic and environmental as well as the social impacts of sub-watershed development, with community sub-watershed development committee members perceiving more impacts. Participation in sub-watershed development significantly positively influenced ($p < 0.01$) the impacts of sub-watershed development, indicating that the perceived sub-watershed development impacts were different for the participating and non-participating respondents. We suggest that raising awareness and dialogue with the community should precede similar community development practices to ensure community involvement at all stages for better watershed development impact.

Keywords: community impact, community development, rural development, watershed development, Ethiopia.

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1.0 Introduction

Successful community development efforts are vital to improve the lives of rural poor people (Nega et al., 2010; Palanisamia & Kumar, 2009; Zielenbach, 2004). Watershed development is implemented with the expectation of positive impacts on communities that directly or indirectly depend on a watershed for their livelihood, mainly to enhance the wellbeing of the rural poor (Palanisamia & Kumar, 2009; Singh et al., 2010; Yabi & Afari-Sefa, 2009). Watershed development has a range of positive impacts on the community when implemented effectively. It leads to sustainable rural development through conserved natural resources, rises in agricultural productivity, increased employment generation and household income, and empowerment of residents in the watershed (Kerr, 2002; Palanisamia & Kumar, 2009). It is also a vehicle to enhance livelihood security of rural households in the watershed because it improves the livelihood asset base (Agol et al., 2014; Ratna Reddy et al., 2004).

Watershed degradation causes high rates of soil erosion, resulting in sediment accumulation in downstream reservoirs and rivers, loss of soil fertility and desertification (Kerr, 2002). In Ethiopia, deforestation and land degradation in the form of soil erosion and declining land fertility have been a serious challenge to agricultural productivity (Lemenih, 2004). Highland areas in the country are seriously eroded and becoming unsuitable for cultivation and livestock grazing (Agidew & Singh, 2018). Watershed degradation has also led to a reduction in the quantity and quality of water and land resources, negatively affecting the livelihoods of the rural agricultural people who rely on these resources. The watershed gradation problem has been severe to the extent that it has affected environmental sustainability and agricultural productivity and contributed to poverty in the country at large (Bishaw, 2001; Lakew et al., 2005). The major factors that have contributed to this, among others, are poor watershed management and improper farming practices (Agidew & Singh, 2018).

Previous studies have investigated the community impacts of various community development practices. Conservation projects (Agol et al., 2014; Rasoolimanesh et al., 2017), community-based tourism (Goodwin & Santilli, 2009; Lucchetti & Font, 2013; Nitikasetsoontorn, 2015; Sebele, 2010; Zapata et al., 2011), food for work intervention (Chen et al., 2018; Nega et al., 2010), and community wind power development (Lantz & Tegen, 2009; Okkonen & Lehtonen, 2016) are some of the community development efforts whose impact has been explored by these studies. Understanding the economic, social, and environmental impacts of watershed development enables us to capture the real perceptions of local community members about the benefits and costs of the intervention (Hinchcliffe et al., 1995). However, most of the studies conducted on community development practices have mainly dealt with community participation and the impacts of the practices (Nitikasetsoontorn, 2015). Many of such studies have also emphasized the aggregate economic, socio-cultural, and environmental sustainability-related achievements of the practices (Agol et al., 2014; Kerr, 2002; Palanisamia & Kumar, 2009; Singh et al, 2010). However, these studies have given less attention to the household-level socio-economic factors that influence the impacts of community development practices.

Although some studies examined the impact of watershed development on local community members (Datta, 2015; Dimtsu et al., 2018; Kerr, 2002; Palanisamia & Kumar, 2009; Ratna Reddy et al., 2004; Singh, 2018; Singh et al, 2010), most of the

impact studies on watershed development are conducted in India. Also, these studies did not look into inter-household variations vis-à-vis the impacts of watershed development. There are few literatures on the issue under discussion, particularly in the sub-Saharan African region. Thus, our study aimed to contribute to bridging the observed literature gap in this region.

Most community development interventions assume that communities are homogeneous, have shared interests and benefit equally from the interventions. However, rural communities comprise complex relationships of class, gender, and ethnicity, and their interests are never uniform (Lucchetti & Font, 2013). As a result, the benefits obtained from a community development intervention cannot be uniform for all community members. Several factors play a role in influencing the impact of community development on households in the community (Kerr, 2002). Kerr argues that watershed development benefits are unevenly distributed among community members, and so are costs. He demonstrates that women and the poor are excluded from sharing the benefits of improved natural resource management in the community. A study conducted by Yabi & Afari-Sefa (2009) also indicates that the impact of community development projects is influenced by socio-economic factors such as family size, level of education and age of household heads.

Community participation at all stages of a community development intervention, from planning to evaluation, is instrumental for its success. The community in the study areas participated in and contributed different resources for sub-watershed development. The community members participated in sub-watershed development through different mechanisms, including meetings to prioritize the most degraded sub-watershed and identify problems, and the contribution of resources required for intervention. They contributed various inputs such as labor, time, farm implements, local construction materials, and seeds and seedlings that were to be planted as biological stabilizers in the sub-watersheds. The sub-watershed development work was conducted annually from February to March, when farmers were relatively free from agricultural activities for 30 consecutive days with five working days a week. The task they carried out on these days was the construction of various physical soil and water conservation structures, guided by development agents and local surveyors. The structures were built on both individual household farmlands and degraded communal lands.

Socio-economic factors concerning the community where the development practices are undertaken can influence the costs the residents incur and the benefits they obtain from the development practices (Hinchcliffe et al., 1995; Kerr, 2002). This reveals that socio-economic factors influence watershed development impacts on community members. However, very few studies have addressed socio-economic factors as influencing variables of impacts of community development practices. This study, therefore, aimed to identify the socio-economic factors influencing impacts of watershed development among communities in southern Ethiopia. The study also tried to answer the following research questions: which household socio-economic variables are associated with the sub-watershed development impacts? Does household participation in sub-watershed development influence the impacts of sub-watershed development?

2.0 Conceptual Issues

In developing countries where the economy largely hinges upon rain-fed agriculture, sufficient water and fertile land are the main requirements for their progress, since agriculture, water, and fertile land are inseparable (Bagherian, 2009). Thus, to bring progress to developing countries' economies, they need improvement in the agricultural sector. However, these countries are characterized by low agricultural productivity, severe natural resource degradation, and high levels of poverty (Kerr, 2002). The increasing vulnerability of agriculture in developing countries is attributed to the inadequate expansion of irrigation and variations in rainfall, particularly during droughts when the soil moisture is low. Soil erosion, overgrazing, deforestation, and land degradation are also among the factors for the vulnerability of agriculture in developing countries (Khajuria et al., 2014).

Watershed development is defined by Khajuria et al. (2014) as "the process of organizing the use of natural resources to provide necessary goods and services to people, while mitigating the detrimental impacts of land-use activities on soil and water resources" (p. 565). Watershed development is a holistic approach to conserve, regenerate, harmoniously use rural natural resources for income opportunities and employment generation, and restore ecological balance (Datta, 2015). Watershed development is seen as a way to mitigate soil erosion, overgrazing, deforestation and land degradation problems since it can conserve and regenerate natural resources such as soil, vegetation, and water, and can also raise rain-fed agricultural production and productivity (Nasrabadi et al., 2013). It can also lead to livelihood generation and raise income for the poor and landless through employment opportunities and reduce poverty since the whole ecosystem and people are involved in the process (Agidew & Singh, 2018; Hanumantha Rao, 2000; Kerr, 2002; Singh, 2018).

According to Khajuria et al. (2014), watershed development involves developing the entire community and natural resources mainly through restoring and managing soil fertility, water quantity and quality, and vegetation cover. He further argues that because soil and water conservation interventions lead to reduction of soil erosion and increasing of surface and underground water, they contribute to the productivity and production of crops, land use and cropping pattern, attitude of the community and their participation, and socio-economic conditions such as income, employment, and assets. Thus, watershed development is crucial to the sustainable production of food, fodder, water, and fuel wood and meaningfully addresses the social, economic and cultural status of the rural community within the watershed (Hanumantha Rao, 2000; Khajuria et al., 2014; Nasrabadi et al., 2013).

3.0 Previous Studies

Evaluating the impacts of community development intervention is a challenging task (El-Kogali et al., 2016; Yabi & Afari-Sefa, 2009). Various disciplines adopted varying approaches to measure the impacts, leading to lack of an agreed-upon methodology to evaluate the impacts of community development practices (Schirmer, 2011). Three approaches have been suggested in the literature with different methods of measurement to evaluate the impact of community development projects, namely, the 'before–after', 'with–without', and 'collective impact evaluation' approaches (Cabaj, 2014; Ratna Reddy et al., 2004; Rogers et al., 2015; Schirmer, 2011; Yabi & Afari-Sefa, 2009). Among these approaches, the collective impact evaluation framework is used in recent years to evaluate the community impacts of development interventions

(Walzer et al., 2016; Weaver, 2016). Our study employed the 'before–after' approach to investigating the economic, social and environmental impacts of sub-watershed development on local communities in southern Ethiopia.

Understanding the factors influencing community impacts of watershed development programs, as well as formulating and implementing policies based on that understanding, are essential for future rural community development interventions and community viability in general. Huge financial, material, and human resources have been expended by the Ethiopian government and the respective communities at sub-watersheds for development efforts since its commencement in the study areas in 2011. However, there have only been a few studies about the performance of watershed development. Most of these studies have also focused on the bio-physical aspects of the performance of watershed development in the country (Agidew & Singh, 2018; Wolancho, 2015; Meaza, 2015; Meshesha & Birhanu, 2015), and there have been no detailed studies about its watershed development impacts. Moreover, the effect of socio-economic factors and community participation on the intervention has not been entertained by any of the previous studies elsewhere in the country.

Previous studies on various community development projects identified different factors influencing impacts of the projects. According to El-Kogali et al. (2016), the impact of a community development project is influenced by household socio-economic characteristics. Household size, age of household heads, gender, land size, and level of education influence impacts of community development projects (Datta, 2015; Dolisca et al., 2006). Community development impact is also influenced by gender, with women benefiting less. This is because women participate less and are marginalized from effective decision making even if they participate in development projects (Singh et al, 2010). According to Dorsner (2004), the social status of individuals affects community participation and benefits from it, with those with a higher status getting more access to impacts of community development projects. However, most of the aforementioned studies examined household socio-economic characteristics influencing impacts of natural resource conservation and community tourism projects. Whether socio-economic variables influence watershed development impacts has been less investigated.

The manner in which a community development project is implemented plays an important role in the success or failure of the project and also influences its impact on the community. In this regard, the degree to which the local community participates counts the most (Lucchetti & Font, 2013). Community participation can make development projects better designed and more responsive to the needs of the poor (Matarrita-Cascante & Luloff, 2008). Community participation leads to better targeted and more equitably distributed project benefits, and better maintained community assets. Participation also plays a crucial role in promoting local development and social empowerment, improving the quality of the physical environment, increasing social justice and solving community problems (Mansuri & Rao, 2004). Rasoolimanesh et al. (2017) also argue that participation and community impacts of development practices are associated in a manner where positive impacts attract more participation and vice versa. According to Milton et al. (2012) and Nega et al. (2010), participation in community development projects leads to a positive impact on the participating households and empowerment of the community. Other studies also confirmed that there is a positive association between community participation and impacts of watershed programs, indicating that when participation is higher, the

benefits obtained from the watersheds also become higher (Nitikasetsoontorn, 2015; Singh et al., 2010).

The available literature indicates that household socio-economic factors can influence the impacts of community development projects in general and watershed development in particular. However, the literature lacks detailed analysis of the impacts of watershed development in relation to the socio-economic characteristics of households in the watershed. Thus, our study tried to fill this gap.

4.0 Methodology

4.1 The Study Site

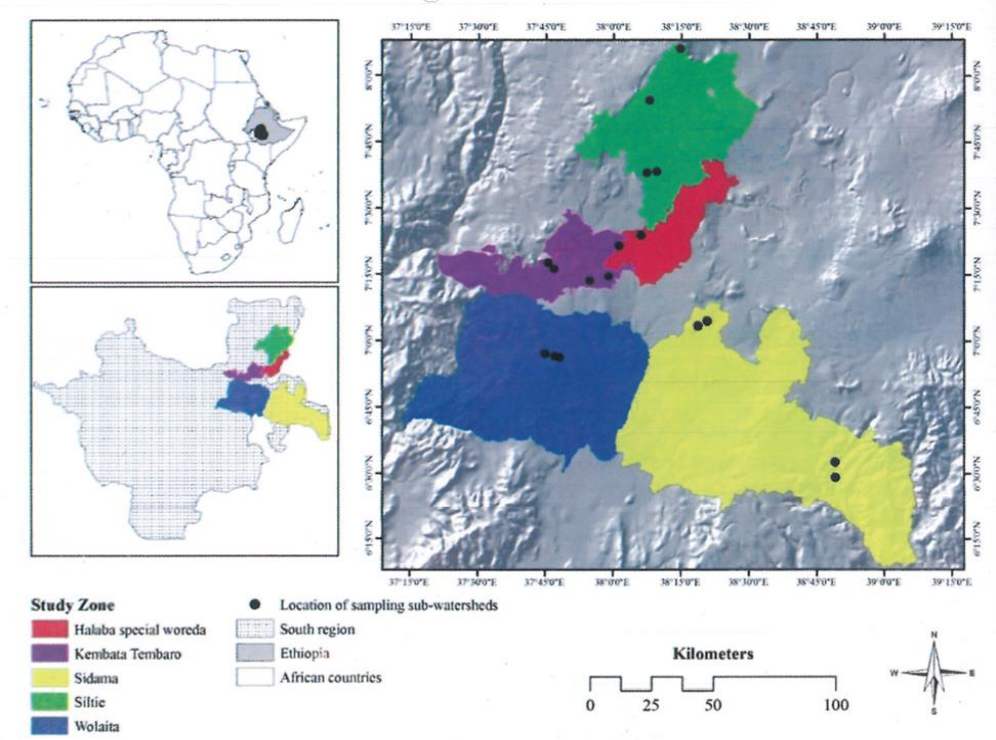
This study was conducted in the Southern Nations Nationalities and Peoples Regional State (SNNPR), which is one of the nine administrative regions in Ethiopia (see Figure 1). Geographically, it lies roughly between 4°43"–8°58" north, and 34°88"–39°14" east. The total area of the region is estimated to be 109,015 km^2, accounting for nearly 10% of the total area of the country. Its total population is 20,806,680; accounting for nearly 20% of the total population of the country and its average population density is 193 persons per square kilometer (Bureau of Finance and Economic Development, 2019). This regional state is located in the southern and southwestern part of the country and comprises several agro-climatic zones with a variety of natural resources. Land degradation was rampant in this region, although its extent varied from place to place. The central administrative zones in the region where population density was higher, and landholding was smaller, were the most degraded places among others. This necessitated an immediate watershed development intervention to curb the watershed degradation threat in these areas (Lakew et al., 2005).

To this end, a large amount of resources has been expended for watershed development by both the Ethiopian government and the respective communities in the sub-watersheds. The sub-watershed development work was started in February 2011 in the communities in the central zones of SNNPR. The main objectives of the sub-watershed development program were to reclaim land productivity and improve the livelihood of the residents, manage and improve environmental conditions, and address the social issues. Considering the high severity of watershed degradation and massive sub-watershed development practices in these administrative zones, the central zones of the region were selected for the study. Accordingly, we selected two sub-watersheds from each district. A sub-watershed has a drainage area ranging from 200 to 500 hectares as delineated by the Lakew et al., (2005).

4.2 Data Collection

A multistage sampling technique was employed for this study. First, four central zones, namely Kembata-Tembaro, Sidama, Siltie and Wolaita, and one special district (Halaba) were purposely selected from the SNNPR. This was done based on the severity of land degradation and the extent of the sub-watershed development intervention in these areas. Second, two districts from each zone and one special district based on their agro-ecology—highland versus midland—for a total of nine districts were selected on the basis of the same criteria mentioned for the selection of zones. Finally, two sub-watersheds from each district, for a total of 18 sub-watersheds, were identified to select the sample households.

Figure 1. Map of the study area.



Source: Authors.

A household survey was conducted to obtain data for the study. Accordingly, 1,080 respondents, 60 from each of the 18 sub-watersheds, were selected using a simple random sampling technique. A list of households was obtained from the respective administrative center where the watershed is located, and 60 heads of household were randomly selected from each sub-watershed. A household survey questionnaire with an exhaustive list of questions was developed to collect data from the respondents. Although data were collected from 1,080 respondents, 16 questionnaires had incomplete responses and were discarded during data entry. Thus, 1,064 sample data were analyzed for the study. Three data collectors were selected from each sub-watershed to collect household data and were given training on the questionnaire. The questionnaire was pretested and all the necessary editing and modifications were made before the commencement of the actual survey.

To get informed consent of the participants in the study, we explained the purpose of the study to the respondents indicating that the study would be used for academic purposes and that participation in it had no foreseeable risks. We informed the respondents that participation was voluntary, refusal to participate involved no penalty, and the subject could discontinue participation at any time. We also assured the respondents that their identity would be kept anonymous and their responses would be confidential. We then, asked the respondents for their consent to participate in the survey, and all the respondents verbally gave their consent. Data were collected from May 2014 to March 2015. Secondary information such as published and unpublished reports and manuals from government offices, non-governmental organizations, journal articles, and books were also used.

4.3 Measures

The dependent variables were the economic, social, and environmental impacts of the sub-watershed development. In this study, the sub-watershed development impacts refer to the desired changes observed in the community as a result of sub-watershed development. The independent variables hypothesized to influence the impacts of sub-watershed development were (a) gender, (b) age, (c) level of education, (d) total household income, (e) land size, (f) family size, (g) social position in the community, and (h)community participation. Participation in sub-watershed development work was computed by taking the average value for participation before—at the beginning in 2011—and after—in 2015—the sub-watershed development. The components of economic, social and environmental impacts were adapted from (Food and Agriculture Organization, 2002; Food and Agriculture Organization, 2015; Hinchcliffe et al., 1995; Singh et al., 2010). The economic impact was explained by the average annual total household income before and after intervention.

Data for total household income were collected with national currency (birr) and converted to U.S. dollars using the average exchange rate during the data collection period (1 USD to approximately 20.0 birr). The environmental impact was evaluated by obtaining the composite mean of response for (a) rehabilitation of degraded and gully areas, (b) reduction of surface runoff and soil loss, (c) increase in soil water content, (d) increase in amount of river or spring flow, (e) vegetation cover, and (f) biodiversity status. Social impact was also evaluated by obtaining the composite mean and the items included (a) reduction of migration, (b) availability of protected places with shade for social events,(c) reduction of conflicts over land tillage practices, (d) access to communal resources—such as grass and fuel wood—(d) and (e) sense of ownership and sustainability of the developed sub-watershed.

4.4 Analysis

The data were analyzed as both inferential and descriptive statistical data using SPSS software version 24.0. Preliminary tests for data cleaning were performed to determine the characteristics for each variable using statistical techniques. Descriptive statistics such as mean, standard deviation, and percentages were used to present data and see the relationships. Finally, multiple regression was deployed to see the relationships between the independent variables and sub-watershed development impacts.

5.0 Results

5.1 Socio-economic Characteristics of Respondents

As shown in Table 1, the respondents were dominated by males (87.7%), and 55.7% of them were aged 40 years or less. Of the respondents 37.6% had no education, whereas only 7.2% of them had completed high school or higher level of education. The average family size of the respondents was 7 family members. The vast majority of respondents (79.2%) held community membership only as a social position, and most of them (64.1%) had landholding of less than 1 hectare. The average landholding of the respondents was 0.8 hectare. The average annual income of the respondents was USD 268.7 before the sub-watershed development intervention in 2010 and USD 336.4 after the sub-watershed development intervention in 2014.

Table 1. *Profile of the Respondents (N=1064)*

		Frequency (%)			Frequency (%)
Gender	Female	131 (12.3)	**Social position**	Member	843 (79.2)
	Male	933 (87.7)		Sub-watershed committee	66 (6.2)
Age	<30	155 (14.6)		Kebele council member	86 (8.1)
	31–40	437 (41.1)		Religious leaders & elders	69 (6.5)
	41–50	288 (27.0)	**Land size**	Less than 1 ha	682 (64.1)
	51-60	123 (11.6)		1–2 ha	361 (33.9)
	>61	61 (5.7)		More than 2 ha	21 (2.0)
Level of education	No education	400 (37.6)	**Total annual household income (USD)**	2010 200 or less	639 (60.1)
	Elementary (1–6)	462 (43.4)		201–400	142 (13.3)
	Middle school	126 (11.8)		401–600	203 (19.1)
	High school	69 (6.5)		601–800	46 (4.3)
				801 or more	34 (3.2)
	College or above	7 (0.7)		2014 200 or less	487 (45.8)
Household size	Less than 5	184 (17.3)		201–400	228 (21.5)
	5–8	628 (59.0)		401–600	94 (8.8)
				601–800	78 (7.3)
	9–12	225 (21.1)		801 or more	177 (16.6)
	More than 12	27 (2.5)	**Household Participation**	2011 No	695 (65.3)
				Yes	369 (34.7)
				2015 No	77 (7.3)
				Yes	997 (93.7)

5.2 Factors Influencing Sub-watershed Development Impacts

This section presents the results of multiple regression. It presents household socio-economic characteristics and participation in sub-watershed development as factors influencing the impacts of sub-watershed development. The results also provided answers for the research questions: which household socio-economic variables are associated with the sub-watershed development impacts? Does household participation in sub-watershed development influence the impacts of sub-watershed development?

As indicated in Table 2, a statistically significant positive association was observed between age and the economic (t = 2.040, p< 0.05) and environmental impacts (t = 3.856, p< 0.01) of sub-watershed development. This indicates that those respondents who were older, perceived more economic impact, that is, increased total annual household income due to the development of the sub-watershed in their community. They also perceived more environmental impacts of sub-watershed development such as (a) the rehabilitation of degraded and gully areas, (b) reduction of surface runoff and soil loss, (c) increase in soil water content, (d) increase in amount of river or spring flow, and (e) vegetation cover and biodiversity status. In the same manner, education was also associated positively with economic (t = 3.442, p< 0.01) and environmental impacts (t = 3.211, p< 0.01), indicating that respondents with more completed years of education perceived more sub-watershed development impacts.

On the other hand, household land size showed a statistically significant positive association with the economic (t = 5.758, p< 0.01*)* and social impacts (t = 2.096, p< 0.05) of sub-watershed development including (a) the reduction of migration, (b) availability of protected places with shade for social events, (c) reduction of conflicts over land tillage practices, (d) access to communal resources—grass and fuel wood, and (e) sense of ownership and sustainability of the developed sub-watershed. This implies that households with a relatively larger land size perceived more economic and social impacts of sub-watershed development than those with small landholdings. The results also showed that the sub-watershed development committee members had a statistically significant positive association with economic (t = 2.265, p< 0.05) and social impacts (t = 2.01, p< 0.05) of sub-watershed development. This indicates that community sub-watershed development committee members perceived more impacts of sub-watershed development compared to other members of their community.

Regarding household participation in sub-watershed development practices, 93% of the respondents had contributed labor and farm implements in the course of sub-watershed development. Again, 5.3% reported that they had contributed local construction materials, seeds, and seedlings in addition to labor. The result also revealed that household participation was significantly positively associated with the impacts of the practices. This shows that households that participated more in sub-watershed development perceived more impacts of social and environmental impacts such as the rehabilitation of degraded and gully lands, reduction of surface runoff and soil loss, increase in soil water content, increase in the amount of river or spring flow, increase in vegetation cover and improvement of biodiversity status. It also shows that the participating households perceived fewer economic benefits than they initially anticipated.

Table 2. *Multiple Regression Analysis*

	Economic impacts			**Social impacts**			**Environmental impacts**		
	B	*β*	t- value	B	*β*	t- value	B	*β*	t- value
Constant	777.633		2.460*	1.731		36.735**	1.701		35.166**
Gender (male=1, female=2)	-13.496	-.003	-.100	-.011	-.017	-.554	-.027	-.042	-1.319
Age	8.425	.066	2.040*	.001	.041	1.241	.002	.125	3.856**
Education (year)	47.713	.112	3.442**	.002	.028	.865	.007	.105	3.211**
Land size (ha)	127.807	.185	5.758**	.007	.068	2.096*	.000	.002	.063
Household size (number of people)	-19.086	-.034	-1.053	.000	.005	.141	.002	.019	.584
Social Position									
-*Kebele* Council	156.67	.026	.856	.029	.033	1.07	.028	.032	1.01
-Sub-watershed committee	367.15	.071	2.265*	.048	.064	2.01*	.047	.060	1.91
-Religious leaders & elders	8.83	.002	.050	.027	.032	1.03	.048	.055	1.78
-Member (reference)	-	-	-	-	-	-	-	-	-
Participation in sub-watershed development (after–before, No=1, Yes=2)	-112.14	-.070	-2.243*	.038	.159	5.083**	.030	.121	3.86**
F value	6.775**			5.210**			5.042**		
R^2	.055			.043			.042		
Adjusted R^2	.047			.035			.033		
Durbin-Watson	1.826			1.398			1.097		

* p<.05, ** p<.01

6.0 Discussion

This study was conducted to investigate the socio-economic factors influencing sub-watershed development impacts among rural communities in southern Ethiopia. The study aimed to identify major household socio-economic factors that influenced the perceived impacts of sub-watershed development in their community. The results clearly showed that socio-economic factors related to the respondents significantly influenced the impacts of sub-watershed development.

The results demonstrated that the age and educational status of the respondents influenced the economic and environmental impacts of sub-watershed development. Age was positively associated with the economic and environmental impacts, indicating that respondents in the higher age group perceived more economic and environmental impacts than the younger respondents. A close examination of the study area provides insights for this result. In the study area, young farmers have less landholdings due to frequent land redistributions and younger farmers invest little in their land compared to the older farmers. On the other hand, older farmers having relatively larger landholdings, tend to invest more, which might have made the older farmers perceive better impacts of the sub-watershed development.

Education was also positively associated with the sub-watershed impacts showing that farmers with more years of education perceived more economic and environmental impacts of the sub-watershed. The general reason for this is that when individuals have more years of education, they get exposed to wider social networks and develop richer social capital, which leads to easier integration into the surrounding living environment, and enables them to easily utilize the available benefits (Li & Tan, 2019). Education also exposes people to a broader range of ideas, beliefs and alternatives and thus encourages them to strive for a better future (Awortwi, 2012; Nasrabadi et al., 2013). This result also coincides with previous studies that suggest age and education as significant factors affecting benefits from community development practices (Datta, 2015; Dolisca et al., 2006; El-Kogali et al., 2016).

Land size was positively associated with economic impacts and social impacts of sub-watershed development, indicating that households with relatively larger land size perceived more economic and social impacts. The explanation for this is that large and medium landholders make more investments in irrigation equipment and other agricultural inputs and get more economic returns (Singh et al., 2010). Social impacts such as the reduction of conflicts among adjacent households over land tillage practices that cause surface runoff and soil loss during rainy seasons were mainly witnessed by households with large land size. Those households with small land size use hoes for cultivating their land rather than plowing it. This finding coincides with other studies with similar results about land size (Kerr, 2002; Singh et al., 2010). Unlike other studies that reported gender and household size influencing the impacts of community development practices (El-Kogali et al., 2016; Singh et al, 2010; Yabi & Afari-Sefa, 2009), these variables were not found to significantly influence the impacts of sub-watershed development in this study.

The results also revealed that households' social position in their community was significantly positively associated with the economic and social impacts of sub-watershed development. The result implies that the community sub-watershed development committee members perceived improvement in their total annual household income more than other members of the community. As opposed to other

members of the community, the sub-watershed development committee members more perceived (a) reduction of migration, (b) availability of protected places for social events, (c) reduction of conflicts over land tillage practices, (d) improved access to communal resources, and (e) better sense of ownership and sustainability of the developed sub-watershed. The reason for this was that the sub-watershed development committee received frequent skill enhancement training about sub-watershed development benefits due to their position in the community, which helped them observe more impacts than the others. This result is also in harmony with a study by Dorsner (2004) that reported that respondents' social position influenced the benefits they obtained from a community development project.

Participation in sub-watershed development significantly positively influenced the impacts of sub-watershed development, suggesting that the benefits obtained were not the same for the participating households and others. As far as the economic impact is concerned, the results show that the participating households obtained less economic benefits than they initially anticipated. The high level of participation in the later years implies that households anticipated more economic benefits from participating in sub-watershed development but obtained less benefit. This could be because the economic returns come relatively gradually and require more additional investment than sub-watershed development alone. Sub-watershed development also yielded more social and environmental benefits to the participating households. The physical impacts of sub-watershed development such as reduction of surface runoff and soil loss that erodes across the adjacent household's farmland in turn, led to lessening of conflicts among households over the same issue. This finding fits well with other studies that reported that community participation influences households' ability to benefit from the practices and helps them to get a better share of it (Mansuri & Rao, 2004; Milton et al., 2012; Nega et al., 2010; Nitikasetsoontorn, 2015).

7.0 Conclusion

We conclude that household socio-economic factors significantly influenced the perceived impacts of the sub-watershed development in the communities. Older farmers and those with more completed years of education perceived more economic, social, and environmental impacts. Community sub-watershed committee members more perceived the sub-watershed development impact than other members of the community because of the frequent training they received about sub-watershed development apart from others. Households that participated in sub-watershed development perceived more impacts compared to those that did not. However, the total variance explained by the socio-economic factors included in our study points out that other factors, which are not included in the study influenced sub-watershed development impact to a greater extent.

We recommend that since skill enhancement training contributed to households' perception of impacts, awareness creation and skill enhancement training should precede similar community development projects. Designing mechanisms for convincing households to participate in development practices is also a useful point worth mentioning. The findings contribute greatly to the available knowledge by identifying the socio-economic factors associated with the impacts of community development practices, where there have only been limited studies. Our study, like other studies, had limitations. The study did not investigate some aspects of community impacts of watershed development such as empowerment of the community and gender issues in participation and decision making. Furthermore, it

did not consider participation at which specific stage of sub-watershed development influenced the sub-watershed development impacts. Future studies could investigate the impact of watershed development on these issues as well. Future research could also investigate the association between intra-household issue, class, and ethnicity with sub-watershed development impacts.

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