Article

Assessment of the farmers' perception on watershed degradation and management practices in Wera sub-watershed, Southern Ethiopia

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Abstract
Land degradation has become an ecological and agricultural productivity issue in the Wera sub-watershed. To curb this, farmers' mobilization was used to execute various watershed management methods. As a result, in the Wera sub-watershed, this study investigated farmers' perception of watershed degradation problems and management practices. The data was collected using a random sample of 110 respondents, a focus group discussion with the households, and field observation. Farmers were aware of the occurrence of watershed degradation (89.5%) and how it was hurting their livelihoods, while 10.5% of respondents said there was no watershed degradation problem on their plots. Watershed degradation was attributed to uncontrolled grazing (81.2%), intensive cultivation (79.6%), deforestation (65.1%), inappropriate conservation practices (64.7%), topographic nature of land (62.8%) and indigenous farming practices (48.4%). The common practices in the Wera sub-watershed included soil bunds, fanya-juu, cutoff drains, check dams, trenches, area exclosure, agroforestry activities, and grasses with and without physical soil and water conservation structures. The approach was benefit-driven and site-specific. In conclusion, watershed management practices via identifying and integrating technical as well as site specific can help to cope with degradation, thus increasing the benefits obtained from the practice.

Keywords farmers' perception; watershed degradation; watershed management.

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1 Introduction

In Ethiopia, watershed degradation in the form of soil erosion and declining fertility is a serious challenge to agricultural productivity and economic growth (Mulugeta, 2004). Natural resources and the benefits they provide in the form of income, food, and watershed protection have no options and have a critical role in

enabling people to have a stable and adequate food supply (Bishaw, 2005). Therefore, watershed degradation is severely reducing the capacity of natural resources to contribute to food security and other benefits, such as fodder and fuel wood, in Ethiopia (Bishaw, 2005; Tesfa and Mekuriaw, 2014). An alarming rate of population increase, more demand for food, and the expansion of settlements result in deforestation for the expansion of agriculture, construction materials, fuel wood, and overgrazing (Gashaw, 2015;Worku and Tripathi, 2015). Watershed degradation has resulted in reduced productivity and has increased poverty and food insecurity (Dalhatu and Garba, 2012; Tilahun and Bedemo, 2014). It is the major environmental problem resulting from the decline in agricultural productivity (Tesfa and Mekuriaw, 2014). The average rate of soil erosion in the country was estimated at 12 t ha^{-1} yr^{-1}, giving a total annual soil loss of 1,493 Mt. The severity is much higher in agricultural land, where 85% of the total population depends on it for their survival (Authority, 2012).

A sustainable, effective and efficient method against erosion is an integral component of natural resource management to achieve productive agriculture, food security and restoration of ecology (Shiferaw, 2015; Tamene et al., 2006). To protect the livelihoods of rural people who are experiencing fragile ecosystems, resource degradation, and loss of fertile soil and stress from soil moisture, watershed management practices have been recommended as a strategy. It is used to ensure the availability of water for domestic use, livestock, and irrigation, increase fodder for livestock, and diversify income and employment opportunities for households and landless people by improving agricultural productivity in general (Arya et al., 2011; Johnson et al., 2013). To achieve food security and environmental rehabilitation, the government of Ethiopia has been implemented different watershed management practices in many parts of the Ethiopia including Wera sub-watershed in Analemo district. Integrated soil and water conservation measures have been practiced since in the early 1990s through community mobilization and Safety Net Program during Plan for Accelerated and Sustainable Development to End Poverty and currently Growth and Transformation Plan. Although, wonderful efforts has been made by the government of Ethiopia to reduce environmental degradation, still serious threat in achieving sustainable agricultural growth and stable economic development (Taddese, 2001). In Ethiopia, most of the time farmers are enforced to participate in the conservation activity without any clear identification and priority needs of them (Shiferaw, 2015; Bewket, 2003).

Watershed resource degradation is closely related to the interests of farmers, so proper identification of degradation prone area and site specific watershed management techniques is the interests of the users (Amsalu and De Graaff, 2007). Awareness and familiarity of farmers about watershed degradation is the determinant social factor which is important in deciding the options to restrain the losses. Taking into account, farmers understanding on watershed management practice are unquestionable and effective mechanism for the sustainable implementation of watershed management activities (Daba, 2003). Identifying site specific problems with integrating local understanding and available raw materials is the major components of successful watershed management practices in sustainable way (GTZ, 2005). Accordingly, without recognizing how farmers are makes a decision to use their land, degradation problem and watershed management practices cannot be stated (Mazzucato and Niemeijer, 2000). Therefore, this study examined farmers' perception on watershed degradation problems and its management practices in Wera sub-watershed in Analemo district.

2 Materials and methods

2.1 Study area description

This study was conducted in Wera sub-watershed which is located in Anlemo district of Hadiya Zone in southern Ethiopia. The district is 210 km far from Addis Ababa and 18 km from Hosanna which is capital town of Hadiya Zone. Geographically it is located 7°54'7.7"N latitude and 37°89'38.06"E longitude (Fig. 1). It

also relatively located at North Silte zone, at South Lemo district, at East Shashogo district and at West Misha district of Hadiya Zone (Fig. 1).The farming system is characterized mixed crop- livestock system on a subsistence scale in which majority of the population live. Commonly growing crops in the area are Teff, wheat, maize, and chick peas. Coffee is a major cash crop and cattle and sheep are the dominant types of livestock. Since the farming system is depending of rain-fed system, therefore, communities are always concerned about the duration and concentration of rainfall (ALDA, 2016).

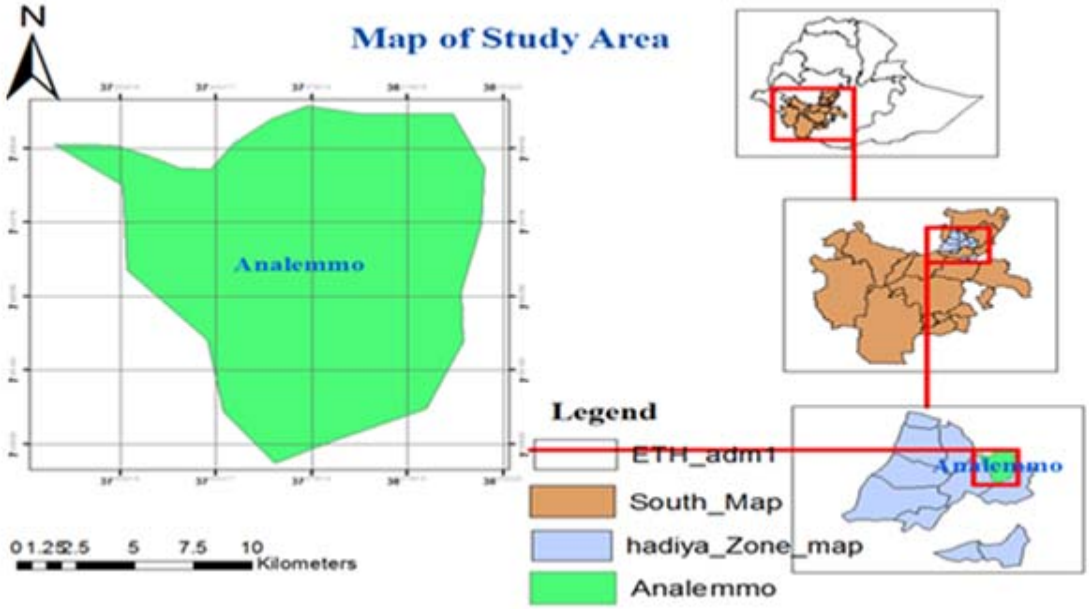

Fig. 1 Location of study area.

Croton macrstachys, *Cordiaafricana*, *Podocarpus falcatus*, and *Erythrinaabyssinica* are some of the frequent plants found in the research region. Vitric and Nitosol are the most common soil types in the area, which encompass the whole district. The district had an average yearly rainfall of 1001 to 1200 mm with a temperature range of 15°C to 20°C. The rainy season is bimodal and irregular, with the short rainy season occurring from March to April and the big rainy season being from June to October. In terms of agro-ecological coverage, the district has 20% highland, 42% midland, and 38% lowland land (Solomon and Tamrat, 2019). District, on the other hand, is reliant on mixed agriculture (crops and cattle).

2.2 Data collection and analysis

Several watershed management practices have been started in different parts of Ethiopia, including the Wera sub-watershed in the Analemo district. On the basis of the severity of the watershed degradation, the Wera sub-watershed was purposefully selected for the study. With the list, a random sampling technique was used to select a total of 110 sample respondents. Primarily, a questionnaire was prepared for quantitative information, then an interview was done with selected respondents while they were doing community based watershed management practices. Supplementary information was obtained through informal discussion at the same time community based watershed management practices were undertaken. Structure questionnaires were comprised of both open and closed ended questions. The issues included in the questionnaires were community observation of watershed degradation, and its management practices and willingness to continue watershed

management practice. After having this information, the entire relevant information was analyzed using SPSS version 20 then, described by using descriptive statistics such as frequency, tables and figures. Based on the results, the perception of farmers towards watershed degradation and their management practices were assessed in the Wera sub-watershed in Analemo district.

3 Results and Discussion

3.1 Respondents characteristics

According to Table 1, 75% of respondents were between the ages of 20 and 49, and only 25% of respondents were over 50 years in the research area, with an average age of 41 years. The survey revealed that 88.3% of the respondents were male, and the male respondents' dominance revealed that they were the most active in watershed management efforts. Female respondents were 11.7%. In terms of family size, approximately 49.6% of respondents have a family of 0 to 6 people, while over 50.4% have a family of more than seven individuals. In the Wera sub-watershed, the majority of respondents were married (85.9%). In contrast, 14.1% of respondents who were surveyed were single. In terms of the research area's educational standing, approximately 59.9% of respondents were literate, while approximately 40.1% were illiterates (Table 1). Educated farmers have a better perception of watershed degradation and management practices than non-educated farmers, according to key informants in the study area, because educated farmers better recognize the risk associated with watershed degradation problems and thus tend to use appropriate measures on their farm plots. Furthermore, they have a habit of not cultivating marginal lands in sloppy places that require a check dam. Similarly, Tesfaye (2003) reported that a unit increases in education increases the probability that farmers will use improved watershed management practices.

On the other hand, approximately 78.2% of interviewed respondents had land size of <1ha, whereas approximately 21.8% of respondents have land size of ≥1 ha (Table 1). Farmers frequently comment on how small our land is in comparison to the number of family members we have. As a result, we extensively cultivate a piece of land without fallowing it, resulting in watershed deterioration in the district. Land is the most important natural resource in the district for accomplishing the district's goals of national food security and economic development.

3.2 Farmers perception of watershed degradation problems in study area

The knowledge and perception of farmers regarding watershed degradation is important when we consider sustainable watershed management practices. About 89.5% of the respondents perceived watershed degradation as a problem on their plot of land (Table 2), while 10.5% only perceived that there was no degradation problem on their farm. The survey households reported the main causes of watershed degradation were the topographic nature of the watershed without conservation measures (64.7%), intensive cultivation (87.2%), uncontrolled grazing (78.3%), deforestation (79.6%), inappropriate conservation measures (65.1%), and using indigenous farming practices (62.8%). In contrast to this, some respondents reported no causes of watershed degradation such as topographic nature (35.3%), intensive cultivation (12.8%), uncontrolled grazing (21.7%), deforestation (20.4%), inappropriate conservation measures (34.9%), and indigenous farming practice (37.2%) (Table 2). As reported by the farmers during discussion, the significant population growth in the area created land scarcity and forced them to highly minimize fallowing in the watershed. However, the findings of the link between population pressure and an increase in soil erosion contradict the findings of some studies which argue that an increasing population is not necessarily a direct cause of land degradation, as a large population may help as an asset for rehabilitation (Sonneveld and Keyzer, 2003).

Farmers use their own indicators to determine whether or not there is watershed degradation on their farm. Among the farmers who perceived a problem with watershed degradation, the surveyed households indicated

the following indicators: gully appearance on cultivated land (98.8%), drop in soil productivity (76.4%), soil color change (79.6%), and decline in plot production (49.1%) (Table 2). Gully formation, top soil runoff removal, and poor soil water-holding capacity were deemed to be less likely indications of watershed degradation. Farmers have recently recognized that natural resources have grown more vulnerable to erosion as a result of intense farming without fallowing due to climate change.

Table 1 Household characteristics of Wera sub-watershed in Analemo district (n=110).

Household characteristics		Percentage (%)
Age (year)	20-49	75
	≥50	25
Gender	M	87.3
	F	12.7
Family size(number)	0 to 6	47.6
	≥7	52.4
Marital status(number)	Married	85.9
	Unmarried	14.1
Education level	Literate	59.9
	Illiterate	40.1
Land size(ha)	<1	78.2
	≥1	21.8

Table 2 Farmers′ perception of watershed degradation, causes and indicators in Wera sub-watershed.

Variables		Responses of households (%)	
		Yes	No
Watershed degradation problems around your locality?		89.5	10.5
Causes for watershed degradation	Intensive cultivation	87.2	12.8
	Uncontrolled grazing	78.3	21.7

	Deforestation	79.6	20.4
	Inappropriate conservation practices	65.1	34.9
	Topographic nature of watershed	64.7	35.3
	Indigenous farming practice	62.8	37.2
Indicators of watershed degradation	Yield reduction	92.3	7.7
	Formations of gullies	98.8	1.2
	Soil fertility decline	76.4	23.6
	Soil color change	79.6	20.4

3.3 Perception of farmers on watershed management practices

Understanding farmers' perception of watershed degradation and its impact is important in promoting watershed management practices. Watershed degradation is a menacing and slow process. Therefore, farmers need to perceive its severity and the associated yield loss before they can consider applying watershed management practices. Likewise, understanding of farmers' knowledge and their perception of factors that influence their watershed management practice is of paramount important for promoting sustainable watershed management (Tesfaye, 2003). It is also interesting to know if and when farmers practice what they know and perceive. When asked about the benefits of watershed management practice, 85.6 percent of those surveyed said they were aware of the benefits, while 14.4% said they were unaware of the benefits of community-based watershed management practice (Table 3). Despite the fact that the majority of questioned respondents (72.4%) participated in watershed management techniques such as soil and water conservation, 27.6% of respondents did not implement the practices on their own land. A lack of farm size, lack of awareness, or other unknown personal causes could be the cause. Participants in focus groups backed up this conclusion.

On the other hand, 86.8% of respondents use an extension agent as a motivator to participate in watershed management techniques, while just 4.6% participated because of their conviction, and 8.6% used food-for-work as a means to participate in the activity (Table 3). Extension services were defined in this study as services such as extension content and signals on watershed management operations, rather than just contact between development agents and farmers. The more the farmers gain important message and contents on land management, they become more initiated to do conservation activities and they also become more interested to invest on watershed management activities (Million, 2001; Paulos et al., 2004). This also will help farmers to be aware of the importance of soil erosion problem. Therefore; it is expected to have a positive relation with farmers' decision on conservation strategies of watershed management.

Designing rules on the basis of farmer's knowledge, the demand they need and integrating with the available local row materials could have huge contribution for the sustainability of implemented community based watershed management practices. From the surveyed respondents, 67.6% respondents replied government provides a rule which was very important for effectively managing and rehabilitating their plot of lands. As well as, a rule designed by the communities themselves was only 34.8% of respondents was assumed to be participated in the design of rules. Also, the communities interviewed on the reason why they did not

implement land management practices on their own land, out of which 67.6% replied due to a shortage of land, 20.6% replied due to lack of awareness and 10.9% replied due to unmentioned reasons (Table 3). The majority of interviewed respondents (93.9%) were willing to accept land management practices, while 6.1% were not willing to accept and continue the conservation activities. The reason might be lack of awareness and other personal reasons. On the other hand, 94.7% of respondents replied that watershed management practices are benefit based technologies and they help to achieve sustainable developmental goals. Meanwhile, 5.3% of respondents did not understand the benefits of land management practices in a clear manner.

Table 3 Perception of respondents on watershed management practices.

Perception of respondents on watershed management practices		Response of respondents (%)	
		Yes	No
Accepting benefits of watershed management practices		85.6	14.4
Applying watershed management practices on own farm		72.4	27.6
Watershed management practices are initiated by	Myself	4.6	-
	Development agent	86.8	-
	Food for work/incentive based	8.6	-
Reason why not involve in watershed management practices	Shortage of land	67.6	-
	Lack of awareness	20.6	-
	Other reason	10.9	-
Responsibility to design watershed management measures	Ourselves	32.4	-
	Government bodies	67.6	-
Willingness to accept watershed management practices		93.9	6.1
Practice is benefit based?		94.7	5.3

3.4 Watershed management practices in the study area

According to the majority of respondents watershed management measures are necessary to decrease the degree of land degradation on their farm plots and communal grazing pastures. Farmers have a good view of the value of watershed management measures on their farms and communal grazing pastures, as evidenced by this. According to the survey findings, farmers in the study areas use a variety of watershed management

measures (soil bunds, fanyajuu, cutoff drains, check dams, trenches, area enclosure, agroforestry methods, and grasses with and without physical soil and water conservation)(Fig. 2) on their own agricultural plots and grazing fields to reduce watershed degradation problems. During field observation, researchers observed that among watershed management practices, soil bund and fanyajuu are widely practiced by farmers on their crop lands in the Wera sub-watershed. Some of the respondents expressed that the implementation and participation of different watershed management practices were undertaken against their will, development agents took the lead in enforcing and imposing punishment on those who had not participated in conservation activities. The primary reason for this was not a lack of awareness about the problem of watershed degradation and the shortage of farm size, but some of the revealed feelings of possession uncertainty. They repeatedly pointed out that if community based watershed management practices were implemented on their land, they felt they were losing and belonged to communal land. The following land management practices were common in the study areas.

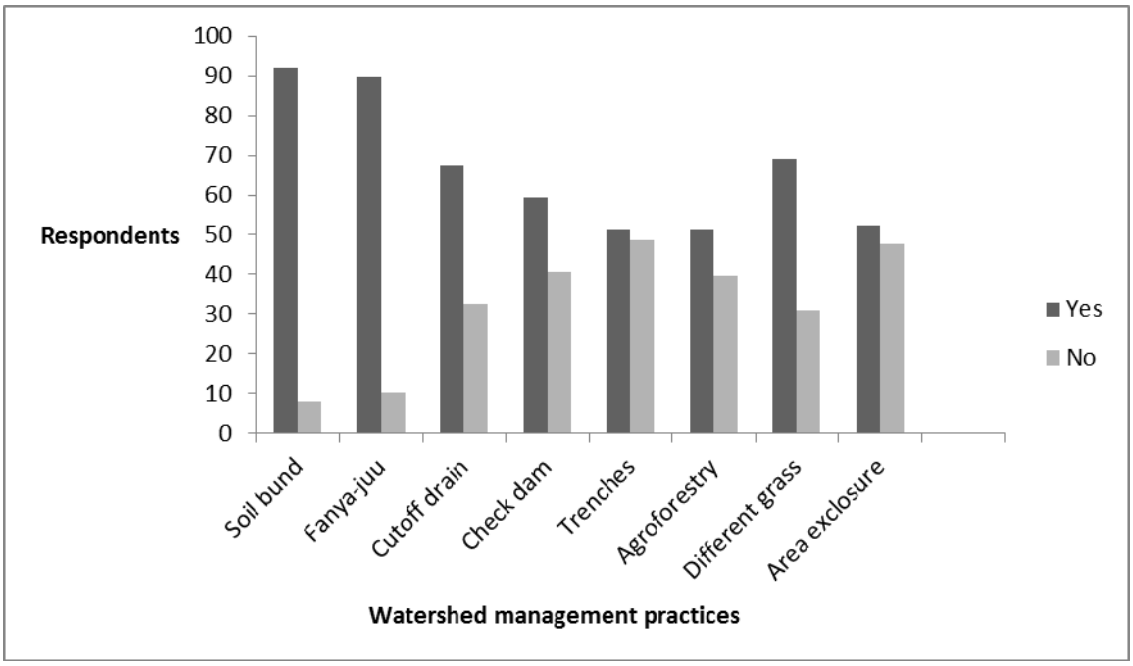

Fig. 2 Common watershed management practices in the Wera sub-watershed.

3.5 Rating of watershed degradation and its productivity change in Wera sub-watershed

Farmers were asked to rate the degradation of their watersheds over the previous nine years. About 67.6% of survey households said the rate of watershed degradation was decreasing, while 26.4% said it had decreased during the last nine years. Farmers' investment in watershed management practices (check dam, soil bund, Fanya-juu, cutoff drain, waterway, trenches, eyebrow, grasses with and without physical barriers, agroforestry, and area exclosure) may be the main reason for the declining trend of watershed degradation. Even though it is impossible for farmers to keep up with the current rate of watershed deterioration over time. Whereas about 3.5% of respondents believed the rate after intervention measures was severe and 2.5% of respondents believed it was unchanged (Table 4). Watershed productivity was one of the determinants of agricultural production in the Wera sub-watershed. According to Table 4, over 92.1% of the interviewed farmers observed watershed productivity on their farm fields after intervention measures increased. About 6.8% of the respondents reported decreased productivity, and only 1.1% of the respondents didn't observe any change on

their farm plots. About 77.6% of respondents reported that the indicator of watershed productivity reduction was yield decline, 16.4% required high input demand and 6% responded to soil color change (Table 4). As shown in Table 4, the interviewed respondents about the mechanisms of improving watershed productivity, replied that crop rotation (30.3%), mulching (21.2%), fallowing (20%), use of chemical fertilizers (17.5%) and use of manure (11%). All these watershed management measures improve soil organic matter in a positive manner.

Table 4 Farmers′ perception on watershed degradation and productivity change over time.

Perception of respondents		Response of respondents (%)
Watershed degradation after its management practices	Severe	3.5
	Moderate	26.4
	Minor	67.6
Watershed productivity after its management practices	Unchanged	2.5
	Increasing	92.1
	Decreasing	6.8
Indicator of watershed productivity decline	Unchanged	1.1
	Yield decline	77.6
	Soil color change	6
	Increased input demand	16.4
Mechanisms of improving watershed productivity	Use of manure	11
	Fallowing	20
	Use of chemical fertilizer	17.5
	Crop rotation	30.3
	Mulching	21.2

4 Conclusion

In the study area farmers are dependent on the agricultural sector for their livelihood due to this analyzing their perception on watershed degradation and their management practice has become very significant. Accordingly, main causes of watershed degradation in the study area were uncontrolled grazing, intensive cultivation, deforestation, inappropriate conservation practices, topographic nature of land, and indigenous farming practices while indicators of watershed degradation were yield reduction and poor crop performance, formation of rills and gullies, decrease soil depth and soil color changing. Now, farmers also noticed that

natural resource has become more vulnerable to erosion because of intensive cultivation without fallowing due to high population pressure. The study identified that farmers of the study area applied various watershed management practices such as soil bund, fanya-juu, cutoff drain, check dam, trenches and eyebrow, area exclosure, agroforestry practices and different grasses. As stated by key informants, farmers uses manure, crop rotation, and chemical fertilizers to improve watershed productivity.

Also farmers required technical support and close contact with different stakeholders for experience sharing and the practice was benefit based and site specific. The farmers have good perception of watershed degradation and its management practices but degradation is not one time process. Therefore, continuous practice of appropriate watershed management technology will be better to reduce rate of watershed degradation and improve farmers' livelihood in the study area.

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