Deforestation and Forest Management Methods in Chencha Woreda, South Ethiopia: From Smallholder Farmers' Point of view

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Abstract: To take appropriate forest conservation and rehabilitation measures, it is important to assess the views and perception of community at local level. This study, therefore, attempted to assess the farmers' perception to deforestation, causes of deforestation and its impacts in Chencha woreda, South Ethiopia. In addition, the study also tried to identify the methods owned by the local farmers for management of forest. The primary data were collected via questionnaire from 330 household heads selected through stratified-systematic sampling. Additionally, interview and FGDs were conducted with purposively selected individuals. The data were analyzed qualitatively and quantitatively. As the study revealed, majority of participants confirmed that there has been severe deforestation with increasing rate since1990 in the study area. Population growth, increasing of wood demand, encroachment of agricultural land, illegal cutting, using forest as grazing land and source of income and weak forest administration were some of anthropogenic causes to deforestation in the woreda. Some of the problems facing the local community as a result of deforestation were shortage of wood, loss of indigenous plants, climate instability, heavy flood and soil erosion. Even though they failed to cope up with the current deforestation, farmers have their own forest management traditional bylaws, system and methods. We conclude that, forest resource in the study area has multiple functions beside to eco logical contributions. In order to harness its values sustainably and address the existing serious d eforestation, all stakeholders should work together and try to implement sound forest manageme nt system including the establishment of institution.

Key Words: Deforestation, Perception, Chencha

1. Introduction

Ethiopia is one of the countries endowed with ample natural resources but at the present time natural resources are under intense pressure and tribulation as a result of population growth coupled with weak economic development, destructive ways of utilization, recurrent drought and mismanagement of natural resources. Deforestation and degradation of forest resources are the major challenges facing the country's striving to sustainable socio economic development (Teketay, 2001) which manifested in land degradation, depletion of water resources, climate change, prolong dry season, crisis of biodiversity and decline of agricultural productivity (Srinivasan, 2014).

Ethiopia has well diversified forest resource that ranges from lowland scrubs to tropical rain forests (FAO, 2005). Apart from environmental values; forest in Ethiopia has immense economic and socio-cultural contributions: creation of job; generation of income; livelihood diversification; combating poverty and food insecurity and source of energy (Fekadu, 2015). It is also important for timber production and tourism development (Feyera, 2007). Production of traditional medicines for human and livestock is the other special contribution forest in Ethiopia, especially in the rural areas. Since some decades of the past, the forest resource of the country fallen to rapid and exhaustive degradation of forest resources. The rapid population growth; increased crop cultivation in marginal areas and increased livestock grazing pressure; soil erosion and poor agricultural practices have resulted in wide speared and intense forest degradation (Badege 2001; Belay 2016; Feyera, 2007).

Many studies have shown that deforestation is undoubtedly increasing from time to time and has occurred in the remaining forested areas of the country. The forest areas in the country have been declined from 40 percent a century ago to less than 3 percent today. The current rate of deforestation is estimated that 160,000 up to 200,000 hectares (ha) per year (Badege, 2001). From 1990 to 2005 Ethiopia has also lost 14 percent of its forest cover, around 140000 hectares (FAO, 2005). Furthermore, the FAO report showed that deforestation in Ethiopia has been continuing with the approximate deforestation rate of 1410km^2 per year (FAO, 2007 cited in Srinivasan, 2014). As confirmed by Dessie and Kleman (2007) Ethiopia lost approximately 40,234 hectares of natural forest between 1972 and 2000. This exhaustive clearing of forest land has been on process and will perpetuate until management plans are put in place which balance the consumption and regeneration capacity of forest sources in the country (Teketay, 2001).

Exhaustive deforestation jointly with other factors has brought great consequence on the soil degradation and soil nutrients depletion which caused to sharp declining of agricultural productivity in Ethiopia. Soil erosion as a result of deforestation remains one of the most critical and far ranging environmental issues that affect the country. Related to this, studies have shown that Ethiopia has lost fertile top soil at an estimated rate of one billion cubic meters per year (FAO, 1988; UNEP, 1983; Yirdaw ,1996 quoted in Badege, 2001); which greatly affects agricultural productivity and production. In 1990 alone, for instance, reduced soil depth caused by erosion resulted in a grain production loss of 57,000 [at 3.5 mm soil loss] to 128,000 tons [at 8 mm soil depth]; which would have been sufficient to feed more than four million people (Badege, 2001; Srinivasan, 2014). In addition, loss of biodiversity, climate change, unexpected devastating flood and high runoff and shortage of wood for different purposes are the other adverse consequences of deforestation in Ethiopia (Fekadu ,2015 and Habtamu, et al, 017).There are different economic, demographic and socio-political factors that act as a root cause for degradation of forest resource in Ethiopia. Land use conversion from forest to agricultural land is the main factor of deforestation (Yechale and Solomon, 2011). In addition, high rate of population growth; over exploitation of forest for wood demands; expansion of investment together with weak management are some of driving forces of deforestation in Ethiopia (Badege, 2001; Belay, 2016; Feyera, 2007; Kasahun andDemessie n.d.). Furthermore, political instability, civil wars, tenure insecurity and administration instability have been considered as the forces to accelerate the rate devegetation and illegal actions on forest ecosystems in Ethiopia (Srinivasan, 2014).

Like the other parts of Ethiopia, the forest resource in Chencha Woreda[1] South Ethiopia is under serious threat from deforestation and significantly reducing its size and biodiversity starting the last few decades (Engdawork and Rudolf, 2014). The woreda has been characterized by high population growth, recurrent drought, climate chock and environmental degradation: soil erosion, deforestation, land fragmentation and overgrazing (Abera, 2006; 2014) which have significant impacts on agricultural production, food security and alleviation of poverty. According to the discussions with government officials and elders in the woreda, deforestation is the main chronic environmental problem which is mainly caused by interrelated anthropogenic

[1] Woreda is the administrative unit next to Kebele in the Ethiopia context; which is equivalent to district

induced factors such as illegal cutting of trees, encroachment of agricultural land and using of the forest as grazing land by the local community and environmental crisis: climate change and variability, recurrent drought and landslides. This persistent deforestation which is occurring in the woreda has resulted in observable adverse effect on economic, social, and ecological values of forest resource.

Apparently, assessing and taking in to consideration the local community's perception[2] to deforestation and related issues have played substantial role in design and implementation of sound forest management strategies that enable to exit out from threats of deforestation and for sustainable use of the remain forest resource. It is also important to involve the local community and incorporate their ideas and views in community based natural resource conservation programs and activities. Thus, this paper was designed to examine deforestation, cause and its impacts from the perspectives of farmers' perception at local level in Chencha woreda, South Ethiopia. Identification of the forest resource management strategies which are owned by the local farmer was also the concern of this study.

2. Research Materials and Methods

2.1.Description of the Study Area

This study was conducted in randomly selected Kebeles[3]: Tegecha, Losha and Mafonazolo in Chencha woreda (fig. 1). It is located about 530kms away from Addis Ababa, the capital city of Ethiopia. It is also positioned between $6^0$8'55" to 6^0 25'30"N and 37^0 29' 57" to 37^0 39' 36''E. Its elevation is found between 1300 and 3250m above sea level (asl). Currently, the woreda covers an estimated area of 445 km^2 and divided into 45 rural and 5 urban Kebeles. It has two Agro-ecology zones: Temperate and Tropical, accounting for about 82% and 18% of the total area respectively. The annual rainfall of the woreda is between 900mm to 1200mm. The minimum and maximum temperature records range between 11 to 13^0C and 18 to 23^0C respectively. Chencha woreda is one of the most densely populated areas with a total population of 111,680 of whom 51, 307 were men and 60, 3 73 were women (CSA 2008 quoted in Amene and Tesfaye 2015). The estimated population dens ity was 382 persons/km^2. The local people have engaged in highland mixed farming system.

[2] Perception is means by which people seek to understand deforestation , causes as well as its consequences to take response measures
[3] Kebele refers the smallest administration unity in Ethiopia context

Barley, Wheat, Maize, Peas, Beans, Potatoes, Enset and Cabbage are the dominant crops which are cultivated by the local farmers.

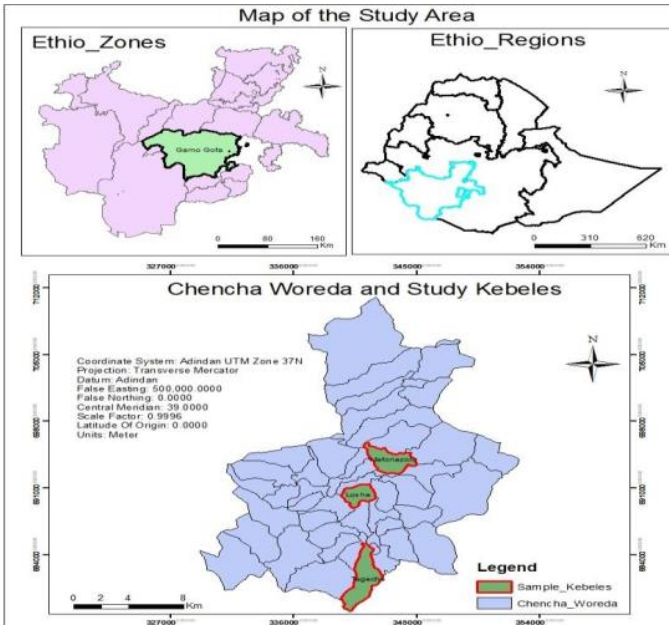


Fig.1 Map of the study area

2.2 Sample Size Determination and Sampling Methods

The household heads, religious leaders, Kebele and woreda administrators, Development Agents (here after DAs) and NGOs were the participants of study. The total number of the household heads was about 1085, of which Losha, Tegecha and Mafonazolo consisted 364, 331 and 390 household heads respectively. The total sample size was determined by statistical formula used by (Geoff and Judy 2004). The formula is given as: $\mathbf{n= n_o*N/n_0+(N-1);\quad n_{0=(Z/e)^2}pq}$

Where:- **n**= Sample size, **N**= Total population, $\mathbf{n_o}$= Sample size of the pilot study, **z**= value of the confidence level at **1.96**, **e**= sampling error at **0.05**, **p**=estimated value for the proportion of sample that will respond to pilot test, **q**= estimated value for the proportion of sample that is not responded to pilot test (q= 1-p)

Based on the formula, 364 sample populations were taken from sampled Kebeles [111 from Tegecha, 122 from Losha and 131 from Mafonazolo]. For the detail information of respondents refer table 1.Stratified sampling and systematic sampling methods were applied to take sample household heads. The list and total nu

mber of Household heads taken from each Kebele administration. Interview and Focus Group Discussion (FGD) participants were selected via purposive sampling; 14 individuals were interviewed from NGOs, religious leaders, DAs and woreda and Kebele administrative bureaus. Beside, three FGDs were held with members range from 9-13.

2.3 Data Collection and Analysis Instruments

In this research, both primary and secondary data sources were used. Questionnaire, interview and FGDs were applied to collect primary data. The secondary source included all important professional published and unpublished literature. In the first place, the logical and psychometric methods were followed to prepare the survey questionnaire. The questionnaire constituted about farmers' view about deforestation, causes and impacts of deforestation and the forest management methods which are applied by the local community

Table 1 respondents background information

		Respondents'(HHH) profile via Kebele							
Variables		**Losha (N=109)**		**Mafonazolo (N=118)**		**Tegecha (N=103)**		**Total (N=330)**	
		No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Sex	Female	18	16.5	7	5.9	11	10.8	36	10.9
	Male	91	83.5	111	94.1	92	89.3	294	89.1
	20-35	35	32.1	38	32.2	23	22.3	96	29.1
Age category	36-55	44	40.4	56	47.4	67	65	167	50.6
	>55	30	27.5	24	20.3	13	12.6	67	20.3
.	Illiterate	52	47.7	56	47.4	43	41.7	151	45.7
Educa. Status	Adult Educ.	6	5.5	5	4.2	6	5.8	17	5.1
	primary(1-8)	45	41.3	45	38.1	51	49.5	141	42.7
	Secondary(9-12)	6	5.5	12	10.2	3	2.9	21	6.4

	Single	7	6.4	6	5.1	1	0.9	14	4.2
Marital									
Status	Married	87	79.8	102	86.4	91	88.3	280	84.8
	Divorce	7	6.4	4	3.4	4	3.9	15	4.5
	Widowed	8	7.3	6	5.1	7	6.8	21	6.4
		22	20.2	22	18.6	16	15.5	60	18.2
Family Size		41	37.6	59	50	47	45.6	147	44.5
	>=7	46	42.2	37	31.3	40	38.8	123	37.3
land holding	<= 0.5 ha	73	67	79	66.9	64	62.1	216	65.4
	0.51-2 ha	31	28.4	37	31.3	36	34.9	104	31.5
	>2 ha	5	4.6	2	1.7	3	2.9	10	3

Source, Field survey

The first draft of the questionnaire was provided to three experienced researchers of Arba Minch University, Geography and Environmental studies department. Based on their comments, items reconstruction was undertaken. Furthermore, by using the revised questionnaire pilot study was made to further strengthen the quality of the items. The final version was administered to 364 respondents. However, the analysis was undertaken using 330 questionnaires which is about 91% of the sample population. During screening period 28 incomplete and wrongly answered questionnaires removed and 6 questionnaires were not returned back from respondents. The data collection and screening steps were followed in data analysis. Majority of the data collected through survey questionnaires were analyzed quantitatively through application of descriptive statistics by using SPSS (version, 20) software. The data collected by interview and FGDs were analyzed qualitatively with key event approach or thematic description. Table, chart and graph have been applied for data presentation.

3 Results and Discussion

3.1 Farmers' Perception to Existence of Deforestation

Like other highlands of the Ethiopia, Chencha woreda was rich in forest resource, especially with good diversification of indigenous plants. Forest is one of very crucial natural resources in Gamo highlands (where the study area is found) for economic development, livelihood diversification, reaction of natural disasters, cultural values and ecological contributions. In Chencha woreda, farmers have relied on forest resource for different purposes, namely; to synthesis of traditional medicines, production fire wood, charcoal, construction materials and fodder for cattle. It has also contribution for farmers' livelihood diversification and it is an asset during bad climate conditions and failure in crop production (Abera 2004; Engidawork 2012). However, in the study area the forest resource base is under intense pressure and its socio-economic values increasingly have been declining and impairing in continuous manner.

It is evident that, out of 330 participants large number of them (94.2%) endorsed the existence of deforestation; of whom 166 and 104 of respondents confirmed that the degree of deforestation became very sever and sever since 1990 respectively (table, 2). The study done by Tindan (2013) in Ghana had shown almost similar finding with the current study. Supporting the views of the local farmers, the study which is carried out by Engdawork and Rudolf (2014) explained that deforestation and its impacts have long history in Chencha woreda as a result of very long history of settlement and traditional agricultural practices. The same authors indicated, the forest coverage in the woreda was declined by 23% between 1972 to 2006 with the most radical change from 1986 to 2006. According to Teshome (2012) on Gamo highlands the degradation of vegetation cover has been very fast wi th 148 ha/year rate of devegetation. Other empirical studies have revealed that deforestation is also a reality for other parts of the country; for example, the forest coverage of the country was about 40 percent in the early twenty century but nowaday it reached around 3-4 % with 100,000 ha/year rate of deforestation (EVDSA 1991 cited in Bielli et al. 2001). The findings of FAO shown that rate forest degradation specially in developing countries due to agricultural land expansion, investment and high demand forest for energy generation has been rampant and contiguous process(FAO 2018).

Moreover, the interview and FGD participants especially DAs and elders explained that among environmental problems in the woreda, deforestation is one of the serious problem which significantly daunting the livelihood base

of the local community. Due to population growth coupled, land fragmentation, reduction of agri cultural output, increasing of consumption wood in the surrounding towns and lack of livelihood assets beside to subsistence agriculture, there has been very fast increment of population pressure on forest resource from time to time. The finding of the study done by Dessie and Kleman (2007) had consistency with this study.

Table 2 Participants' response to the extent of deforestation since 1990

Kebele of HHH	Level of Deforestation(N=311)									
	Very little		Little		Severe		Very severe		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Nosha	2	2	17	17	36	36	45	45	100	100
Mafonazolo	3	2.7	17	15.2	29	25.9	63	56.2	112	100
Tegecha	0	0	2	2	39	39.4	58	58.6	99	100
Total	**5**	**1.6**	**36**	**11.6**	**104**	**33.4**	**166**	**53.4**	**311**	**100**

Source: Field survey

The above mentioned conditions again aggravated by illegal cutting of trees, especially on the community and government owned forests. They explained that *currently the rate of forest degradation is very fast and rife. Unless sound and comprehensive measures to be taken by the stakeholders and local community, it is hardly possible to see forest resource in the area after the coming one decade*. This implies that in the woreda deforestation is very high and it is one of the environmental problems that need immediate response measures. In relation t o this Abera (2006) and Engidawork (2012) reported that due to anthropogenic induced deforesta tion was reached at unacceptable level in the Chencha woreda and other parts of Gamo highlands.

3.2 Perceived Causes of Deforestation

The outputs of many empirical researches on forest resources in Ethiopia have shown that the loss of forest resource and its socio-economic and ecological values caused by different natural and human induced causes: land slide, forest fire, conversion forest land to grazing and agricultural land, utilization for income generation, production fuel wood, use to furniture factories, and so on (Dessie and Kleman 2007; Fekadu 2015; Feyera 2007; Gete and Hurni 2001; Seif and Reddy 2013). In the study area, respondents were asked to identify the causes of deforestation and they identified the followings as the main causes of forest destruction in the study area (look table 3).

Population growth: Many studies revealed that in the agrarian society particularly in developing countries very fast population growth is the most important driver of degradation of natural resources specially forest and wood lands(e.g. Angelsen and Kaimowitz 1999; FAO 2018; Tindan 2013). Unprecedented population growth and its resultant effects coupled with shortage of agricultural, weak off farming activities, natural disasters[drought, flood and like] and weak forest management experiences has become the dire cause to deforestation and degradation of forest resource in the highland areas in Ethiopia(Gete et al. 2006; Mohammed 2011). Similarly, i n this study majority of the respondents (76.2%) of this study answered that very fast uptrend of population in their local area is one of primary causes to deforestation. augmentation of population and its pressures on natural resources [like forest] is a naked reality in the woreda. It is one of the densely populated areas in SNNR with population density of 348.5 people per km^2, which is more than two times the zonal average, which is estimated about 156.5 people per km^2 (Amene and Tesfaye 2015). The collected data of this study showed that majority of the respondents (44.5% and 37.3%) had family members range in 4-6 and equal and greater than7 respectively [look table, 2]. The average size of households of the participants was about 5.7 which was more than the average households' size of region and Ethiopia that was 4.8 and 4.7 respectively (CSA 2014 cited in Amene and Tesfaye 2015). The situations has forced the community towards forest and marginalized areas to get additional land to meet the basic needs of the growing population including demand of cultivable land.

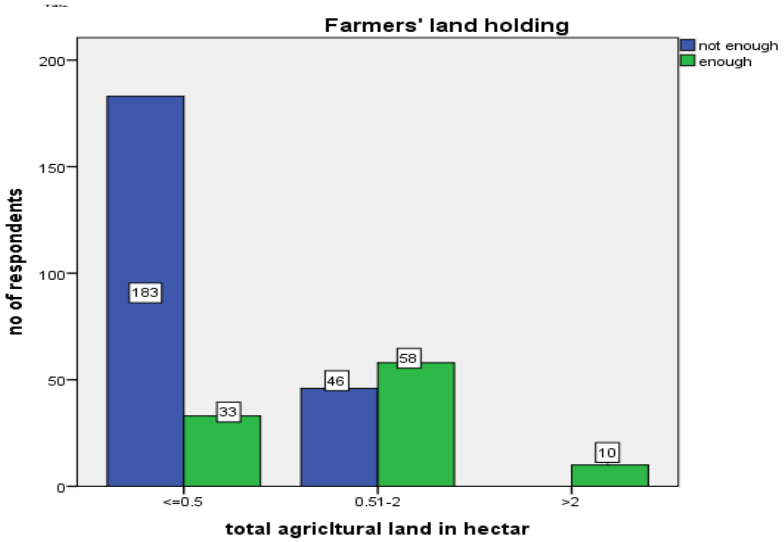
It is disclosed fact that the high population density in the study area jointly with other factors: land fragmentation and high unemployment rate (Abera 2014), has geared the farmers towards

shortage of agricultural land, food insecurity and subsequently forced them to expand their agricultural land on the forest area and fragile ecosystems; meaning that the small hold farmers has been clearing forests and vegetation to meet their increasing requirement of agricultural land and other demands, like selling of wood to get income for households' expenditures. The distraction of the forest resource ultimately has led to shortage of wood resources, lack of material for soil regeneration/formation/, increase in soil instability and soil erosion which results in the depletion of soil fertility and consequently sharp decline of agricultural production (Dessie and Kleman 2007).

Expansion of Agricultural land on Forested land: It is real fact that land is important natural resource for agricultural production, income generation and house construction as well as settlement in Chencha Woreda. Related with population and soil erosion the shortage of agricultural land is rife. In relation to this, 81.3% and 68.4% of respondents explained that using of forest areas for the expansion crop land and to get grazing land for their livestock were the main derivers of forest degradation respectively. The study undertaken by Engidawork (2012) confirmed that cultivated land was expanded by 39% from 1973 until 2006. Studies in different parts of the Ethiopia also identified that expansion of agricultural land to forest areas was the chief cause of deforestation and disturbance of forest ecosystems. For example, (Bielli et al. 200; Dessie and Kleman 2007) noted that agricultural land encroachment is the serious problem to the loss in forest coverage in Ethiopia. In relation to this, WBISPP reported that in Ethiopia approximately 19000 ha/year forest departed for the intent of agricultural land expansion (WBISPP 2004b cited in Srinivasan 2014). Similarly, Pielke et al. (2011) pointed out the globally agricultural land expansion with expense forest resources has been critical problem. According the aforementioned authors crop land has increased from 300 million ha to in 1700 to 1530 million ha in 2000 and the grazing has also increased from 324 million ha in 1700 to 3429 million ha in 2000; which is 25% of the total land area. Majority of expansion has been done through extensive clearance of vibrant forests (Tindan 2013).

Moreover, the interview and FGD participants pointed out that the livelihood source and living strategies of the entire community have been almost depended on crop production and animal rearing. However, the existed land which is owned by farmers was not enough and unable to satisfy the increasing demand of land for fast growing population to increase their agricultural

production. Similarly, the data presented in graph 1 show that about 69.4% of 330 respondents had no enough agricultural land for crop cultivation. Beside, (85.8%) of the surveyed farmers claimed that shortage of grazing land for cattle and other animals is the very serious problem. As the result of very high population density with alarming growth rate, the problem of agricultural land shortage has become uncommon and very acute for immemorial period of time (Teshome, 2012). According to the survey data, the agricultural land size owned by respondents ranges from 0.25 ha to 2.5ha, those who owned the former one is about 12.1%, whereas; the later one[maximum] is owned by very small number of farmers (0.9%). In addition, as can be seen in the graph 1, 65.4% of respondents had the land size which is about less or equal to 0.5 ha. Similarly, the research which is undertaken by (Engdawork and Rudolf 2014) revealed that about two-thirds of the interviewed farmers in their study had land less than 0.5 ha per households and they also argued that insufficient of agricultural was the primary factor for the loss of forest resource. Likewise, the central statistic survey (CSA 2002) report cited in Abera (2006) showed that 84% of the households of the woreda has the cultivable land with the sizes of equal to or below 0.5 hectare, which is below the Gamo Gofa zone average land holding size (Amene and Tesfaye 2015).



Source; field survey; Graph 1 Agricultural land owned by respondents

Form this it can be understood that agricultural land to crop cultivation and animal husbandry is the critical problem which accelerates the rate of destruction of forest and other land use types to

get additional land for agricultural activities. The shortage of grazing land also forced the farmers to use forest areas and streets for grazing land. According to the DAs, the forest areas have become the only option where the farmers to get grazing land for cattle and for expanding of cultivable land. As they underlined that still successful and adequate measures are not yet to be taken, the sustainable use of forest resources will be under question throughout the woreda. In line with the findings of the current study (Srinivasan 2014) endorsed that shortage of cultivable land and grazing land to cattle in Ethiopia are the main derivers for deforestation.

Another cause of deforestation which was stressed by FGD participants was land fragmentation. As they said farmers have reached at the maximum limit; they cannot redistribute their farm land for their children hereafter. They have, therefore; decided children to live within the family and /or to search other job in towns instead of allowing them to run own life by providing plot of lands. Eventually, this dire situation has led youths to participate in conversion of forest, wetland and steep slope lands in to agricultural land and some of them have also engaged in illegal tree cutting and outmigration [Arba Minch, Wolayita, Addis Ababa, e.t.c] for searching of other job and seeking of better life. The studies carried out by Abera (2014) and Teshome (2012) in Chencha and other parts of Gamo highlands supported the ideas of discussants in this study.

Table 2. Perceived causes of deforestation

	Frequency of respondents via Kebele							
***Causes of Deforestation**	**Losha (N=100)**		**Mafonazolo (N=112)**		**Tegecha (N=99)**		**Total (N= 311)**	
	Frequ.	**%**	**Frequ.**	**%**	**Frequ.**	**%**	**Frequ.**	**%**
Population growth	89	65	95	84.8	77	77.8	261	76.2
Expansion of agri. land	79	79	82	73.2	92	92.9	253	81.3
Expansion of grazing land	67	67	90	80.3	56	56.6	213	68.4
Demand for fire wood	85	85	89	79.5	84	84.8	258	82.9
using as income source	88	88	72	64.3	90	90.9	250	80.4
Expansion of settlement	48	48	31	27.7	56	56.6	135	43.4

Road construction	19	19	16	14.3	47	47.5	82	26.4
limited administration	54	54	66	58.9	79	79.8	199	63.9

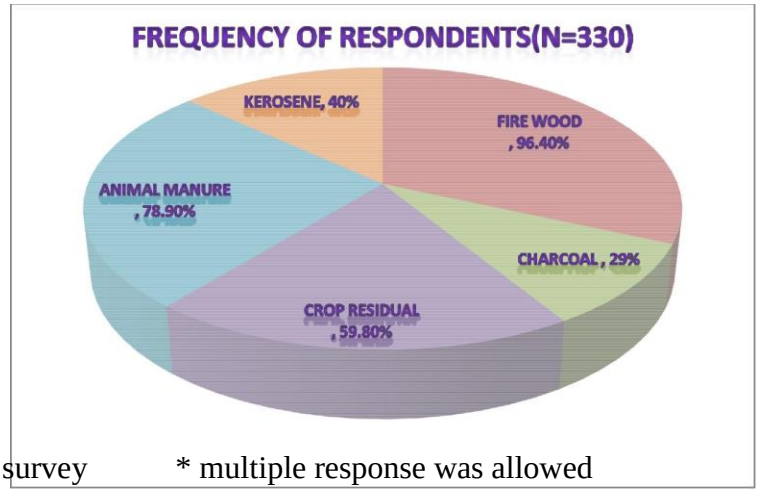
Source: field survey *multiple response was allowed

High forest demand to fire wood and energy production: In the world natural forests are the most important source of energy for different uses. For example FAO (2018) reported that 40 percent of global energy in the form of wood fuel generated from forest and trees. In the study area and its surroundings, fire wood is the main source of energy. Accordingly 82.9% of respondents exhaustive using of forest resource for the production of energy to cooking food, to get heat and light has increasingly led to intense pressure on forest resource. Similarly, the research work done by Habtamu, et al. (2017) reported that fire wood and charcoal production has increased the rate of deforestation in Ethiopia. The availability of non-wood and renewable energy sources has fundamental contribution to reduce the rate of deforestation and use forest resources sustainably. However, studies confirmed that majority (roughly, 96%) of energy demand in Ethiopia [including rural and urban areas] derived from biomass fuels: fuel wood, animal dung and crop residuals (Gete et al. 2006; Srinivasan 2014). Similarly, the finding of the study indicates that great majority of respondents (96.4%, 78.9% and 58.9%) have obtained energy for food preparation and other purposes from fire wood, animal waste and crop residuals respectively. Overreliance on forest resources to generate energy with lack of alternative energy sources that can substitute the energy demand from wood is significantly aggravating the rate of deforestation and finally the loss of soil resource.

Furthermore, the interview and FGD participants noted that fuel wood is predominantly the source of energy in both rural and urban areas of the woreda. Apart from lack of alternative energy sources for the local farmers, the high consumption of fire wood by the local community, urban dwellers in the surrounding towns and governmental institutions have played sizable roles for sharking down of forest coverage in the woreda. Specially, the DAs said that, *institutions like universities, hospitals and other governmental organizations found in the w oreda and surrounding towns [e.g. ArbaMinch] depend on forest resource of the woreda to meet their fire wood consumption instead of striving to tackle the causes of deforestation*. They have a lso requested the universities, hospitals, colleges and hotels [especially which are located in Arba Minch and Chencha town] to use non-wood sources of energy to reduce their pressure on forest

resource and should involve in forest conservation activities and programs. Similarly, the findings of the research conducted in Gamo highlands by Abera (2014) and Teshome (2012) had consistency with the current study.

In short, high consumption of forest resources by the local farmers, urban dwellers, institutions and hotels in order to generate energy and to get wood for construction is very critical deriver to degradation and cramp of the forest resource there. Therefore, introduction and access of alternative energy sources and energy saving fire stoves are necessary conditions in addition to establishing strong legal management system and sound administration to reduce the pressure exerting by different consumers and maintain the natural well being of the forest ecology

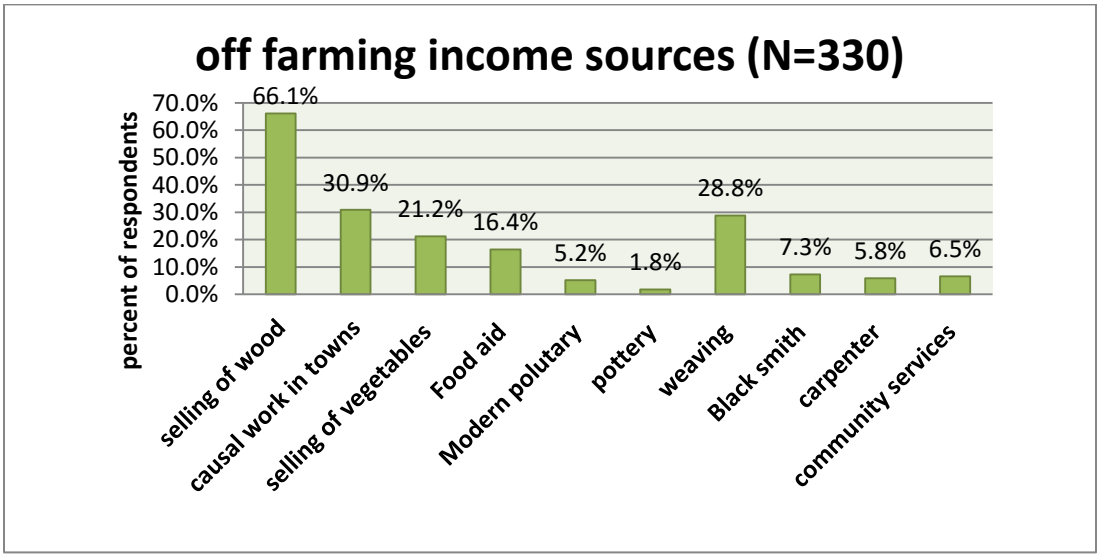


Source: field survey * multiple response was allowed

Graph 2 Energy source of respondents

Using of forest as source of livelihood: Non-farm and off farming income sources have positive implication to sustainable use of natural resources by reducing the community's intense pressure on it. In contrary having limited or no non agricultural income/off farming/ sources agitate the rate of natural resources epically the forest and land resource destruction. As pointed out by FAO apart from agricultural encroachment, using of natural forest as source of livelihood, grantee to disasters including food insecurity and primary source of energy demand, particularly in developing counties considerably trigger the deforestation process. For example, around 250 million (40%) extreme world's rural poor people are dependent on forest and savannah areas to generate their livelihood and using as safety net in difficult times (FAO 2018). Likewise, in the

study area the traditional subsistence agriculture is the predominant source of food crops, cash income and job opportunity for the households of the farmers. In addition, farmers have involved in non-farm activities to get income for their expenditures and supplement the agricultural livelihood. However, surprisingly majority of the respondents have opted forest to diversify their livelihood by selling of fire food, charcoal and woods for construction materials, which can accelerate the pace of deforestation and dwindling the efforts to forest conservation and management in the woreda (look graph 3). In Gamo highlands, over the past two and half decades, agricultural and nonfarm activities output have not been enough for farmers' food consumption and generation of cash income to the expenditure of their families' needs (Abera 2014). This situation has also increased the dependency of farmers on forest and forest products to get income and meet the basic needs of their households in steady of conservation of and rehabilitation. Moreover, the farmers listed other factors which have been the case for deterioration of forest resource in their locality included expansion of settlement (43.4%), cleaning forest for construction of roads (26.4%) and lack of adequate administration (63.9%).



Source: field survey * multiple responses were allowed

Graph 3. Off farming income sources of respondents

Generally, the livelihood diversification and income outside agriculture have undeniable role in offsetting and minimization of the pressure of the people on the forest and other natural resources like agricultural land, wetland and biodiversity (Belay 2016). But the result of this

study has shown that the majority of the respondents have generated their major income solely from subsistence mixed agriculture. The limited non-farm activities of the farmers mainly focused on forest. In addition to modernizing the agriculture sector, the community should broaden their livelihood in all available livelihood assets and strategies to boost up their income and use the forest resource sustainably.

3.3 Perceived Impacts of Deforestation in the study Area

Even though forest resource has multifaceted contribution to socio-economic development and survival of subsistence farmers, many studies that conducted in different part of the country [Ethiopia] reported that degradation of forest is one of the catastrophic environmental problems which is caused by human induced factors (e.g. Badege 2001; Belay 2016; Fekadu 2015; Mohammed 2011) resulted in multidimensional economic and ecological adverse impacts: loss of biodiversity, climate instability, soil erosion, reduction of agricultural productivity, reduction of income, expansion of aridity, shortage of wood production and the like. In addition, Tindan (2013) asserted that Even though deforestation and forest degradation have contribution to the development of households' livelihoods, income and employment as well as social amenities for the sustenance of indigenous people, the long term environmental implication for sustainable development evident in global warming, biodiversity loss and soil degradation more significant .

Likewise, in the study area, forest has played tremendous roles, ranging from farmers livelihood, sources of animal fodder to watershed protection and climate moderating. In addition farmers produce traditional medicines and home furniture. It has also social, spiritual and religious values. But deforestation together with other constraints is resulting in great repercussion on these economic, social and ecological values of forest. The following table 4 displayed the impacts of deforestation in the study area which is observed and understood by the local community. Majority of respondents (87.8% and 79.7%) confirmed that they have been facing shortage of fuel food and degradation of soil resource as a result of deforestation respectively. In the same way, the DAs argued that forest has great contribution in shading and protecting of crop land from wind, sun and other agent of erosion but now these roles are increasingly declining as the result of exhaustive extraction of forest with inadequate conservation and administration.

Large number of the respondents (70.7% and 59.8%) revealed that the loss of indigenous plant and disappearance of medicinal plants that have contribution of the production of traditional medicines to cure both human beings and livestock are the other impacts of deforestation facing the local farmers respectively. During the discussion time, the aged interviewees and FGD discussants were strongly stressed on the issue of loss of indigenous and medicinal plants. As they said the woreda, particularly, the highland parts were the center of ingenious species and sources of various medicinal plants that could be used to cure different diseases. Most of medicinal and ingenious plants are wild and valuable economically [for construction, timber and furniture production and fuel wood]; however, due to selective cutting and over consumption majority of these plants were disappeared and some of them are increasingly declining. The DAs also confirmed that these plants have been used by the community since immemorial time and the community's pressure on them is very high which quickened the loss of species throughout the woreda. The studies which conducted by (Engdawork and Rudolf (2014); Mohammed and Seyoum (2013) also revealed that deforestation has exerted significant impacts in terms of decline, modification, and change in the biodiversity and indigenous trees which can be used to multiple purposes. Nowaday, it has been very difficult to get these plant species like the previous time. They are found merely around religion institutions and reserved areas with limited number and diversification as well as scant spatial coverage.

Table 4, Respondents responses to impacts of deforestation

	Frequency of respondents via Kebele							
***Impacts of Deforestation**	**Losha (N=100)**		**Mafonazolo (N=112)**		**Tegecha (N=99)**		**Total (N=311)**	
	Frequ.	**%**	**Frequ.**	**%**	**Frequ.**	**%**	**Frequ.**	**%**
loss of forest resource	85	85	93	83	89	89.9	267	85.5
loss of indigenous plants	60	60	76	67.8	84	84.8	220	70.7
extinction of medicinal Plants	57	57	70	62.5	59	59.6	186	59.8
increasing of soil erosion	71	71	86	76.8	91	91.9	248	79.7
increasing of grazing land shortage	69	69	74	66.1	78	78.8	221	71.1
shortage of fire wood	87	87	98	87.5	88	88.9	273	87.8

climate change	72	72	73	65.2	82	82.8	227	72.9
migration of wild animals	65	65	70	71.4	85	85.8	220	70.7

Source: field survey * multiple responses were allowed

Furthermore, migration of wild animals, loss of agricultural land productivity, climate change [shortage of rainfall during crop seasons, unexpected storm, increasing of temperature and irregularity pattern of seasons], expansion of stony and bare land and formation of strong flood and large gullies are others negative outcomes of deforestation in the study area as mentioned by FGD, interview and questionnaire respondents. Similarly, the research conducted in different part of the country reported that land degradation, loss of habitats, destruction of biodiversity, decline of agricultural out puts and like are the consequences of forest degradation (e.g. Dessie and Kleman 2007; Habtamu, et al. 2017; Woldeamlak 2002).

3.4 Forest Management and Conservation Practices in the Study Area

Forest management embraces very vast concepts and processes whereby the application of biological, socio-economic, cultural, physical, managerial, administrative and policy measures are taken into consideration to maintain the sustainable utilization and regeneration by offsetting of the causes of forest degradation (Gete, et al. 2006). In Gamo highlands including the study area forest management and/or conservation practices have long history. The elder respondents explained that they have their own traditional administration system and techniques to address the issues of forest degradation and promote the socio-economic, spiritual and ecological values. That means, farmers have several strategies shared from forefathers, which have been directed and operated by the local community [individually or in group] without or with supervision of natural resource experts and governmental institutions. As table (4) displayed, farmers have been involved in plantation of trees [afforestation, reforestation] around their home, in surrounding and on farm plots, on degraded and gullies areas. Again FGD participants stated that the local community has credible knowledge and abilities on forest management systems, agro-forestry practices and different values of forest: economic goods, soil conservation, improve quality of water, habitat of wild life, cultural values.

Table 4 Forest management practices of the local community

*Methods of forest management	Frequency of respondents	
	Frequ.	percent
Reforestation	240	72.7
Afforestation	217	65.8
Controlling of illegal cutting	162	49.1
use of alternative energy source	58	17.6
controlling of grazing in forest	97	29.4
controlling conversion to agri. Land	114	34.5

Source: field survey * multiple response was allowed

Moreover, for many years, the local farmers have integrated their utilization of forest resource with efforts of conservation to balance the consumption with the service providing capacity and protection of biological diversity. For example, they have involved in controlling of illegal cutting, controlling of expansion grazing land on/in forested areas, protection of conversion forest land into agricultural lands, protection of rare species form cutting down, limit the number of trees to be cut down and making the consumption below equal to the carry capacity of forest resources though their own traditional bylaws and administration system. In relation to this, (Abera 2006; Abera 2014) also stated that People in Gamo highlands have spiritual connection with the environment they live. That is, forests are respected as sacred ecologies; they have used for spiritual, cultural and traditional beliefs uses. The local community has applied social rules, regulation and ways to mange and monitoring forests/plants/ that have religious and spiritual significances. Therefore, this condition has created an effort for forest conservation programs and actions. This may be also the core reason that indigenous and endanger plants species are found around religious institution and cultural places in the woreda.

On the other hand, the traditional forest management system and practices became less effective due to very fast growing of forest demand for economic value, lack of sufficient support from government, violation traditional regulations particularly by youths and lack of integration of the traditional knowledge and management system in policy and environmental conservation strategies. The woreda natural resource experts argued that the conversion of the people from

traditional belief to protestant and other religions has lowered the acceptance of traditional natural resources management practices and regulations. Therefore, it is necessary and very important to promote and incorporate the traditional management systems, rules and regulations in the modern natural resource management policies, strategies and programs.

4. Conclusion and Recommendation

Assessing of deforestation, its main causes and impacts from the views and perception of local community is very crucial to get detail insights and factual data which can be used as basement to develop strategies and programs that enable forest resources sustainable for socio-economic development and other values. This study was carried out to examine the extent of deforestation, causes and consequences of it in Chencha Woreda, South Ethiopia. In addition, it also focused on forest conservation and management mechanisms which are owned by the local community. As the study result revealed that deforestation is one of the acute problems in study since 1990. Soil erosion; reduction of agricultural productivity; shortage of grazing land, loss of indigenous and medicinal plants, climate change, recurrent drought and food insecurity are some the problems which were facing the local community as a result of deforestation and forest degradation of natural resources. As the study revealed that expansion of agricultural land, high demand forest for fire wood and construction, lack of alternative energy source, illegal felling of trees and using of forest resource as opted source of livelihood next to agriculture were the main causes of deforestation. Over consumption of fire wood by institutions and urban dwellers and institutions had considerable contribution to clearing forest resource. Very weak forest administration also aggravates the problem and its resultant effects. In the study area, farmers have different forest management techniques that have a long history to address the issues of forest degradation and promote its socio-economic, spiritual and ecological values. These methods have been directed and run out by the local community [individually or in group] with application of traditional rules. Thus, in order to reduce the pressure on forest resource and reap its socio-economic and ecological values sustainably, diversifying farmers' livelihood sources, provision of alternative energy sources, controlling of illegal cutting and prompting indigenous management systems and mainstreaming in modern mechanisms are the necessary conditions. Moreover the Government, Development Agents, NGOs and others should work together to bring fruitful results in management and conservation of forest resource in the study area.

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Not applicable

Consent for publication

Not applicable

Conflict of interests

On behalf of all authors, the corresponding author states that there is no conflict of interest

Availability of data and materials Data

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