Journal of Environment and Earth Science
ISSN 2224-3216 (Paper) ISSN 2225-0948 (Online)
Vol.8, No.3, 2018

Assessing Existing Forest and on Farm Tree Management Practices and Its Livelihood Contribution for Rural Small Holder Communities Found at the Forest-Farm Interface Integrated Landscape Mosaics in Ethiopia

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This research is financed by Centre for International forestry Research (CIFOR) and Southern Agricultural Research Institute(SARI)

Abstract
In the Ethiopian context, forest-farm interface landscapes are areas created through encroachment, officially unclassified as either forest or agricultural lands, found under intensive economic activities (crop farming, grazing, and forest products exploitation) possibly un-sustainably by those without defined legal entitlement. As far as viewed, there are no adequate site specific empirical studies on use and management of forest and trees in an agricultural landscape in relation to local livelihoods and agricultural production in Ethiopia. Therefore, the overall objective of this study was to assess and document existing forest and on farm tree management practices and its livelihood contribution for rural small holder communities found at the forest-farm interface integrated landscape mosaics in Guraferda and Arsi Negele district. Data was collected using household survey taking a total of 218 randomly selected households from the two districts. The two study sites from each district were selected on the extent of deforestation i.e high deforestation and low deforestation sites. The data were analyzed using appropriate descriptive statistics and chi-square test. Descriptive and inferential statistics were used for analyzing demographic and different socioeconomic characteristics of sample households. The comparisons of different households' characteristics between the two contrasting sites were done using inferential statistics with χ^2-test and t-test.The results of the study revealed that there is high forest product extraction and minimum forest management in high deforestation sites, while high crop and livestock production in low for low deforestation sites.The result confirms that there is a negative impact of high forest extraction on forest management and cover. this work has identified key drivers of deforestation like settelement programs, agricultural expansion and large scale investments or commercial farming. The study also assesses communities' forest cover maintenance mechanisms.In both districts there should be up dated policy intervention and better land use planning regarding forest resource conservation.

Keywords: forest extraction, forest management, deforestation.

1. Introduction

1.1. Background

Forests are means of livelihood for many of the rural communities in Ethiopia (Wondie & Temesgen 2013). Rural communities depend on forests and forest resources to meet the demand for energy and construction materials, and to diversify their livelihoods. However, deforestation for the expansion of agricultural and pasture lands, and for settlement areas, has been reducing forest resources and local communities benefts (Wondie & Temesgen2013; lemenih & Kassa 2014; Reynolds et al. 2015). Deforestation and habitat fragmentation are critically a ecting forest size and the ecosystem services that they can provide as well as causing losses of biodiversity (Wright & Muller-landau 2006; laurance et al. 2009; Aerts et al. 2011; Mekuria et al. 2011; Mekuria & Veldkamp 2012). In the Ethiopian context, forest-farm interface landscapes are areas created through encroachment, officially unclassified as either forest or agricultural lands, found under intensive economic activities (crop farming, grazing, and forest products exploitation) possibly un-sustainably by those without defined legal entitlement. Such landscapes varied in the causes of their creation, and temporal and spatial extensions, and are often crammed with wildlife and human conflicts. Though such areas serve communities as critical livelihood sources, they are also spaces with little understanding about their management by the research community, and hence the extension service has little contribution on how to optimize gains from these interactions and sustainably manage the resources. The forest products used by smallholders and communities are often poorly understood or underappreciated even though they play crucial roles in supporting local livelihoods. Farmers use tree resources as an important additional source of income, especially when crop prices decrease (Idol et al., 2011). Previous studies of the southern Ethiopian highlands have improved understanding about the condition, biodiversity, and economic importance of the area, as well as several management challenges and drivers of deforestation (e.g. Chilalo, and Wier-sum, 2011; Takahashi, and Todo, 2012 and 2014; Aerts et al., 2013 and 2015; Belay et al., 2013; Hylander et al., 2013).However, there was gap on documenting

existing smallholders forest farm interface landscape management practice as well as viable management of forests and trees on such mosaic landscape in Ethiopia in general and in the two study sites in particular. The present study is, therefore, aimed at filling the information gap by assessing interaction between forests and agriculture land management practices in Guraferda and Arsi Negele district. There are various ways by which local people may be involved in the management of forests, such as ethnoforestry, forest co-management, and community-based forest management (Wassie 2002; FRA 2010). The Ethiopian Forest Policy of 2007 (FRA 2010) emphasizes the need for people's participation in natural forest management. The policy document asserts that local communities should be motivated to identify themselves with the development and protection of the forests from which they derive benefits. Thus, the policy envisages a process of co-management of forests by all relevant stakeholders.

Forest co-management approach enables the local actors participate in the decision-making of the strategy and the selection of priorities. The benefit of rural households poor from these forest roles determined by forest tenure and management themes .These natural forests are owned and managed in a variety of ways, including open access; communal with enforced access rules; private unmanaged; private managed. The tragedy-of-the-commons arise consequences' such as risks on the sustainable use of the forest, sustainable forest management biodiversity loss, deforestation and others like ecosystem services, carbon sequestration and the role take part in climate change mitigation by the forest.

1.2. Statement of the Problem

Preventing environmental degradation and alleviating poverty are the majorchallenges of sustainable development. Forest resources in Ethiopia are under complex challenges including continuous expansion of agricultural activities and settlements on forestlands due to high rate of population growth around forest resources ; increasing demand for forest products (energy and construction); the impacts of large livestock population in forests; that are also exacerbated by unregulated access to forest resources (lack of clear ownership); and frequent changes in the institutional and organizational context of forest resources management in the country(Badege ,B.,2009). However, there was gap on documenting existing smallholders forest farm interface landscape management practice and there was no study carried out regarding sustainable as well as viable management of forests and trees on such mosaic landscape in Ethiopia in general and in the two study sites in particular. The present study is, therefore, aimed at filling the information gap by assessing interaction between forests and agriculture land management practices and implications on the livelihood of the people in Guraferda and Arsi Negele district.

1.3. Objective of the study

The objective was assessing and documenting existing forest and on farm tree management practices in the integrated forest-farm interface landscape mosaics of Guraferda and Arsi-Negele districts and assessing the distribution of dominant woody species on such mosaic land scape and institutional support regarding such land scape management

2. Literature review

2.1. Forest cover change in the Southern Ethiopia

As in past millennia, natural forests will continue to be converted to agriculture in developing countries to enable livelihood support. Forests have (indirectly) had an important role in increased levels of consumption over time. In 2005 it was estimated that 11.9% of the Ethiopian territory was covered by forest (0.13 million km2) and that these forest areas had been declining at a rate of 1.1% annually between 2000 and 2005 (FAO, 2005 as cited by Garedew, 2010).

2.2. Overview of forest farm interface

Forest –Farm interface is the zone within or near forests occupied by smallholder farmers that is historically remote from markets and typically difficult to access (Fisher and Hirsch, 2008). It often includes both *ambiguous lands*, or lands cultivated by people who do not have official use rights (Sato, 2000)

2.3. Forest-Farm Interface Landscape Management in general

Forest management is the process of planning and implementing practices for the stewardship and use of forests and other wooded land aimed at achieving specific environmental, economic, social and/or cultural objectives. (FAO, 2005).A recent Forest Resources Assessment (FAO, 2010) estimated the global forest cover at just over 4 billion hectares, which is 31% of total land area of the world.

2.4. Role of forest-farm interface landscapes in sustainable forest management

Many tropical agricultural landscapes consist of forest patches and other land uses including home gardens and

various types of agroforestry practices such as grazing land with trees, tree crops with shade (e.g. coffee or cocoa with shade tree), and trees above annual crops (i.e., alley cropping). Trees in these types of agricultural landscapes are clearly managed; that is they are planted and/or retained from previous natural forest and coppices to provide various benefits including wood fuels and wood products, shade for other crop production (e.g. coffee), and fencing (Dewees, 1995; León and Harvey, 2006; Tolera et al., 2008; Pulido,S., and Renjifo, 2011; Borkhataria et al., 2012). The forest patches and trees on agricultural land may connect existing forest fragments and thus enhance migration of wild animals between the forest patches (Bhagwat et al., 2008; Perfecto and Vander, M., 2010; Pulido-Santa Cruz and Renjifo, 2011). In addition to trees and tree-dwelling biodiversity (e.g. birds), the mosaic less intensively used tropical agricultural landscapes (DeFries,et al., 2004) shelter several other types of associated biodiversity that may indirectly support the agricultural ecosystem and production (e.g. pollinators, predators of agricultural pests) as well as various micro-organisms that use the agricultural habitats for food or shelter and that may cause disease or damage to crops (CBD, 2001:107).

Farmers‘ management practices and work processes in relation to trees and forest mainly involve planting and/or retaining of trees inside fields (e.g. shaded coffee and grazing land) and/or along field boundaries on different land uses (e.g. annual cropland), establishing woodlots, and removing trees and clearing forest land to expand agriculture.

Overall, the biodiversity of forest patches and tree-rich agricultural mosaic landscapes is often essential for the health and function of not only the local agricultural ecosystem, but also the ecosystem processes at a regional scale. It is possible to generalize this kind of landscape management has greater contribution for sustainable forest resource management. This landscape can play vital role as wildlife corridors and as buffer zone. This has implications in reducing deforestation pressures on adjacent forest resources.

3. MATERIALS AND METHODS

3.1. Study area

This study was conducted in two different districts which are located in Southern part of Ethiopia; namely Guraferda and Arsi- Negele districts. Guraferda is found in the southwest part of Ethiopia, in Bench Maji Zone about 630 km southwest of Addis Ababa. It is located between 6° 45´ to 7°00´ N latitude and 35°00´ to 35°15´ E longitude. The total population of Bench Maji Zone in July 2014 is estimated at 786,421 of which 83% are rural population CSA., 2014. Guraferda district is one of the districts in the Zone and has a total population of 43,137.Since 2001, people from around North Shoa, Gondar and Wollo migrate in to the area in search of farmlands. As a result, it became home for a multitude and diverse population.

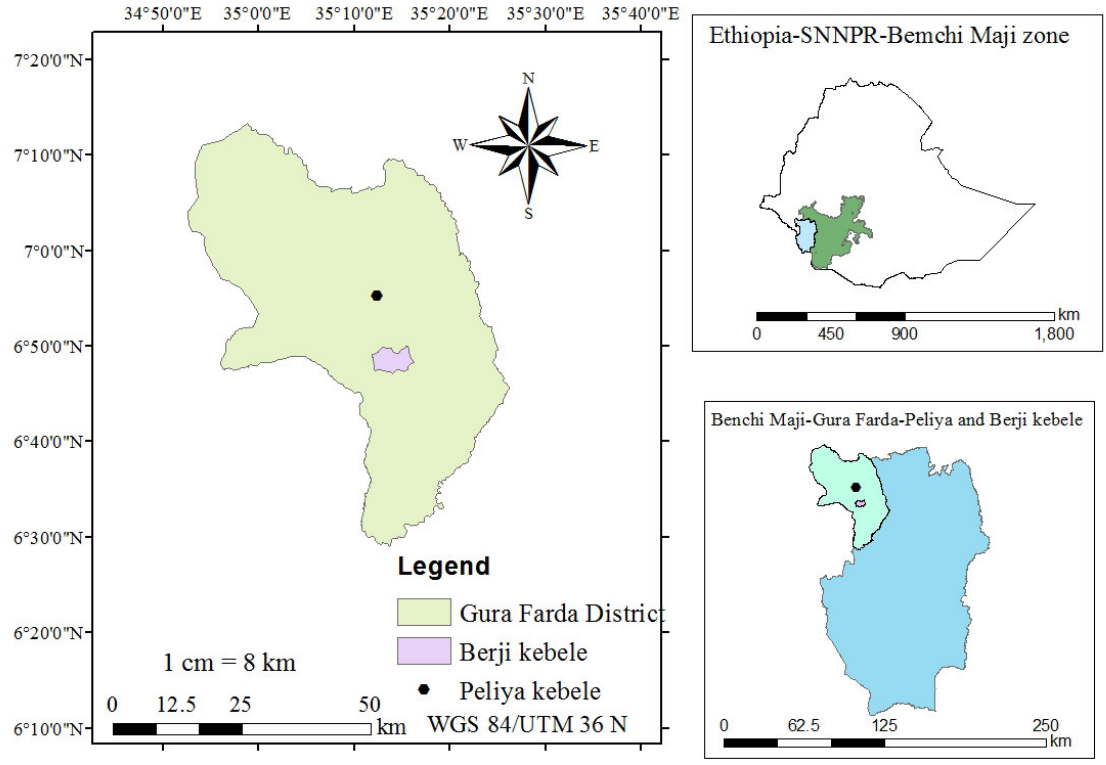

Fig 1: Location map of the study area / Guraferda

Whereas the second district where The other area of study was Arsi Negele, which is found in the south central part of Ethiopia, in West Arsi Zone. The West Arsi Zone has an area of 2,410 km^2 and is located some 250 km

south of Addis Ababa. It is located at 7° 27' N and 38° 53' E and in the Oromia Regional State, Arsi Zone. The district has a population of 320,384 with much of the population living in forest-farm landscapes. The four largest ethnic groups reported in Arsi Negele were the Oromo (85 %), the Amara (7%), the Kambaata (3%), and the Soddo Gurage(1%); all other ethnic groups made up 4% of the population. Oromiffa was spoken as a first language by 83%, 12% spoke Amharic, and 3% spoke Kambaata; the remaining 2% spoke all other primary languages reported. The majority of the in habitants were Muslims, with 75% of the population reporting they practiced that belief, while 20% of the population said they were Ethiopian Orthodox Christianity, and 5% were Protestant. The area has been inhabited by Muslim Oromo agro-pastoralists for over one hundred years,(Source OFWE report)

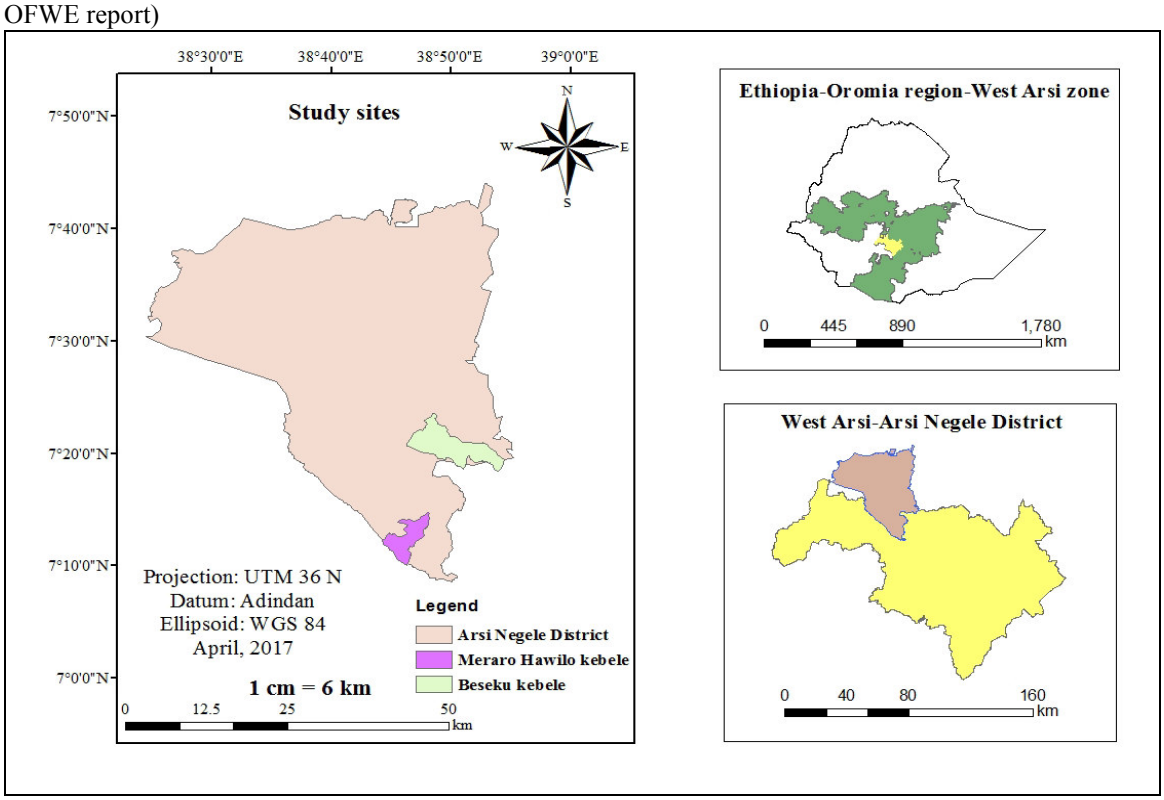

Figure 2. Location of the study area/ Arsi-Negele

3.2. Data collection and sampling

Based on the degree of deforestation; two contrasting kebeles (PAs) (areas with extreme high and extreme low deforestation) have been selected purposively from each district. In addition to this, each study site or PA was categorized or stratified into two different zones; namely, site nearer to forest as zone 1 and site far from forest as zone 2. As above description, Guraferda destrict from SNNPRs and Arsi-Negele from Oromia region have been selected. In similar manner Berji and Pelya from Guraferda purposively selected as low deforestation and high deforestation PA's respectively. Similarly from Arsi-Negele Destrict Beseku and Merarohawulo PA's were purposively selected as low and high deforestation PA's respectively. Then for both destricts, each PA's were further stratified in to two zones, as zone 1-site nearer to forest and zone-2, site far from forest.

3.2.1. Sample Size and technique

Random sampling technique was used to select sample respondents from each zone. Sample units for formal survey have been selected randomly using the probability proportional to sample size technique based on the number of farm households in each PA as well as in each zone. This study covered total of 218 households, 103 and 115 household from Guraferda and ArsiNegele district as well 86 from Zone 1 and 132 from zone-2 respectively. Total households included in this study were 218, of which 81% (41.2% from *Guraferda* and 39.8% from *ArsiNegelle woreda*) and 19% (6% from *Guraferda* and 13% from *ArsiNegelle woreda*) were male and female headed households, respectively.

Table-1 Sample of respondents versus Zone

	Sample Woreda's							
	Guraferda Woreda				Arsi-Negele Woreda			
	Berji		Pelya		Beseku		Merarohawulo	
Zones	Total	Sample	Total	Sample	Total	Sample	Total	Sample
Zone-1	143	23(39%)	112	18(41%)	479	28(40%)	288	17(37%)
Zone-2	223	36(61%)	163	26(59%)	702	41(60%)	492	29(63%)
Total	366	59(100%)	275	44(100%)	1181	69(100%)	780	46(100%)

N.B: Zone 1 and 2 are the nearest and furthest site from forest.

3.2.2. Data Sources and Types of Data Collected

This study used both primary data and secondary information sources. The primary data were collected using questionnaire surveys and Participatory Rural Appraisal (PRA)/ Rapid Rural Appraisal (RRA) techniques. Primary data was obtained through key informant interview, focus group discussions, and household survey to collect socio-economic data related to livelihood activities and forest use. Several secondary data sources in the form of published and unpublished research reports and administrative records were also consulted.

3.3. Data Analysis

The statistical data was coded, rearranged summarized, entered and analyzed using SPSS version 20 and Microsoft excel 2010. Demographic characteristics and socio economic condition of respondent households in site were analyzed using descriptive statistics such as percentage, frequencies, means and standard deviation. The comparisons of different households' characteristics were done using inferential statistics like χ^2-test and t-test.

4. Results and discussion

Table.2 Characteristics of communities

		Guraferda		Arsi-Negele	
		Zone-1(%)	Zone-2(%)	Zone-1(%)	Zone-2(%)
Education	Illiterate	28	23	27	26
	Grade 1-4	11	17	8	20
	Grade 5-10	2	15	3	10
	> Grade 10	0	4	1	5
Sex	Female	0	10	9	16
	Male	39	51	30	45
Marital status	Married	27	46	40	43
	Other-Wise	13	14	12	18

Small holder communities who found at zone-1 were mostly less educated, male headed as well as mostly divorced than communities at zone 2, this might be due to lack of access to market, infrastructure and related issues

Table3. Asset difference across sites

		Guraferda		Arsi-Negele	
		Zone-1	Zone-2	Zone-1	Zone-2
Age	Mean	33	42	39	45
	SD	7.65	11.37	10.32	7.16
TLU	Mean	5	3	12	7
	SD	3.43	1.85	8.43	4.31
physical asset	Mean	268	612	395	715
	SD	118.71	265.63	105.31	127.42
Crop land	Mean	2	3	1.53	2.27
	SD	1.32	2.36	0.48	0.35

From the above table the result shows that respondents around zone-1 were mostly youths, have high number of live stocks , have lower value of physical asset and they do have less crop land coverage .regarding livestock population, communities in Arsi-Negele's do have higher TLU than Guraferda , while in terms of total land the reverse is true.

Table.4. Tree planting trends and Reason of plantation via zones

		Guraferda		Arsi-Negele	
		Zone-1	Zone-2	Zone-1	Zone-2
Tree planting	No	24	21	13	7
	Yes	19	36	26	54
Reason of planting	Fuel-Wood	12	17	18	25
	Coffee	18	28	4	14
	Timber	3	4	7	9
	Pepper	2	1	-	---
	House	6	9	10	13

Regarding tree planting trend across zones, most of tree planting and managing communities were found in zone -2 than 1.this might be due to various forest resource in zone-1. In addition the primary reason of plantation was for coffee shade purpose in Guraferda where as in Arsi-Negele, the reason was for fuel wood consumption. Tree management involves a series of mechanisms, put into practice by rural people who in many cases are coordinating their actions with others, at the command of some (ideally) local authority they regard as legitimate. In both districts, when tree management trend of households is compared between those kebele's, there was significant difference (x^2=259.2, p=0.000 for Guraferda and x^2 = 245.9, p=0.000 for Arsi- Negele, 2-sided) (table 1).This indicate the tree management trend and objectives vary between kebele's in each district.

Table 5. Tree Management profiles of Study Sites

	Guraferda Woreda					Arsi-Negele Woreda				
Tree management Types	Pelya %	Berji %	Tot%	χ^2	P-value	Meraro%	Beseku%	Tot%	χ^2	P-value
Not managing	32	22	26			24	16	19		
Thining	27	20	23			17	13	15		
Lopping and Pruning	23	14	17			11	19	15		
Pollarding	6	10	10			7	10	9		
Coppicing	11	34	24			41	42	42		
Total %	100	100	100	259	0	100	100	100	246	0

Source: Field Survey 2017

4.2. Dominant Woody Species Distribution.

As it has been observed from the field during reconnaissance survey and information incorporated from key informant interview as well as from various focus group discussions, many woody species were found in both districts depending on their agro-ecology. In Guraferda District, the four most dominant indigenous tree species that were found in the adjacent forest nearby study sites were *Olea welwitschia, Aningeria adolfi-frierichi, Ficus vasta* and *Allophylus abysinicus* whereas tree species like *Celtis africana andCroton macrostachyus* were found in farm landand the others like*Albizia gummifera*, *Cordia africana* and *Millettia ferruginea* were found nearby home garden for coffee shade purpose. In addition to this *Eucalyptus camaldulensis* was dominantly found around boundaries and roads for construction poles, fuel wood and sale purpose. In Arsi-Negele District, the four most dominant indigenous tree species that found in the adjacent forest nearby study sites were *Hagenia abyssinica*, *Podocarpus falcatus* and *Juniperus procera*. Tree species like *Cordia africana, Albizia gummifera* and *Millettia ferruginea* dominantly found around farm land. The others like *Coffea arabica* and *Persea americana* were found around homegarden. *E. camandulensis* dominantly found around road and boundary.

4.3. Institutional support Regarding on-farm tree and forest Management

From Governmental institutions the institution responsible for all administrative affairs is the *woreda* offices and *PA's* administration offices. In addition Forest and Environment Coordination offices in Guraferda play vital role in landscape management aspect. OFWE/ Oromiya Forest and Wild life Enterprise/ is responsible for the forest plantations and indirectly for Meraro and Beseku PA's of Arsi-Negele.

From Religious institutions, In Arsi-Negele most of residents are Islamic. Whereas diversified religion in Guraferda, Therefore, the mosques and churches are of great importance in the community. They provide spiritual guidance, but also promote union between the community members. In Guraferda Mekaneyesus Project plays influential role in sustainable management trends of forest resource, awareness creation for communities and related issues. From Local institutions, Village leaders', religious leaders within village etc A youth group (at *kebele* level) tries to create activities to reunite all young members as well as to find opportunities for them. A women's group (at *kebele* level) controls a credit scheme and provide loans to its members.

There are some NGO's who support PA's regarding sustainable resource utilization and management issues. WCC (wild coffee conservation) projects attain the above issue in Guraferda and in Arsi-Negele, Ethiopian Sustainable Tourism Association promoted the creation of the Ecotourism Cooperative by raising funds from

USAID and building the capacity of the cooperative.

4.4. Drivers of Forest cover change

According to the survey result and field observation a multiple drivers contributed to forest cover change in the study area. Survey results shown that forest cover, grass land, and shrub/bush land were decreased. Findings of this study showed, the main drivers of forest cover changes in the study area were settlement, annual and perennial crop investment, wildfire, and fuel wood. House construction and farm implementing material collection, poor governances, and land tenure system of the farming community also had a great impact on the land cover change according to key informants and group discussions result.

Table 6. Drivers of Forest cover change

	Guraferda Woreda					Arsi-Negele Woreda				
Drivers	Pelya %	Berji %	Tot. %	χ^2	P-value	Meraro	Beseku	Tot. %	χ^2	P-value
Settlement	45	37	41			17	14	16		
Agricultural Investment	32	42	38			59	64	62		
Wild fire	23	21	21			24	22	22		
Total	100	100	100	242.8	0.000	100	100	100	240.7	0.000

Source Field Survey 2017

From the above result, it is obvious that the main driver of forest cover change in Guraferda were settlement and large scale commercial farming/ or investments where as rapid agricultural expansion was the main driving factor of forest cover change in Arsi-Negele.

5. Conclusions

In both districts better on farm tree management practice has been seen in low deforestation site than higher one. Forest management trend is weaker in high deforestation site, particularly, in nearer sites than lower one particularly, farther site due to challenging drivers of forest cover changes like: settlement, agricultural investment or expansion and land certification problems in high deforestation sites.

Dominant woody species in both site of Guraferda were four indigenous such as, *Olea welwitschia, Aningeria adolfi-frierichi, Ficus vasta* and *Allophylus abysinicus and Exotic one, Eucalyptus camandulensis.* Where as in Arsi-Negele the dominant indigenous species were *Hagenia abyssinica*, *Podocarpus falcatus* and *Juniperus procera* and *Cordia africana,* while exotic one was *Eucalyptus camandulensis.*Both agricultural productivity and forest product availability is declining due to seasonal anthropogenic factors.Lack of market access has been seen as a problem for unbalanced utilization and harvest of forest and agricultural products.

6. Recommendations

- Forest products contribute share of local community livelihoods. Therefore conservation and better management of forests is thus very essential to sustain local people livelihoods.
- Land certification program should be revisited for the district in order to ensure sustainable natural resource management system as well as to increase social stability on such mosaic landscape.
- There should be well-organized, strong and effective policy intervention to safeguard the natural forest patch that exist within interface from further destruction. These policy interventions should attempt the active involvements of local communities at the same time governmental and nongovernmental organizations for effective natural resources conservation within the district.
- Further researches should be done especially on loss of biodiversity related to natural forest conversion within such mosaic landscape.

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