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EXTENT AND CAUSES OF EUCALYPTUS TREE FARMING EXPANSION IN EZA WEREDA, ETHIOPIA

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Land use/land cover change is a common phenomenon in all parts of the globe although with varying magnitude. There are several possible causes for these changes, which may have economic, political or social reasons. Eucalyptus tree farming has become the dominant activities next to growing enset in the Gurage Zone in general and the study area, Eza wereda, in particular. The study assessed Extent and causes of Eucalyptus farming expansion in three selected KPAs (Kebele Peasant Administrations) namely, Zigba Boto (kolla), Shebraden (woinadega) and Koter Gedra (dega). Here dega, woinadega, and kolla represent temperate, subtropical and tropical climatic divisions respectively. In this study both primary and secondary data were employed. Purposive systematic sampling procedure was used to select the three agro-ecological areas of the wereda. In each selected KPAs 180 households were selected. Thus, after selecting households with eucalyptus farms from the list of each KPA, every 5th households were interviewed**.** Direct observations, discussions with key informants and focus groups were undertaken by the researcher. The required data were also collected using schedule through structured open and close-ended questionnaires. Enset is a perennial herbaceous monocot and a staple food for more than 130,400 people in Eza wereda. These two dominant perennials grow together with other food crops such as cereals, pulses, vegetable, fruits, and chat. The amount of eucalyptus woodlot generally increases with farm size because farmers have better opportunities to grow more trees once they have satisfied their subsistence and cash crop needs. In the study area eucalyptus tree plantation is a well-known emergent and accelerating activity by small holder farmers. Eucalyptus is planted in the form of woodlots, farm boundary, roads sides and around homesteads as a first priority tree species in the three sample Kebele Peasant Administrations (KPAs). Eucalyptus trees are not found within croplands in these KPAs, which could be the result of the fear of competition with agricultural corps, however, they are competing side by side. Eucalyptus camaldulensis (red eucalyptus) grows in kolla and woina dega (but more in kolla zone), while eucalyptus globules (white eucalyptus) grows more favorably in the woinadega and dega zones.

Key Words: Extent of eucalyptus tree expansion, causes of eucalyptus tree expansion, Land use land /land cover change, Economic factors, Eza wereda

INTRODUCTION

Farm forestry is the integration of trees into farming systems though plantation, regeneration, or conservation forestry through private initiative, either as part of crop production system or planned succession of field cropping system by trees with in the farming system (EFAP, 1991; Tenaw, 2007). The environmental deterioration caused by combined effect of growing population and the pressure on the natural forests calls for the need to establish plantation forests in tropical regions. Ethiopia is one of the countries badly struck by wide spread decline of environmental stability and productivity due to a rapidly increasing population and long lasting deforestation. In order to stop or slow down the deterioration, large sum of money and manpower have been invested to plant mainly fast growing exotic tree species, mostly in connection with the establishment of plantations for the production of fuel wood. One such exotic group is the eucalyptus, whose popularity, as plantation tree species is attributable to their being generally adaptable, fast growing and with a wide range of productive and a variety of uses (Lisanework, 1994). Livelihood is the way and means of

making a living and it also is about creating and embracing new opportunities (Parrota et. al., 2006). In financial terms, eucalyptus tree plantation yields substantial economic returns better than growing food crops under many circumstances (Asaye, 2001; Tenaw, 2007). The mean annual increment of eucalyptus tree production is also greater than many indigenous and exotic tree species. It is also hypothesized that farmers adopt tree plantation practices when there are substantial economic incentives to do so at the regional and household level and as long as associated risks can be managed (Selamyihun, 2004). Small-holder farming practices in the tropics are faced with constant pressure of change brought about by demographic, economic, technological and social pressures. Population growth, increasing commercialization of products and the use of modern inputs are the most important factors that contributed to land use changes. In many tropical countries, agricultural land use changed following the trajectory from hunter-gatherer life style in rain forests to market oriented mono-culture systems resulting in increased higher per capita food supply at the global scale. Recently, concerns have developed on the long-term sustainability and environmental consequences of the intensification of agricultural systems. Increasing attention is being given to achieving stability in land utilization in the longer term while fulfilling the needs of the local population (Reijntjes et. al., 1992; Swift and Ingram, 1996; Matson et. al., 2002). Notably, in small holder farming systems in the tropics, the use of modern technologies might not be the first option to improve agriculture. In such areas, better use of local resources and natural processes could make farming move effective and create conditions for efficient, profitable, and safe use of modern inputs (Reijntjes et. al., 1992; Altieri, 1995).Trees are integral components of most agricultural systems in the tropics playing vital roles in the livelihood of rural and urban populations. They provide fuel wood, the major energy source in these areas, wood for construction and other purposes, and their timber provides cash to many rural families (Fernandez and Nair, 1986; Long and Nair, 1999). With the rapid increase in population, off- farm tree resources in most developing countries are becoming scarce and thus farmers manage trees on their farms (Arnold and Dewees, 1995). The volume of wood in farms varies due to physical and socio-economic factors. For instance, farmers with small land holding cannot have a large stock of trees since the available land is primarily used to produce crops for consumption. Large holders on the other hand, could produce a large volume of wood (Sherr, 1995). A good access to market could encourage farmers to engage in intensive management of trees for marketing (Gilmour, 1995). Ethiopia has one of the longest forest plantation histories in Africa. To relieve the shortage of fuel wood caused by extensive deforestation, eucalypts were introduced to the country in 1894-1895 (Pohjonen and Pukkala 1990). Eucalyptus globules were the most successful of the 21-eucalypt species introduced and was quickly adopted by farmers. The reason for the wide-spread, early popularity and success of the blue gum can be attributed to its fast growth, coppicing property, unpalatability of its leaves, and adaptability to a wide range of site conditions (FAO, 1981b; Turnbull and Pryor, 1978). Various kinds of imperial incentives, such as tax relief for land planted with eucalypt trees and the distribution of seeds, have been important factors in the spread of the tree in the early years (Horvath, 1968).Forest plantations in Ethiopia were established essentially for fuel wood, and for industrial and environmental purposes, such as soil conservation. The establishment of large-scale forest plantations planned primarily for fuel wood production was started after the two global oil crises in the 1970s (Pohjonen, 1989). Most of these fuel wood plantations established after the oil crises were funded by international organizations and owned by the state. Over 90% of the population uses biomass fuels for cooking, heating and lighting (Mustanoja and Taye, 1990), and consequently, fuel wood is by far the major product of Ethiopian forests, woodlands and trees on farms. For instance, in 1992 it consisted over 95% of the wood produced in the country (FAO, 1994). Because of this prime importance of fuel wood to the society, forest plantations were established for fuel wood production purposes. On the other hand, the share of industrial forest plantations was estimated to be 38% of the total plantation area in the country (FAO, 2005).According to Pohjonen and Pukkala (1990), in order to stop the deforestation of the remnant natural foresters, about 3-4 million hectares of firewood plantations were planned by the year 2000. However, the expansion of industrial and firewood plantations was constrained by the availability of land and the limited capacity of the state bureaucracy to establish and operate commercial forestry undertakings. Furthermore, government policies severely limited private sector activities in the forest sector and this had detrimental effect on the expansion of forest plantations (EFAP, 1994).

METHOD OF DATA COLLECTION

Location and Extent

The area of this study, Eza wereda is found in Gurage Zone of SNNPRS. The wereda (district) lies between $8^0$03' North to $8^0$16' North latitude and 37^0 50' East to 38^0 12' East longitude. Agena, the wereda main town is found 198 km and 42 km. away from Addis Ababa and Gurage Zone main town of Welkite respectively. The wereda is found in West Gurageland and bounded by Cheha Wereda to the south, Muher and Aklil Wereda to the north, Abeshge and Kebena Weredas to the west, and Silte Zone and Gumer Wereda to the east and southeast respectively (see Fig. 1).

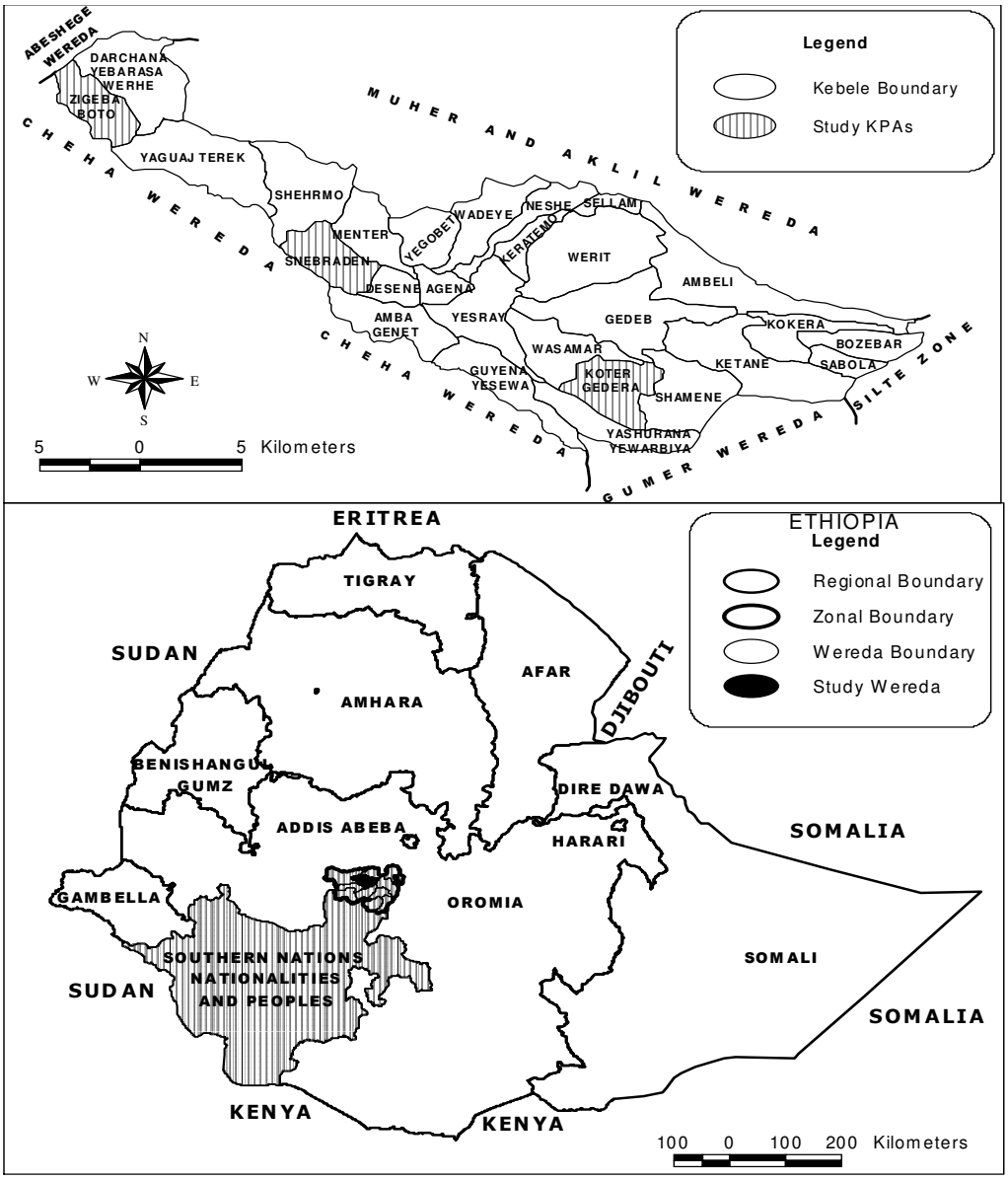

Figure 1 Location map of the study area

RESEARCH METHODOLOGY

Secondary Data:

To get clear understanding of the concept such as causes of eucalyptus farm forestry practices and land use land cover changes, secondary data from journals, books and theses were reviewed.

Primary data:

Data Collection Methods

To get primary data about the study purposive systematic sampling method was employed. Thus, after selecting households with eucalyptus farms from the list of each KPA, questionnaires were distributed and asked to every 5th

households. The questionnaires were distributed for sample households of the three KPAs agro ecologically. To supplement the information, discussions with focus groups and key informants were undertaken. Key informants and focus groups were:

- KPA (Kebele Peasant Administration) leaders
- Wereda Office of Agriculture and Rural Development officials including DAs (Development Agents)
- Selected model and locally known farmers in eucalyptus tree farming
- Wereda Water Desk officials

SAMPLING PROCEDURE, SIZE AND DISTRIBUTION

The study area, Eza wereda has 28 kebele Peasant Administrations (KPAs) with 130,487 populations (estimate of 2007). For the purpose the study 3 KPAs were selected. The reason for selecting KPAs is that they represent agroclimatic zones of the study area, eucalyptus tree farming is carried out more widely and they are more accessible to road transportation. The surveyed KPAs were the following.

Table 1 Sample Size and Sampling Distribution

No.	KPAs	Agro-climatic zone	Total population	%	No. of Households	%	No. of sample Households	%
1	Zigba Boto	Kolla	2,749	27	514	27	50	27.8
2	Shebraden	Woinadega	3,733	36	699	36	55	30.8
3	Koter Gedra	Dega	3,882	37	727	37	75	41.7
	Total		**10364**	**100**	**1940**	**100**	**180**	**100**

Source: Compiled from Eza wereda Administration Office, 2008 and EWIDP, 2007

As stated in table 1, from the selected three KPAs, 180 households were surveyed as unit of analysis. These households were representatives of eucalyptus farming activities since eucalyptus growing and tenure system are more or less the same in the wereda. The number of households interviewed were 50, 55, and 75 in kolla, woinadega and dega KPAs respectively. These sample sizes were selected in relation to the extent of expansion.

Data Analysis

To analyze the various data collected, the study employed both qualitative and quantitative techniques. Qualitative techniques were used to describe data acquired through observations, key informants, group discussions and questionnaires. The quantitative data were analyzed using descriptive statistics (minimum and maximum percentage).

Extent of Eucalyptus tree Expansion

As a result of the dramatic expansion of eucalyptus particularly after 1980's most households at least planted one hundred red or white or both types of tree species. Particularly eucalyptus planting has increased over the period of 1997 and 2001 in Eza wereda. The increase in eucalyptus planting is attributable to price increment in eucalyptus poles. (See Table 2).

Sample households from the three agro climatic areas have clear understandings about the increment of their eucalyptus wood lots from the adoption periods up to now. Planting more trees means creating varieties of opportunities in their livelihood. Thus, as clearly indicated in Table 2 all respondents planted eucalyptus trees throughout those consecutive fifteen years. From the total eucalyptus planted in those years 59%, 40% and 15% were planted in nearly flat or gently sloping topography of Zigba Boto, Shebraden and Koter Gedra whereas 41%, 60% and 85% were planted in rugged areas respectively. Trends in the total area of plantation indicate an increasing situation from 1980's to 2007/08. Muluneh (2003) in his study of West Gurageland on land use/land cover changes by using aerial photographs for two periods (1957/71 and 1998), indicated considerable dynamics in the land use systems of six KPAs including the two KPAs in which this study focuses (Shebraden and Koter Gedra). A total land use/land cover change in time span of 27 years for Koter Gedra (1971-1998) and 41 years for Shebraden (1957-1998) were observed. Accordingly, eucalyptus tree plantation expansion showed an increment of 169% for West Gurageland (six sample KPAs) including Shebraden and Koter Gedra. Woodlands mainly eucalyptus trees showed the most dramatic expansion. Eucalyptus woodlots increased from 4.2% (1957/67/71) to 11.2% (1998). Thus it showed an average expansion of about 169% as mentioned

Table 2 Eucalyptus trees planted by households for the last fifteen years in sample KPAs

Year	Number of eucalyptus														Site of land use					Total additional planted area (in ha.)	%
	500	%	1,000	%	1,500	%	2,000	%	2,500	%	3,000	%	Total	%	Type of Eucalyptus	Plain	%	Rugged	%		
Zigba Boto																					
2003-2007	11	22	18	36	13	26	-	-	3	6	5	10	50	100	Red	13	26	37	74	48	23
1998-2002	5	10	13	26	13	26	8	16	8	16	3	6	50	100	”	32	64	18	36	45	22
1993-1997	5	10	18	36	11	22	5	10	6	12	5	10	50	100	”	26	52	24	48	43	20
1988-1992	11	22	16	32	13	26	10	20	-	-	-	-	50	100	”	37	74	13	26	42	20
Before 1988	20	40	5	10	3	6	8	16	3	6	11	22	50	100	”	39	78	11	22	32	15
Total	52	21	70	28	53	21	31	12	20	8	24	10	250	100	”	147	59	103	41	210	100
Shebraden																					
2003-2007	6	11	11	20	12	22	4	7	11	20	11	20	55	100	”	15	27	40	73	54	20
1998-2002	5	9	12	22	12	22	8	14	12	22	6	11	55	100	”	18	33	37	67	52	20
1993-1997	12	22	9	16	8	14	11	20	8	15	7	13	55	100	”	20	36	35	64	51	20
1988-1992	10	18	17	31	6	11	9	16	5	9	8	15	55	100	”	27	49	28	51	50	19
Before 1988	28	51	6	11	10	18	7	12	2	4	2	4	55	100	”	30	55	25	45		100
Total	61	22	55	20	48	18	39	14	38	14	34	13	275	100		100	40	165	60	253	
Koter Gedra																					
2003-2007	11	15	10	13	29	37	12	16	13	17	-	-	75	100	White	16	21	59	79	70	27
1998-2002	10	13	14	19	21	28	19	25	11	15	-	-	75	100	”	13	17	62	83	66	25
1993-1997	25	33	13	18	29	39	5	7	3	4	-	-	75	100	”	15	20	60	80	65	21
1988-1992	29	38	11	15	27	36	6	8	2	3	-	-	75	100	”	9	12	66	88	63	14
Before 1988	33	44	10	13	17	23	15	20	-	-	-	-	75	100	”	4	5	71	95	59	13
Total	108	29	58	15	123	33	57	15	10	3	9	5	375		”	57	15	318	85	323	100

Source: Household Survey (2008)

above in the last three to four decades, though the recorded expansion in the six agro climatic areas ranged from about 100% in the woina dega KPAs to 169% in the dega KPAs. Hence, the expansion was more important in the dega areas and accounted for about 42% in the aggregate expansion while the woina dega and kolla KPAs contributed for about 34% and 26% respectively. Forest areas showed no considerable changes probably due to the problems of interpretation and the scales of aerial photograph used. However, personal field observations showed marked determination, with considerable parts of Geche (Shebraden KPA’s possession) and Koter Gedra (Koter Gedra KPA’s

possession) forests thinned out by selective tree cutting and clearance for settlement. Thus, eucalyptus expanded at the expense of others by way of transformation from one type of land unit to another or through modification. However, at agro climatic zone level, the rate of conversion varied from about 71% in Koter Gedra (dega KPA). Out of the observed changes, conversion from pastureland to eucalyptus wood lots (13%), shrubland to eucalyptus woodlots (7%) and cropland to eucalyptus tree plantation (5.2%) were more important and accounted for about 46% of all transformations. The expansion of eucalyptus plantations has been most important and competitive. Their expansion was largely at the expense of grazing areas and to some extent to bush lands and croplands. The aforementioned land use/land cover change of the three sample areas from 1957/71 to 1998 is shown in figure 2 to figure 5 below.

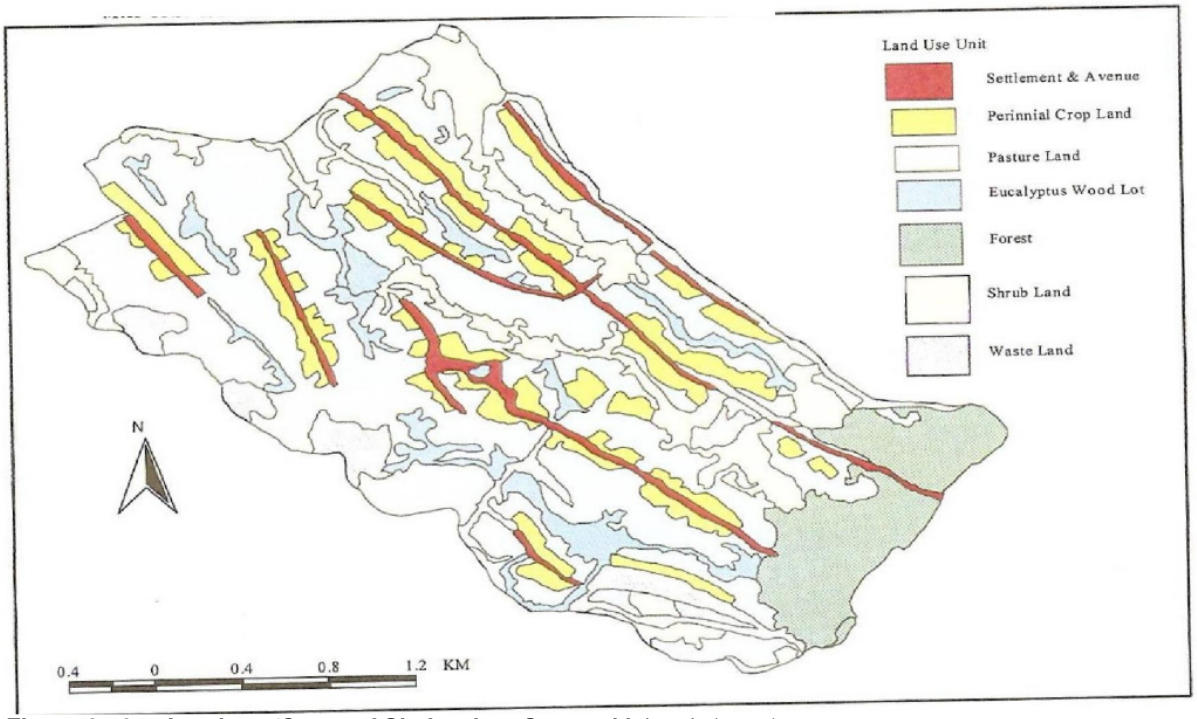

Figure 2-1957 Land use/Cover of Shebraden- *Source: Muluneh (2003)*

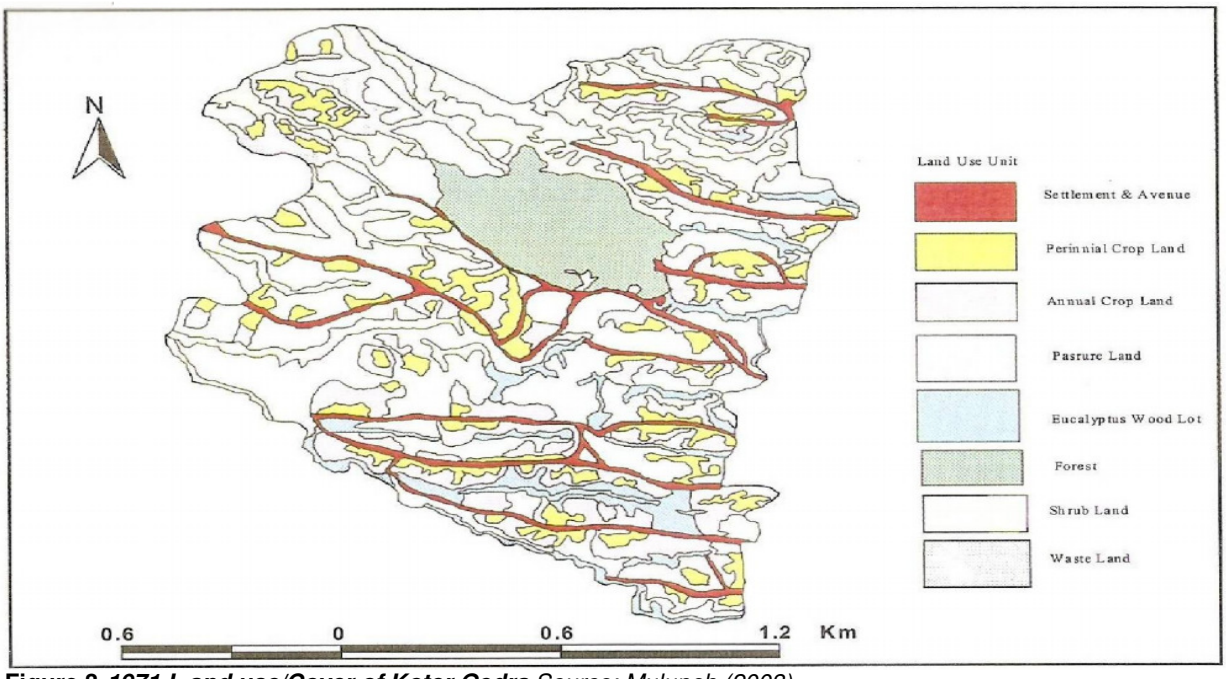

Figure 3-*1971 L and use/Cover of Koter Gedra* *Source: Muluneh (2003)*

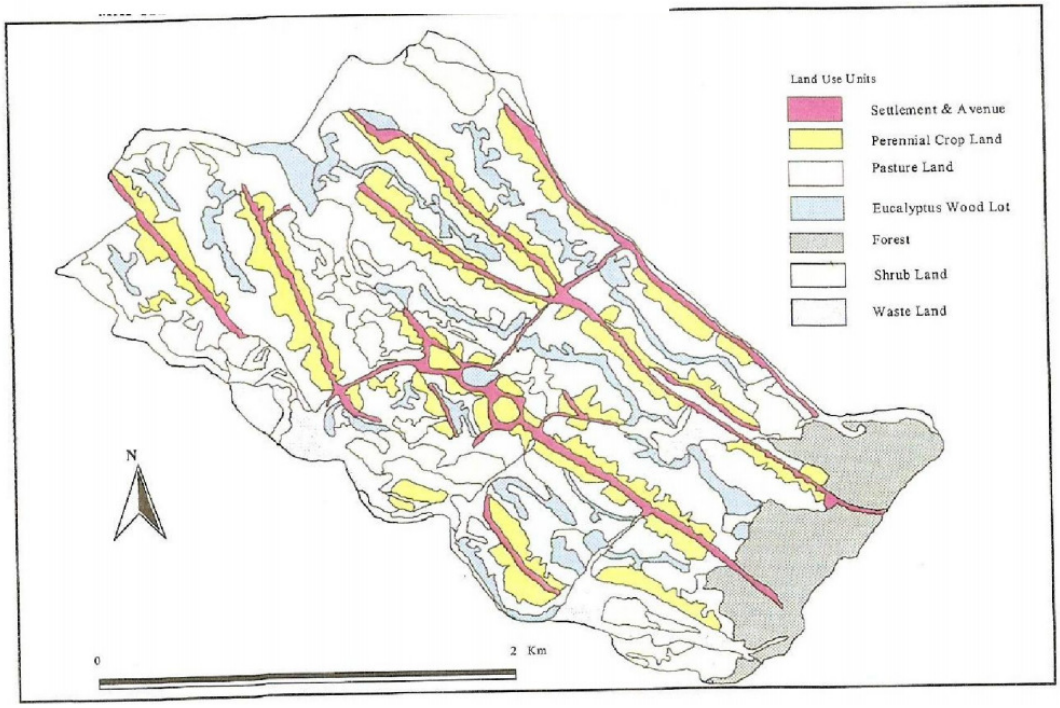

Figure 4-*1998 Land use/Cover of Shebraden -* *Source: Muluneh (2003)*

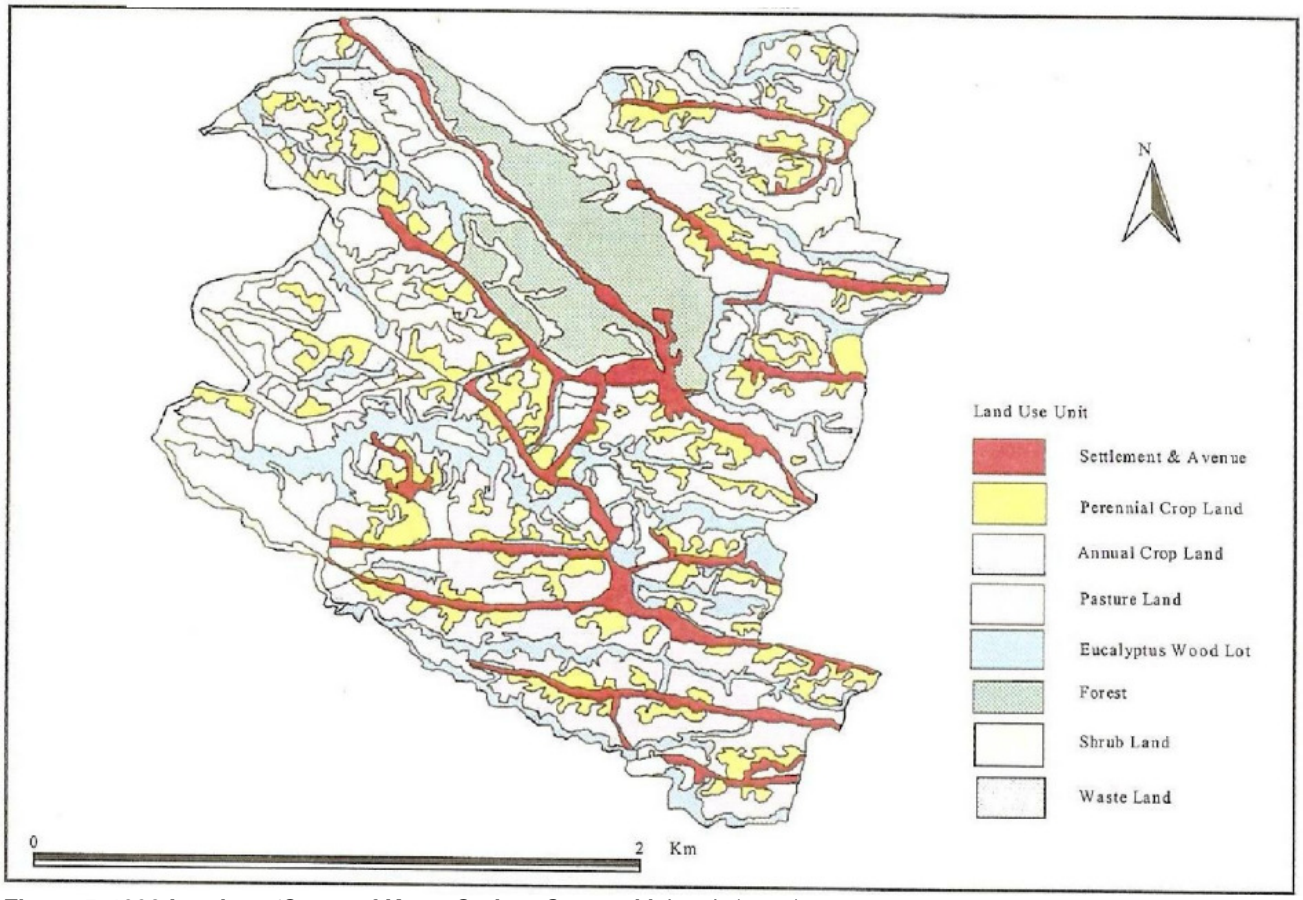

Figure 5-*1998 Land use/Cover of Koter Gedra -* *Source: Muluneh (2003)*

Table 3 Households' perception on the trend of expansion of eucalyptus tree farming for the past consecutive years (1980's - 2008*)*

Response	Number of Respondents							
	Zigba Boto	%	Shebraden	%	Koter Gedra	%	Total	%
Increased	50	100	55	100	75	100	180	100
Decreased	-	-	-	-	-	-	-	-
No change	-	-	-	-	-	-	-	-
Total	50	100	55	100	75	100	180	100

Source: Household Survey (2008)

As shown in Table 3, 100% of the respondents from all sample KPAs reported the dramatic trend of expansion of eucalyptus tree plantation. The main reason as stated by respondents is that the role of eucalyptus trees play in supporting households' livelihood tend to excel the contribution generated from other cash crops. However some of the respondents reported that the fear eucalyptus trees creates particularly in its competition with food crops such as enset and grazing lands is undeniable. Table 4 shows the beginning of adoption of eucalyptus in the three sample KPAs.

Table 4 The starting years of planting Eucalyptus trees

Years	before 60	before 60-40	before 40-20	before 20-10	before 10-5	before 5-3	Total
Zigba Boto							
No. of Respondents	7	15	21	5	2	-	50
%	14	30	42	10	4	-	100
Shebraden							
No. of Respondents	9	17	21	6	2	-	55
%	16	31	38	11	4	-	100
Koter Gedra							
No. of Respondents	12	27	27	9	-	-	75
%	16	36	36	12	-	-	100
Grand Total	28	59	69	20	4	-	180
%	16	33	38	11	2	-	100

Source: Household Survey (2008)

As shown in Table 4, about 87% of the households started planting eucalyptus tree before 20 years; while about 13% of them after 20 years. It appears then that the study region has had long experience of cropping eucalyptus trees.

Socio-Economic and Environmental Factors that Cause Eucalyptus Tree Farming Expansion
Population pressure and land use land cover change

Recently eucalyptus farm has rapidly expanded in West Gurageland. As noted by Muluneh (2003) the link between population and environment, on the one hand, and population and the economy, on the other hand, are one of the most critically debated issues. Many people consider that the most unfavorable changes in the environment and the economy of many pre-industrial societies, most particularly degradation and poverty respectively, are the result of fast population growth. But there is a new school of thought that views population growth, all other things remaining in a normal course of move, can induce innovation, environmental recovery and, consequently, growth in the economy.Although the area under study is less known for its environmental degradation like other weredas of Gurage Zone, small land holders intensively practice eucalyptus tree farming as one means of conserving degraded areas particularly those of rugged areas. As stated by Muluneh (2003) in West Gurageland including the study area; on individual basis, one peasant planted, on the average about 61 trees. Thereupon, eucalyptus plantation density increased by about 170% in the last four decades. This could have partly contributed to the environmental recovery particularly in the degraded areas and justify the more people more tree situation, although it may be partly attributable to some other factors. At agroclimatic zone level, the rate of expansion varied from 0.12% in kolla to 2.4% in woinadega and 7.3% per annum in dega. In addition to this population growth, of course together with other factors such as improved access to road, town market and information has induced people to plant trees in degraded areas and outside. These, therefore, serve for the purpose of environmental conservation and recovery. Muluneh (1994) in his study revealed that the growing need of wood for construction and firewood, partly due to population growth, has been one of the major drives to plant more eucalyptus trees. But the development of all season motorable road networks in the region since about 1960's reported as one main factor in the expansion of eucalyptus tree farming at smallholder level. Hence, in order to fulfill socio-economic needs, households preferred to plant more trees in their landholdings without taking some considerations to land diminution, which is the very serious issue in West Gurageland including the area of the study.

Table 5 Households' Responses on whether Population Growth Facilitate Eucalyptus tree Expansion or Not

Response	Number of Respondents		Percentage
Zigba Boto			
Yes	39		78
No	8		16
I don't know	3		6
Total	50		100
Shebraden			
Yes	49		89
No	6		11
I don't know	-		-
Total	55		100
Koter Gedra			
Yes	59		79
No	13		7
I don't know	3		4
Total	75		100
Grand Total	180		100
Aggregate	Yes	147	82
	No	27	15
	I don't know	6	3

Source: Household Survey (2008)

Table 5 shows, of the total 180 respondents from the three sampled KPAs; 78%, 89% and 79% of the respondents believe that expansion of eucalyptus tree farming has been due to population pressure in Zigba Boto, Shebraden and Koter Gedra respectively. In aggregate 82% of them have the awareness that expansion of tree farming is in response to population increase. This may partly substantiate the notion of "more people more tree", particularly in fragmented and diminutive land holdings of the country. Only about 15% of the respondents disagree with the situation. Their reason to this is that there is no more additional land due to its diminution. The remaining 3% of the respondents are not sure of such relationship.

Meskel Celebration and Fuel wood Consumption

Like other areas of the country, Meskel holiday/celebration has impacts on the socio-economic lives of Gurages. However, the attachments of Gurages with Meskel is quite unique in terms of long duration of the celebration, cost, many number of returnee people from domestic Diasporas and the like. The households start engaging with preparation for Meskel celebration before three months. Among other things, fire wood is fetched well in advance before one to two months. Starting from June, i.e. before three months of the celebration weak, each household begins to prepare fuel wood of higher quality. The best and readily available in this regard is eucalyptus tree which is often used for this purpose. This has been the experience since the time of the eucalyptus tree adoption. Discussions with an elder in Zigba Boto, noted that celebration of Meskel without fuel wood preparation, one may not able to say I have celebrated

Meskel in Gurage area in general and West Gurageland (Sebat Bet Gurageland) including the study area in particular. The accumulation of splited eucalyptus logs are displayed in impressive arrangement in all *"Guye Bet"* (big houses) of Gurages. After Meskel celebration, the remaining collected firewoods are used until end of October or in some case until November and December.Thus, for the prime reason of economic benefit, environmental recovery and social values such as Meskel, eucalyptus tree farming is practiced with less attention to its negative ecological effects and land use competition. This is figurative when it is compared to the number of Orthodox and Protestant Christianity followers which celebrate Meskel. As mentioned earlier, 86% and 7% the respondents are flowers of Orthodox and Protestantism. Hence, collectively 93% of the respondents celebrate Meskel and thereby use ample amount of eucalyptus fuel wood in the form of torch *('demera'),* for cooking food, heating and light.Some KPA leaders such as Gizachew Bizani from Shebraden reported that farmers plant eucalyptus at least to fulfill fuel wood for Meskel celebration if not for economic benefit. Generally speaking the wealthier the farmer is the more the amount of eucalyptus fuel wood preparation is needed for Meskel. Therefore, eucalyptus trees remained part of Meskel celebration requirements in Eza wereda similar to other Gurage regions in general and West Gurageland in particular and hence its expansion will continue for such needs.

Land Degradation and Conservation

Population growth may not lead to environmental degradation if there is a reasonable amount of natural resource base, significant access to internal and external markets, opportunities for non-farm income sources, active private trading network, fair social and physical infrastructure, reasonable social and political stability, forward looking society and good governance (English, 1993; cited in Muluneh, 2003). Muluneh (2003) in his study *"population growth and Environmental recovery"*, by supporting Boserupian Theory, mentioned that, an increase in the destiny of population means that the number of people who can be served from an individual location (other things being equal) increase; conversely, the cost of providing service to a given number of people falls. At the same time the number of other individuals, with whom one person is likely to interact, will rise, which will tend to increase the exchange of ideas and flow of information and increase the likelihood of new ideas and innovations being generated. This in turn, will assist in solving the supply problems generated by population growth.This, therefore encourage people to plant farm forestry such as eucalyptus trees in their degraded land holdings. Thus, in the area of study, Eza wereda, like other weredas of Gurage Zone farmers practice conservation of their land to cope with the environment since land diminution is a common problem. Such practice is done not for the sake of government plans and policies rather for survival in such limited landholding size. Table 6 indicates household response on conservation mechanisms through eucalypts tree planting.

Table 6 Households' Participation in Environmental Conservation through Eucalyptus tree planting

Response	Number of Respondents		Percentage
Zigba Boto			
Yes	32		64
No	18		36
Total	50		100
Shebraden			
Yes	40		73
No	15		27
Total	55		100
Koter Gedra			
Yes	64		85
No	11		15
Total	75		100
Grand Total	180		
Aggregate	Yes	136	76
	No	44	24

Source: Household Survey (2008)

As indicated in Table 6, out of the total sample KPAs 64%, 73% and 85% of the respondents in Zigba Boto, Shebraden and Koter Gedra respectively participated in environmental conservation by planting eucalyptus trees. In aggregate 76% of the respondents use eucalyptus for conservation in degraded lands of households while 24% of them do not use such

conservation practice. The reason behind this, according to the respondents, is the fear of the adverse ecological effect of eucalyptus such as its high water consumption, erosion, and soil nutrient depletion.

Road Development

Road development as one of the basic infrastructure has great role in the integration of economic, social, political and cultural conditions of any country of low economic development like Ethiopia. As Muluneh (1994) stated the development of all-weather roads in the Gurageland contributed to the land use/land cover change. As one of the factors of production, road stimulate farmers to plant cash crops which have high demand in the market. Due to nearness to Addis Ababa and other towns, the Gurage area in general and the area of study in specific has great actual and potential advantages with regard to income diversification. Thanks to the pioneers of road construction in West Gurageland, Gurage Road Construction Organization, almost every wereda has at least one all-weather road, which links to the nearby markets and towns. Eucalyptus poles, therefore, is transported by households using this road facilities. Particularly the kolla and woinadega farmers are more beneficiaries due to the flat nature of the topography. Meaning, in dry seasons the purchasers can reach up to eucalyptus woodlots without road networks since the terrain is not rugged. Therefore, Shebraden and Zigba Boto are more accessible than Koter Gedra to reach eucalyptus woodlots even after the roads end up all weather and dry weather roads. That means in these areas much man power is not needed to transport eucalyptus poles than the latter which transport from rugged areas to flat surfaces in most cases. Thus, road development facilitated eucalyptus tree expansion in these areas.

Table 7 Households' response on time spent from eucalyptus woodlots to the nearby roads (all weather roads and dry whether roads) in minute

Time Spent in minutes	All Weather Road No. of Respondents		%	Dry Weather Road No. of Respondents	%
Zigba Boto					
10-14	5		10	21	42
15-19	8		16	24	48
20-24	8		16	5	10
25-29	13		26	-	-
30-34	16		32	-	-
35-39	-		-	-	-
Total	50		100	50	100
Shebraden					
10-14	-		-	8	14
15-19	-		-	28	51
20-24	-		-	17	31
25-29	4		7	2	4
30-34	19		35	-	-
35-39	32		58	-	-
Total	55		100	55	100
Koter Gedra					
10-14	-			6	8
15-19	-			15	20
20-24	4		5	41	55
25-29	16		21	13	17
30-34	33		44	-	-
35-39	22		30	-	-
Total	75		100	75	100
Grand Total	180		100	180	100
Aggregate	10-14	5	3	35	20
	15-19	8	4	67	37

Continuation of **Table 7**

	20-24	12	7	63	35
	25-29	33	18	15	8
	30-34	68	38	-	-
	35-39	54	30	-	-

Source: Household Survey (2008)

As depicted in table 7, the total time spent to reach dry weather roads is shorter for Zigba Boto than Shebraden and Koter Gedra. All the sample respondents travel not more than 24 minutes to reach to dry weather road. People of Shebraden and Koter Gedra reported that they travel up to 29 minutes. The reason why the travel time is too shorter for Zigba Boto is attributable to flat topography. Vehicles can reach very close to eucalyptus woodlot areas without much difficulty. Distance traveled to all weather roads by Zigba Boto households is also shorter than Shebraden and Koter Gedra. All the sample respondents in Zigba Boto travel only 10 to 34 minutes while those of Shebraden and Koter Gedra travel up to 39 minutes to reach to all weather road network. In aggregate 14% of the respondents travel 10 to 24 minutes and the other 86% travel 25 to 39 minutes to all weather roads. However, 92% and 8% of them travel 10 to 24 and 25 to 39 minutes to dry weather roads respectively.It appears that the development of motorable road transportation in the region has promoted farmers to plant more eucalyptus trees. After they sell eucalyptus poles, of different sizes (small, medium, and big), they became motivated to plant additional trees, and this has continued up to serious land use competition.

Increased Access to Markets

The sample KPAs of the study area are accessible to rural market places and towns. Agena the capital town of the wereda is about 15kms, 7kms and 20kms away from Koter Gedra, Shebraden and Zigba Boto. Poles can be transported using all weather roads to the town in reasonably short time when farmers want to sell. On site sale of poles is also possible. Thus, farmers can sale their tree plantation products either on site or transport into market place such as Agena, Welkite and Addis Ababa. Table 8 shows time spent by households to travel the nearby towns.

Table 8 Time Spent from Households' residence to the nearest town in minutes

Time Spent in minutes	**No. of Respondents**	**Percentage**
Zigba Boto		
30-59	9	18
60-89	27	54
90-119	14	28
Total	50	100
Shebraden		
30-59	25	46
60-89	29	52
90-119	1	2
Total	55	100
Koter Gedra		
30-59	56	75

Continuation **Table 8**

60-89		19	25
90-119		-	-
Total		75	100
Grand Total		180	100
Aggregate	30-59	90	50
	60-89	75	42
	90-119	15	8

Source: Household Survey (2008)

As indicated in the Table 8, households from Koter Gedra have better access to the nearby town than Shebraden and Zigba Boto since they travel in average 59 minutes. On the other hand respondents of Shebraden and Koter Gedra travel in average 74 minutes to reach the nearest town. Thus, eucalyptus poles of different types are sold to the town of their proximity. Shamene, Agena and Gubre are the closest markets to Koter Gedra, Shebraden and Zigba Boto respectively. Middle men *('Dellalas')* provide assistance in creating links between woodlot sellers (farmers) and merchants. Therefore, improved access to market places facilitated the expansion of eucalyptus tree farming in the study area.

Economic factors

Economic factors are by far the most important catalysts of eucalyptus tree plantation expansion in the study area and other areas of Gurage Zone. With the growing trend of population pressure and degradation of natural forests farmers' decision to plant fast growing trees such as eucalyptus is unquestionable in the study area (which is one of the most densely populated areas of the country). The main economic reasons for planting eucalyptus in the wereda include the growing need for fuel wood, construction, and cash (money) for different purposes.

***The Growing Need for Fuel Wood*:** In rural areas biofuel has been the most important source of household energy. These sources come mainly from firewood, crop residues and animal dung. Natural forests are rarely used as source of fire wood or else because they are promoted natural balance and reduced environmental degradation. Thus, to cope with fuel wood demands at household farmers started planting fast growing species mainly eucalyptus. The survey result showed that in Eza wereda, dependency on natural forest for firewood has been shrinking because of the dramatic expansion of eucalyptus tree farming particularly to fulfill domestic energy consumption. Animal dung and crop residues are good compliments of eucalyptus firewood particularly in Koter Gedra than in Shebraden and Zigba Boto. In Shebraden and Zigba Boto, using animal dung was common before the expansion of eucalyptus woodlots.

Table 9 Type of fuel wood energy used by households

Type of Fuel wood	Number of Respondents												Aggregate			
	Zigba Boto				Shebraden				Koter Gedra							
	Users	%	Non users	%	Users	%	Non users	%	Users	%	Non users	%	Users	%	Non users	%
Eucalyptus wood	50	100	-	-	55	100	-	-	75	100	-	-	180	100	-	-
Animal dung	21	42	29	58	6	11	49	89	68	91	7	9	95	53	85	47
Crop residue	49	98	1	2	49	89	6	11	75	10	-	-	173	96	7	4
From forests	8	16	42	84	10	18	45	82	13	17	62	83	31	17	149	83

Source: Household Survey (2008)

As shown in Table 9, eucalyptus wood is used by all the three KPAs' respondents. Animal dung is used by 53% of the three sample KPA households whereas non-users of it are 47%. This much reduction of using animal dung is probably attributable for the wide adoption of eucalyptus tree farming by each household. Crop residues' consumption by all the respondents is admirable (96%) and encourageable since it has indirect advantage in reduction of deforestation and to some extent land use competition of eucalyptus. Thus, the total consumption of eucalyptus in substituting the degraded natural forest is significant in the study area.

From Table 10, it can be understood that in the past years 87% of the households were using animal dung as source of fuel consumption. When it is compared to the present consumption (53%), there is reduction by 34%. The reason for such reduction according to the respondents is due to the fact that animal manure is more useful when it is applied to enset farms and others as fertilizer. The main reason to this is the availability of eucalyptus tree due to its dramatic expansion.

Table 10 Experience of Households in using animal dung in the past

Response	Number of Respondents							
	Zigba Boto	**%**	**Shebraden**	**%**	**Koter Gedra**	**%**	**Total**	**%**
Yes	37	74	44	80	75	100	156	87
No	13	26	11	20	-	-	24	13
Total	50	100	55	100	75	100	180	100

Source: Household Survey (2008)

The Need for Construction: Before 20 years using eucalyptus as source of construction raw materials was less common particularly in the woinadega and dega zones of the study area. The main sources of house construction materials were obtained from own indigenous woodlots and natural forests. However, now a days because of the restriction of cutting of the existing natural forests by government and the community at large and individual households in particular, farmers shifted their attention to using fast growing trees such as eucalyptus. Previously *junipers procera* was the most preferred and defrosted plant for construction. However, as a result of its slow growth nature, lack of availability and the very costly nature of the tree, its use for construction purpose became less important. However, in woinadega areas, it is still used for construction proposes. Particularly farmers prefer using *eucalyptus camaldulensis* (red eucalyptus) to *eucalyptus globules* (white eucalyptus) for construction purposes as a result of its beauty and resistance to termites within the ground. The straight nature of red eucalyptus is more conducive than the white one. The need of eucalyptus by farmers for construction purpose is totally accelerated. In addition to house construction, eucalyptus tree has great role for fencing, making farm tools and local bridges.

Table 10 Households Multiple Response on Source of Wood for Construction

Sources	Number of Respondents							
	Zigba Boto	%	Shebraden	%	Koter Gedra	%	Total	%
From own planted tree (eucalyptus)	50	100	55	100	75	100	180	100
Buying form market and villages	26	52	51	100	70	93	147	82
Cutting from community forest	-	-	-	-	-	-	-	-
Collecting from neighbors	45	90	55	100	68	91	168	93
From relatives and friends	42	84	55	100	71	95		93
Total	163	100	216	100	75	100	180	100

Source: Household Survey (2008)

Table 10 shows that all the respondents from the three agro-ecological zones reported that they are using eucalyptus trees from their own land holdings and 82% of them purchase from market or villagers. Farmers also collect contributions of trees from neighbors, relatives and friends. According to the report all the households collect construction materials from this source as noted above other than community plantation forests and natural forests. Most of these collected and purchased construction woods are of eucalyptus tree and that is why, in addition to being source of fuel wood and money, eucalyptus trees became the stable source of construction tools and other means of livelihood sustenance (support) of the households in the region. Thus, the need for construction has its own impact for the expansion of eucalyptus trees in the area.

Growing Need for Cash (money): In the study area there is the need to rationalize the allocation of farm forestry and optimize its use through competitive market economies to achieve maximum economic efficiency. It seems that cost and benefit from the use of particularly eucalyptus trees is known by farmers. Eucalyptus tree for a given farmer means living bank account that can be used when one is in need of money for different purposes such as to pay land or agricultural taxes, yearly celebrations like Meskel and for supporting social institutions such as *mahiber,* weeding, *zikir, ekub* and *idir*. Even when a farmer needs to cultivate own farmland one has to have enough money so as to pay for daily laborers and to purchase food items such as *teff*, coffee, meat, drinks such as *katikala* and *tela*. The immediate source of money for all such expenses and others now a days partly come from the sale of eucalyptus tree poles of different size (small, medium and big) in addition to selling cash crops such as enset, chat, coffee, fruits, vegetables, cereals and pulses.
The author of this paper was well informed during household survey that some farmers in kolla (Zigba Boto) and woinadega (Shebraden) collect about 35,000 ETB. in six years by selling eucalyptus poles, and logs. Such farmers are not only high prestige ones because of their higher income but also socially more respected; and stated as model farmers by Woreda Agriculture and Rural Development Office. Such farmers also motivated other peasants to plant

more eucalyptus trees on their landholdings.

Table 11 Households' Participation of Social Organizations in their Locality

Type of social organizations	Number of Respondents (Multiple response)							
	Zigba Boto	%	Shebraden	%	Koter Gedra	%	Total	%
Idir	50	100	55	100	78	100	180	100
Ekub	26	52	21	38	48	64	95	53
Religious celebrations	50	100	55	100	75	100	180	100
Community meetings	50	100	55	100	75	100	180	100
Total	50	100	55	100	75	100	180	100

Source: Household Survey (2008)

All the sample KPAs' respondents participate in all social organizations except in *'ekub'* in which only 53% of the total respondents take part (Table 11). Therefore, to take active part in all these social settings, cash generated from eucalyptus seems has been very important. The income generated from selling eucalyptus woods supplements/compliments the household income (livelihood support) obtained from crops, livestock and non-farm activities. Eucalyptus woodlots are also becoming strong coping strategy of food security in addition to all others as reported by some farmers. Thus, many households have started growing more trees, which ultimately accentuated expansion of eucalyptus tree plantations.

Conclusion

Land use/land cover change is a common phenomenon in all parts of the world. There are several possible causes for land use/land cover changes. These might be economic, political, social or cultural reasons. In the study area eucalyptus tree farming is becoming an important agricultural practice next to enset with similar cases to other areas in the zone. The latter is a perennial monocot and a staple food for greater than 130, 400 people in the region. Enset and eucalyptus trees are grown side by side with different crops such as cereals, pulses, vegetables, fruits, chat, coffee and different types of trees and shrubs.

As a result, the dramatic expansion of eucalyptus tree farming increased from 1997 to 2008 due to attractive market price of various types of poles (small, medium and big). The adoption of eucalyptus tree farming has more than half century ages. Thus, 49% of the respondents started growing eucalyptus trees before forty years and others (51%) after forty years. In the study area economic, social and environmental factors contributed for the expansion of agroforestry in general and eucalyptus tree farming in specific. Population pressure encouraged people to plant farm forestry such as eucalyptus in different plantation sites as mentioned before. In dega and kolla KPAs farmland woodlots practices are attributable to the flatness of the areas than the woinadega. Thus, land use competition between eucalyptus tree and food crops is becoming stronger in these areas. On the other hand, road development in the area initiated farmers to plant eucalyptus in flat areas, which are near to roadside.

Two ways of selling eucalyptus products is possible, i.e. to the nearby town (market); and to Addis Ababa and other towns near to the area. Economic factors are the most important catalysts of eucalyptus tree expansion so as to cope with fuel wood, construction and financial shortages for various social and governmental duties. Before twenty or thirty years using eucalyptus as construction material was very scanty particularly in woinadega areas of the study area. However, due to shortage of indigenous tree products in farmers' landholdings and markets, eucalyptus tree became the dominant source of construction. The main reason to this is that eucalyptus is fast growing and ubiquitous than other farm trees.

As key informants noted, eucalyptus for a given household means a living bank account that can be used during shortage of money for different duties. The immediate source of money for all these expenses now a days come from the sale of eucalyptus poles and logs in addition to food crops such as enset, vegetables, cereals and pulses; and cash crops including chat and coffee. Thus, all the aforementioned causes facilitated the rapid expansion of eucalyptus tree farming in Eza Wereda in specific and Gurage Zone in general. Hence, to manage such rapid expansion of the species participatory community research and appropriate land use zoning/plan is needed. To combat environmental degradation and competition with farmlands, closer and continuous awareness creation to smallholder farmers by wereda/district agriculture and natural resource experts is also needed. This effort will sustain the ecology and livelihood of the community.

References

Altieri M.A. (1995). Agroecology: The Science of Sustainable Agriculture (second edition). West View Press.
Arnold W. and Dewees, P. A. (1995). Forestry Policy and wood fuel markets in Malawi. Natural Resources Forum 19(2): 143-152.
Asaye Asnake (2001). Yield Performance and Economics of Growing Eucalyptus of Small holders in Gonder Zuria Districts of Amhara Regional States. MSc. Thesis, Wondo Genet Collage of Forestry. Unpublished.
EFAP (1991). Main Report of Tasks, Forces on Farm Forestry Extension. Volume 1 August 1991 Addis Ababa.
FAO (1994). Forest Products Year Book 1994. FAO Forestry Series No. 27: FAO, Rome 336p.
FAO (2005). State of World Forests. Rome.
FAOs (1981b). Eucalyptus for Planting. FAO Forestry and Forest Products Studies 11, FAO, Rome.
Fernandes E.C.M. and Nair P.K.R. (19866). An Evaluation of the Structure and Function of Tropical Home Gardens. Agricultural Systems 21:279-310.
Gilmore D.A. (1995). Rearranging Trees in the Landscape in the Middle hills of Nepal: In Arnold J.E.M. and Dewees P.A. (eds). Tree Management in Farmer Strategies: Responses to Agricultural Intensification. Oxford University Press. Oxford. UK.
Horvath, R.J (1968). Addis Ababa's Eucalyptus Forests. Journal of Ethiopian Studies Volume I. Addis Ababa.
Lisanework Nigatu (1994). Ecological Studies of Plantation in some parts of Ethiopia, with Special Regard to Ecological Effects of use of Eucalyptus Species. PhD. Dissertation, Addis Ababa University Unpublished.
Long A.J. and P.K.L. (1999). Trees Outside Forests: Agro-Community, and Urban Forestry. New Forests 17:145-174
Matson PA, Parton W.J., Power A.G. and Swift M.G. (20002). Agriculture Intensification and Ecosystem Properties. Science 277:504.
Mustanoja, K.J. and Taye Beyene (1990). Ethiopia wood fuel Production development Draft Sectoral Plan. Ministry of Agriculture. Fuel wood Plantation expansion division 22p.
Parrotta J.A. (1999). Productivity, Nutrient Cycling, and Succession in a single and Mixed species plantations of Casuarina equisetifalia, Eucalyptus Robusta and Leucaena Leucocephala in Puerto Rico. Forest Ecology and Management 124:45-77.
Pohjenen, V. and Pukkala T. (1990). Eucalyptus globules in Ethiopian forestry. For Ecology and Management 36, 19-31.
Pohjonen,V.(1989). Establishment of fuel wood plantation in Ethiopia. Forests Ecology Management.
Reijntjes C, Havecort B. and Waters Bayer A. (1992). Farming for the future: An Introduction to low-external-input and Sustainable Agriculture. ILEIA, Leusden. The Netherlands.
Scherr, S. J. (1995). Economic Factors in Farmers' Adoption of Agroforestry.
Selamyihun Kidanu (2004). Using Eucalyptus for soil and water conservation in the Highland Vertisols of Ethiopia. PhD Dissertation Wageningen, The Netherlands.
Swift, J. and Ingram A. (1996). Desertification : narratives, winners and losers : In Mearns, M. Leach and R. Mearns (ed). The Life of the land: Challenging received wisdom on the African Environment. Oxford: James Currey
Tenaw G. (2007). Forestry as an Emergent Economic Strategy and Its Implication on Rural Livelihood, Land Uses and Ecology: A Case of Koga River Catchments Area, Mecha Wereda, and Western Gojjam Zone, MA Thesis Addis Ababa University Unpublished.
Turnbull, J. W. and Pryor, L. D (1978). Choice of Species Seed Sources In: Hills, W.E. and Brown, A.G. (Eds), Eucalyptus Wood Production. CSIRO, Adelaide, Australia pp. 6-66