

# Impact of Urban Expansion on Livelihood of Urban Fringe Agricultural Community: A Case of Ambo Town, Oromia, Ethiopia

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## Abstract

To investigate the spatio-temporal expansion of the town and its impact on the livelihood of urban fringe agricultural community, the study was made on land transformation analysis in between 1984 and 2015. The main objective of the study was to assess the impact of urban expansion on livelihood of urban fringe of Ambo town as a result of land use change in pre urban area of the town. The 1984 and 2011 administrative boundary maps of the town were used to analyze the extent of area expansion of the town. During this period the town was expanded from 1020.220 ha to 8421.75 ha indicating that the net expansion of the town over the study years was about 7351.1062 ha with about 237 ha increment yearly within 31 years. This boundary expansion of the town directly or indirectly affecting the livelihood of the urban fringe agricultural community of the town. Predominantly at the expense of croplands in the hinterlands, built-up area was increased from 307.44 ha (in 1984) to 913.05 (in 2015). Beside to this, the productive farmland of the urban fringe of the town was decreased from 6651.65 ha (in 1984) to 5625.75 ha in 2015. Land cover transformation analysis in between 1984 and 2000 the built-up area expansion was contributed by 451.6675 ha and 60.75 ha conversion of cropland and vegetation area respectively while cropland and vegetation area was negatively affected by 176.085 and 173.9703 ha respectively from its previous area coverage. A household survey was conducted on 146 households with different demographic composition through systematic and purposive sampling techniques. The data were collected from both primary and secondary data sources and analyzed using descriptive statistics and had arrived at conclusion that horizontal urban expansion has adverse impact on livelihood of urban fringe farming community. The analyzed information also indicates that the possession assets and hence annual income of dislocated farmers were declined due to declining their asset possession they had. The evidence from the sampled house hold shown that the majority (82.90%) of household heads' annual income was below 5000 ETB indicating that majority of the affected community's livelihood is not beyond subsistence way of life. This indicated that the intervention of governmental and non-governmental organizations should be needed to support the dislocated households financially and technically to make sustainable life and adaptive strategies with the change occurred.

**Keywords:** Ambo town • Change detection • GIS • LULC change • Livelihood • Remote sensing • Urban expansion • Urban fringe

## Introduction

### Background of the study

The presence of mankind on the earth and their modification of the landscape have had an intensive effect upon the natural environment. These anthropogenic influences on shifting patterns of land use are a primary component of many current natural resources concerns. The land cover change is gaining recognition as key drivers of natural resource change and can have unfavorable impacts and implications at local, regional and global scales [1].

The history of urban expansion indicates that urban areas are the most dynamic places on the earth's surface. Despite their regional importance, urban expansion has a considerable impact on mostly towards the urban-rural-fringe where there are less built-up areas and existences of different natural resources. The rapid population growth of the world in general, and in urban areas in particular, has resulted in uncontrolled haphazard growth in the fringes of urban areas without the knowledge and permission of both concerned towns' and bordering rural administrative institutions. This uncontrolled expansion which often appears in a dispersed manner along highways, or around developmental infrastructures such as universities and hospitals has pervasively been affecting the existing natural resources in the urban fringe [2].

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As it was indicated by Simmons, the major impact of urban expansion is the declining of natural resource and high consumption of productive agricultural land around urban fringes of the town. Urban fringe area where rural livelihoods are depending on and future directions of expansion. Taking more agricultural land use for urban land used mean that affecting and dislocating more people from their original place. The physical expansion and land cover change of urban on landscapes can be detected, measured, and analyzed using remote sensing and geographic information system. Operational analyze of urban expansion from multi-period satellite images which contain abundant information about earth surface will provide the comprehensive data to analyze the changes between different ground features [3].

In case of our country, some recent empirical research has shown the application of GIS and RS in urban expansion analysis using Land-sat satellite images. Study conducted in Gondar city with the application of satellite imageries with the application of GIS and RS indicates that the exerted impact of urban expansion on agricultural land is more significant than the other land use types and resulted from the intensified land use transformation due to urban land use encroachment especially that of new residential development in to the fringes of the city. This became socio economic problem because land is the most important economic base for the rural residents. But, as urban expansion consumes agricultural land use farm lands become smaller and smaller and farmers cannot produce enough to feed themselves and their families and provide for the market.

There was also another study which was conducted in bahir dar city shows that the integration of GIS and Remote Sensing and generate land cover maps. The result of the study shows that urban expansion exerted impact and influences it has becoming one of the major problems for environmental change and livelihood of farming community of the area. Identifying the complex interaction between changes and its drivers over spatio-temporal is important to predict future developments, set decision making mechanisms and construct alternative scenarios. In spite of its low urbanization rate compared to other African countries, the impact of urban expansion and land use land cover changes become a big challenge to our country [4].

### Statement of the problem

Urban expansion is an inevitable part of economic development and results changes in the large amount of agriculture parcels transformation cause the reduction of owners' farmland which is the backbone of developing country's economy. This very rapid expansion experience large rural-urban fringes, where the mixing of land use such as rural settlement, modern residential place, higher institutions, industries, urban based agriculture and service centers occur. Urban expansion and dislocation of farming community from their original place and acquiring their basic property mostly land is more significant in the developing countries than the developed one as the majority of the people in developing countries live highly depending on agriculture. Even planned urban expansion has its own impact on the land use/land cover changes as a driving force of livelihood changes.

Although Ambo town administration has put in place some benefit packages to compensate the affected community in line with the federal urban land governing policy and this by itself need an assessment to show the area of intervention in which the concerned bodies make some improvement.

Therefore, these gaps initiated the researcher to investigate in the area to dig out what the existing reality looks like [5].

## Materials and Methods

### Concept of urban expansion

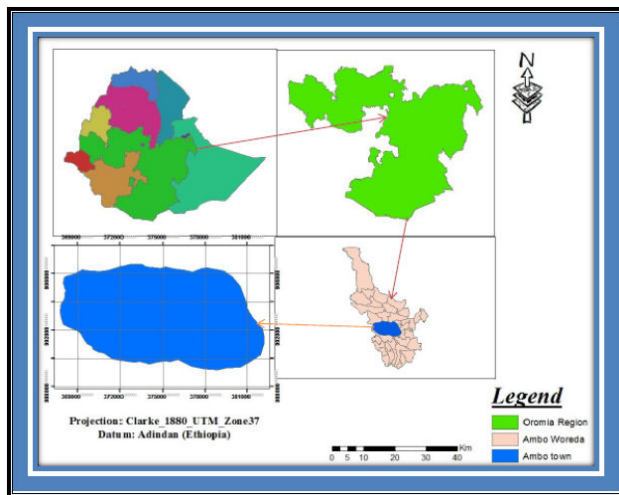
The development of urban expansion is linked to urban and suburban decline as economic activities move from inner city region to relatively open area development sites at the urban fringes. These open area sites frequently offer lower construction cost in the initial stages of development. The movement to new location is associated with population growth, advances in transportation technology, and policies governing housing and infrastructure and it is also the area where the human beings live in is the symbol of human civilization, and it is an important place for humans to do their social activities. Urbanization is a significant characteristic of humans' modern lives.

For a town, the level of urbanization can be used to estimate the level of development of economy, social, science and technology. Meanwhile, it is an important data to monitor the level of management and organization of a town. Many things in reality have dual characters, so does urbanization. On the one hand, urbanization means the advanced industry, convenient transportation, and prosperous metropolitan area and so on. On the other hand, in the process of urbanization, the undesirable effects could not be avoided, such as the damage and pollution of natural environment and consumption of productive farm land. Because one of the most significant characteristic of urban expansion is that the proportion of urban population to total population is increasing. One of the effects of expansion of population is the expansion of urban area, so the surrounding natural environment is destroyed, such as the deforestation [6].

### Causes of urban expansion

**Population growth:** Urban areas in developing countries and their inhabitants face the highest population growth and suffer, due to the lack of sufficient infrastructure and urban development control, most from the population growth.

The dynamics of urban expansion and the lack of leadership with regard to settlement development by the public sector impede the sustainable development of urban areas in the ever-growing towns in developing countries (Figure 1).



**Figure 1.** Location map of study area.

More than 50% of the earth's population now lives in urban areas. This percentage is projected to increase in the coming century and

Sensor	Resolution	Path and row	Sources/Website
Land-sat TM	30 m	169/054	USGS
Land-sat ETM+	30 m, pan15 m	169/054	USGS
Land-sat OLI	15 m	169/054	-

**Table 1.** Characteristics and sources of satellite data.

In reality, several socioeconomic and physical factors were considered to be potential drivers affecting urban expansion, such as topography, urban planning, infrastructure construction and so forth. The revised polycentric model includes labor market at multiple locations in the town, but still relies on the same theory that the demand for housing decreases as distance to the labor market increases. Because the existing urban form resilient to be changed, the new demand could only be met by a large amount of land conversions on urban fringe. A decay of transmission to built-up areas was hypothesized to appear extended from preexisting labor market in urban space, the old core town and nucleus in this case [8].

The 20<sup>th</sup> century is related to the phenomenon of rapid urban expansion. By 1900 13% of the world's population was urban. According to UN reports, the urban population increased from 220 million in 1900 to 732 million in 1950 (29% of the world's population). By 2007 50% of the world population was living in town further improvements in technology, medicine and prevention of disease allowed even larger urban densities. According to latest predictions, 4.9 billion people, or 60% of the world's population, are expected to be urban dwellers by 2030 and this investigation shows significant differences in urban population change between the more developed regions and the less developed ones. The majority of the inhabitants of the less developed regions still in line being urbanizing, but in the more developed regions the population is already highly urbanized. As urban expansion tends to rise and as development increases urban expansion is expected to rise as well in the future. However, despite their lower levels of urbanization, less developed regions have more than double the numbers of urban dwellers than the more

urban expansion is also expanding rapidly. Future towns will require increased amounts of natural resources, feasible methods to maintain the environment and a better understanding of the urban natural environment all to make them sustainable [7].

Many studies have investigated urban spatial structure using population density by using a gradient outward from urban center. Developed spatially-explicit land-use models to analyze the spatial organization of town as known as monocentric model. These theories simplify the town to a Central Business District (CBD) that acts as a job center, decentralized by trip distance to it along with decay of land price and population density. The unprecedented growth of urban population in Africa and in other developing world is causing an exceptionally rapid increase in the demand for urban land. The rising demand for urban land therefore tends to be met primarily by converting urban fringe agricultural land at the periphery of the existing built-up area. The town expands when high land value at the perimeter put simultaneous pressure on all landowners in the fringe to convert to urban use (Table 1).

developed (2.3 billion vs. 0.9 billion). By 1968, the urban population of the less developed regions surpassed for the first time that of the more developed regions and continues to do so thereafter. Furthermore, according to UN predictions, the rapid growth of the population of the less developed regions combined with the near stagnation of the population in the more developed regions implies that the gap in the number of urban dwellers between the two will continue to increase (UN) [9].

**Emerging satellite towns and infrastructure development:** A growing body of evidence shows that the rates and patterns of urban expansion even within developed country differ from each other. Some studies have shown that medium to large-sized towns in China have experienced core expansion and the rapid growth of satellite towns outside the core, as well as the development of transportation corridors extending outward from the city that have led to urban expansion to fringes of the town. Massive urban expansion was first observed in coastal regions as a result of rapidly increasing international trade, the influx of floating workers, tremendous infrastructure construction, reform to a market oriented economy, increasing foreign direct investment and newly established development parks. Similar reform policies were adopted in Western China in the late 1990's and early 2000's. With gradual transition to market oriented economy, vast infrastructure construction and newly built industrial parks may generate similar spatial restructuring in the region [10].

**Population migration:** Migration is defined as the long-term relocation of an individual, household or group to a new location outside the community of origin. In the recent time, the movement of people from rural to urban areas within the country (internal migration) is most significant. Although very insignificant comparing

the movement of people within the country; international migration is also increasing. International migration includes labour migration, refugees and undocumented migrants. Both internal and international migrations contribute to urban expansion. Internal migration is often explained in terms of either push factors conditions in the place of origin which are perceived by migrants as detrimental to their wellbeing or economic security, and pull factors the circumstances in new places that attract individuals to move there. Examples of push factors include high unemployment and

political persecution; examples of pull factors include job opportunities or better living facilities. Typically, a pull factor initiates migration that can be sustained by push and other factors that facilitate or make possible the change. For example, a farmer in rural area whose land has become unproductive because of drought (push factor) may decide to move to a nearby city where he perceives more job opportunities and possibilities for a better lifestyle (pull factor) (Table 2).

No.	Name of kebeles	Total households	Stratification of households	
			Households who not lost their properties (land)	Households who lost their property and took compensation (land)
1	Awaro qora	873	714	159
2	Senkele faris	751	681	70
	total	1624	1395	229

**Table 2.** Kebeles and Populations size of the study.

**Industrialization:** Establishment of new industries in countryside increases impervious surfaces rapidly. Industry requires providing housing facilities to its workers in a large area that generally becomes larger than the industry itself. The transition process from agricultural to industrial employment demands more urban housing. Single-storey, low-density industrial parks surrounded by large parking lots are one of the main reasons of sprawl. There is no reason why light industrial and commercial land-uses cannot grow up instead of out, by adding more storey's instead of more hectares. Perhaps, industrial sprawl has happened because land at the urban edge is cheaper [11].

**Impact of urban expansion on agricultural land:** The pressures of rapid urban expansion and a fast growing population have caused widespread land use patterns change and destruction of existing agricultural land in urban fringes area. The general characteristics of rapid urban expansion experienced by most sub-Saharan countries, such as Ghana are spreading uncontrolled changes in land and building uses and growth in urban population goes with no equivalent growth in land supply. Land is fixed in supply and does not increase with increasing population growth. The pressures exerted by increases in population and rapid urbanization deprive other sectors of the needed land. Agricultural lands are most affected by rapid urban expansion and its functions of demand. Land uses for residential, industry and commercial, civic and culture tend to dominate agricultural lands in the bid for space in the urban place. This dominance tends to deprive farmers of arable land to cultivate thereby reducing. In Ghana, over 60% of the populations are involved in agriculture as a major source of employment to the populace. Depriving the sector of land therefore brings an increase in the unemployment rate. In the urban areas, the cumulative effect of succession and dominance factors has made land increasingly scarce for urban fringe farmers. Rapid urban expansion has adversely affected development efforts in many cities. One of these is changes in land use subsequently leading to decreased agricultural land in favor of the provision of residential accommodation in most urban fringes settlements. The key challenge of the urbanization process is the rapid conversion of large amount of prime agricultural land to urban land uses (mostly

residential construction), in the urban periphery. The effect is the unavailability of prime agricultural lands. The consequence is low agricultural productivity, low standard of living and food insecurity. Urban expansion and the lively competition for land which may latter on result in changes in land use, ownership, property rights regime and land tenure. The competition for secure, serviced land as a result of rapid urban expansion increases the importance of urban land still further. Thus, urban fringe areas are the center of almost all new developments that range from urban expansion both formally and informally to the decline of agricultural land and rural employment opportunities [12].

### Impact of Urban expansion on livelihood

Concerning urban fringes livelihoods, have conducted a study in urban fringe of Nyahururu town, Kenya with the objective of assessing the impact of the urban fringes development dynamics to household income. Their finding showed a decline in economic significance of agriculture in these areas due to rapidly shrinking of agricultural land because of the effect of urban expansion. They have also indicated households have adopted diverse non-farm activities whose earnings proved to be of varying importance to the annual household income. Urban expansion refers to the demographic process of shifting the balance of national population from rural to urban areas. Rapid urban expansion, one of the greatest socio-economic changes during the last five decades or so, has caused the burgeoning of new kinds of slums, the growth of squatter and informal housing all around the rapidly expanding town of the developing world. According to the 2003 UN-Habitat global report on human settlements, urban populations have increased explosively in the past 50 years, and will continue to do so for at least the next 30 years as the number of people born in towns increase and as people continue to be displaced from rural areas that are almost at capacity. The rate of creation of formal-sector urban jobs is well below the expected growth rate of the urban labor force, so in all probability the majority of these new residents will make longer out an informal living. In developing countries people are migrating to urban centers. From the centre the poor move to the periphery for urban renewal or squatting. These areas need provision of infrastructure like road, power line, water pipes and drainage line. This requires high



development cost that draws on the financial capacity of the municipal government. In many cases the municipality cannot afford to provide and people remain deficient of basic means of life. Because of this most of the residents are exposed relatively to high cost of living. There is also limited work opportunity in the area. The challenge is perhaps more intense to the dislocated and evicted farming community since they lose their means of livelihood.

### Urban expansion in Ethiopia

**History of urban expansion in Ethiopia:** Like most African countries on Ethiopia large scale urbanization is a fairly a recent phenomenon. However, the history of towns developing in the country extends back to the Axumite Kingdoms of 14<sup>th</sup> c, when Axum, the first political and religious center in the north of the country, was established. Despite this long urban history however, Ethiopia remains one of the least urbanized countries in sub-Saharan Africa. Prior to 20<sup>th</sup> c, the establishment and growth of the Ethiopian cities are said to be in response to indigenous political, religious, economic as well military strategic, requirements. Despite its failure to build a well-organized and large size urban settlement, the constant shift of the location capital cities of the empire during this period had accounted for the establishment and growth of a number of towns, particularly in north Ethiopia. For instance Axum, Lalibela, and Gondar found in the 4<sup>th</sup> c, 11<sup>th</sup> c and 17<sup>th</sup> c, respectively

are some of the urban centers that served as capitals of nations. The factors that contribute to the growth of urbanization in Ethiopia include the establishment of central government, the introduction of modern means of transport and communication, schools, hospitals and modern business, Ethiopia's contact with the outside world and the establishment of large number of industries and organized farms as intensified process of urbanization in Ethiopia [13].

In Ethiopia, as in several other African countries, urbanization is occurring at a more rapid rate and the competition for land between agriculture and non-agriculture is becoming intense in the urban fringe areas. The growing demand of land for urbanization is primarily intended to be supplied by expropriation and reallocation of urban fringe land through lease contract. This shows that land acquisition and delivery for urban expansion and development purposes is completely state controlled on the rational that all land belongs to the state and peoples of Ethiopia. As urban territory extends into the urban fringe areas adjacent to the municipal boundaries, the existing land tenure relation is expected to cease compulsorily. Therefore, land issues in the urban fringe areas of Ethiopia in the process of urbanization involve at least three parties: 1) land provider or the government; 2) land acquirer which is generally a private or joint company and 3) land losers who are local urban fringe land holders or small farmers (Table 3).

No	Offices (kebeles) from the key informants were selected	Numbers	Responsibility	Method of selection
1	Office of Mayor	1	Head of the mayor	Purposive
2	Office of ULAME	2	Surveyor and valuator	Purposive
3	Elders	4	Elders and knowledgeable people	Purposive

**Table 3.** Selections of key informants from different sectors of the municipality.

### Causes of urban expansion in Ethiopia

**Population growth:** In Ethiopia, one can find hundreds of communities with 2,000 to 5,000 people. But in the majority of cases, these are just an extension of rural villages without urban administrative functions. Even, if in the last decades and very likely in the next ones, the urbanization rate will be faster in Ethiopia than in Africa. In 2030, the proportion of urban population in the country would be largely lower than in the Continent (35.3 versus 54.5 percent). Still in 2030, the rural population (83 millions) could almost double the urban one (45 millions). Urbanization accelerated between 1950 and 1965, when the average growth rate was between 5.4 and 5.6 percent a year, a rate, which implies a doubling of population in only 13 years. Again, urban population growth in the last fifteen years of the last century was very fast with rates over 5 per cent and a peak in the quinquennium 1985-1990, when the annual rate of change reached 5.93 percent (which implies a doubling time of only 12 years). The most rapid growth of the urban population is associated with the highest values of the difference between urban and rural rates and massive rural-to-urban migration up to 1975. Whereas, the 1975 land reform program provided incentives and opportunities for peasants and other potential migrants to stay in rural areas. Restrictions on travel, lack of employment, housing shortages, and social unrest in some towns

during the 1975-1980 period also contributed to a decline in rural to urban migration.

### Impact of urban expansion in Ethiopia

**Impact of urban expansion on farmland:** Farmland is one of the most productive natural resource and most of the livelihood of urban fringe agricultural community depends on it. The study conducted shown that, land use transformation in the urban fringes of Gondar city, mostly occurs from agricultural land to urban land use. This occurs due to the following main reasons: urban population growth mainly because of rural-urban migration, urban-urban migration, industrialization and an investment in housing construction like condominium in the urban fringes. Agriculture in fringes becomes inevitably influenced by urban penetration of encroachment which results the loss of farm land. This considerable loss affects the production and provision of agricultural production to the city and the surrounding the city. This study shows that there is considerable land use land cover change around Gondar city. Among these land use the impact exerted on agricultural land is much more than that of the other land uses. This resulted from the intensified land use transformation due to urban land use encroachment especially that of new residential development in to the fringes of the city. Regarding to the socio economic impacts exerted, it could be seen from two basic dimensions. The first one is the impact of urban expansion on

the agricultural land because land is the most important economic base for the rural residents. But, as urban expansion consumes agricultural land use and farm lands become smaller and smaller. Small farm lands cannot produce enough to feed themselves and their families and provide for the market. The other social problems are the displacement of the people to urban areas which in turn highly affects urban population living standards. Accordingly, decreasing in agricultural land holding and food production ranks at the top of the problem imposed on pre urban societies.

**Impact of urban expansion on livelihood:** Among his major findings, youth were found to be less engaged in agriculture and diversify more towards non-agriculture activities to earn income. In addition, poor households were found spreading their income source more to rice and non-farm income whereas higher income groups were found specializing on cash crop cultivation. However, depending on the academic background of researchers and area of interest variations were observed in the theoretical arguments of livelihood analysis. For instance, a social anthropologist used the cernea's impoverishment risk model and scudder and colson's possessual model to explain urban expansion-induced displacement and resettlement process. This methodology is more of qualitative description of development-induced displacement and resettlement programs. It also lacks setting objectively measurable indicators for post-displacement welfare situation evaluation of urban expansion-induced displaced households. Used the sustainable livelihoods framework to describe the urban expansion-induced displacement in the urban fringes area of Addis Abeba city [14].

### Urban expansion operation using geo-information techniques

Urban expansion is initially detected by gauging urban growth in many ways and one way of measuring urban expansion is by using remote sensing and GIS to detect patterns of the expansions. Clearly, there have been many ways to measure urban dynamics indicating that there are numerous avenues to reach a similar destination. Population growth can be a driving force behind urban sprawl. To this end, state that if population growth is substantial enough to produce the required consumer market, "big-box" commercial development often takes place seeking larger lots for stores, ample parking, easy access for multiple communities, and heavy commuting traffic, big-box developments locate on the outskirts rather than in the existing town commercial centers. Therefore, in order to understand urban expansion it is important to contemplate many different urban growth dynamics including population growth and land conversion practices (Figure 2).

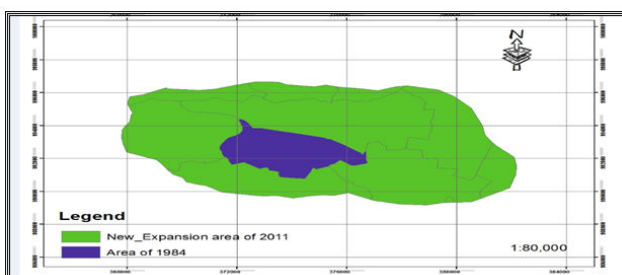


Figure 2. Clipped the two boundary map of the town.

The complexity of urban systems makes it difficult to adequately address their changes using a model based on a single approach

and therefore, it is ideal to use a tool such as a GIS as part of the study on urban expansion because of its capacity to handle many different types of spatial data. Allen also indicated that, in South Carolina, a GIS based integrated approach to modeling and prediction of urban expansion in terms of land use change was employed to meet the challenge of studying urban expansion and the researchers used satellite imagery incorporated into a GIS to map predictions of urban expansion in the study area. In East and West St. Paul, Winnipeg, Manitoba, Canada, most urban expansion was occurring on prime agricultural land. In that study, a GIS was used to predict future growth patterns and the impacts that such growth would have on agricultural land and used the data base analysis capabilities found in a GIS to analyze aerial photographs of the study area from 1960 and 1989 to determine impacts on agricultural land. For that study, land use derived from the aerial photographs in the GIS was placed in one of three main categories: Urban, agricultural, and other [15].

A GIS will not only allow for powerful visualization of urban expansion within the study area by providing maps, but it will also allow for an in depth analysis of the data by providing the capability to examine all of the data in one system, therefore facilitating the measurement of urban expansion. A GIS is also an extremely powerful tool for creating new data from existing data and is often referred to as a decision support system. In china, a GIS was used as a decision support system to test different development scenarios and land consumption parameters for use by planners and local government officials. Using the neighborhood function in the GIS was able to test development scenarios that would reduce the fragmentation of new growth, a component of urban expansion. In another study by the same authors, it was concluded that land-sat tm images coupled with an entropy integrated GIS was successful in measuring and monitoring urban expansion when the area is large and land use changes quickly employed a Shannon's entropy technique with the integration of remote sensing and GIS. Shannon's entropy is another landscape metric calculation technique whereby the authors measured urban expansion patterns statistically based on the spatial variation and temporal changes of expansion areas. The methods used to quantify urban expansion throughout the literature are dependent on the intended purpose and the individual aim of each piece of study. The objective of the study conducted on the washington-baltimore cmsa was to relate observed changes in land cover to economic and demographic drivers of that change. They used historic and present-day satellite imagery to measure land use change, but it was unclear how the researchers were going to link those changes to economic and demographic data. The purpose of the study was to quantify and map urban expansion thereby determining the geographic extent, pattern, and class of such growth over time (Figure 3).



Figure 3. Formal and informal land transaction in awaro kora kebele.

Satellite images, which are rapidly accessible and have been available for the past several years or so from the Land-sat satellite series and then from the spot series<sup>4</sup>, are used to monitor at regular intervals, annually or more frequently, the dynamics of urban expansion and land use transformation, particularly in countries which have very high rates of urbanization and maps and geographic databases, which rapidly become obsolete, can thus be updated.

There is a growing tendency to combine satellite remote sensing and GIS into a single system for analyzing geographic space and its dynamics although it seems difficult to find a single definition for the approach. The use of integrated approaches combining satellite remote sensing and GIS to monitor, analyze, geographically model and spatially represent urban expansion is combined with the dynamic representation of geographic processes is used in physical geography to model and represent changes in relief, or a natural resource. Prior to data analysis, initial processing on the raw data is usually carried out to correct for any distortion due to the characteristics of the imaging system and imaging conditions. Depending on user's requirement, some standard correction procedures may be carried out by the ground station operators before the data is delivered to the end user. These procedures include radiometric correction to correct for uneven sensor response over the whole image and geometric correction to correct for geometric correction due to earth's rotation and other imaging conditions such as oblique viewing. The image may also be transformed to conform to a specific map projection system. Remote sensed raw data, received from imaging sensor mounted on satellite platforms generally contain flaws and deficiencies. The correction of deficiencies and removal of flaws present in the data through some methods are termed as pre-processing methods.

Ambo town was established in 1889 and it is one of the oldest towns in Ethiopia. Ambo area is known for its different abundant natural resources and attractive scenery. Its perennial rivers including Ambo mineral water and construction minerals known as senkele lime stone are of crucial importance resources of the area including senkelle, Awaro and liban waterfalls. The name of Ambo town is originated from the natural hot spring called "Ambo tsebel" even today it is well known tourist spot attraction for the town. The name of the town was changed to hagere hiwot during the emperor hailesellase regime and back to its original name in 1974 when the derge came to power. Ambo town is among a few privileged towns of its time to have its own municipal administration since 1931, and a master plan since 1984. Over the past few years the population of Ambo town has been growing rapidly and 1997; Ambo had a total population of 54,560. Five years later, in 2001, it rose to 67,514 inhabitants. According to the municipality of the Town, the current total population of the town is about 83,756 and expected to reach more than 115,429 by 2019 including the population the expansion site. The mean annual temperature and rainfall of the town for over 30 years (1981-2010) are about 18.64°C and 968.7 mm respectively. The highest rainfall concentration occurs from June to September. The majority land surface area of the town has slope gradient less than 20 percent. In other words, the slope classification of the town is largely dominated by terrain with flat to undulating and steep slopes and the altitude of the town ranges from 1872 m to 2362 m above sea. The expansion of the town is in all direction and mostly towards two kebeles namely Senkele Faris and Awaro Qora in the Western and Eastern direction respectively following the main road of Addis

Ababa to western part of our country in both directions. geographically, ambo town is located approximately in between 08056'30" N up to 080 59'30"N latitude and 37047'30" E to 370 55'15" E longitudes. It is located in the western showa zone of the oromia regional state and administrative centre of the zone. relatively ambo town is located at 114 Km far away from the capital city of the country, addis ababa in western direction.

$$n = N / (1 + N(e^2))$$

Where, n=Designates the sample size the researcher was used

N=Designates the total number of households of the study area

e=Designates maximum variability or marginal error (5%) or 0.05

1=Designates the probability of the event occurring.

n=146; 102 and 44 households from A/Kora and S/Faris kebeles respectively.

After determining the sample size of the study, the main thing is to determine sampling techniques. To select samples from households in urban fringe of the town probability/systematic sampling technique was employed by giving equal chance of inclusion in the sample to the population. It was employed in which households of urban fringe in each kebele were first listed alphabetically and serial numbers was given for each households. To get the desired sample, the first unit was selected randomly from list of total households and the remaining units of the sample were selected at fixed intervals. Structured and semi structured household questionnaires and key informants and focus group discussion were selected to collect the necessary data from the selected households [16].

## Household questionnaire

Household questionnaire was designed to encompass a range of issues that could provide an insight into the socio-economic standing of the household, attitude on the urban expansion issue, what compensation package the municipality provide to them, awareness creation made at grass root level on the expansion program and what their livelihood looks like in general was incorporated. The questionnaires was translated in local language and pre tested and necessary amendment was made with selected 10 households (Figure 4).



Figure 4. Eucalyptus plantation for different purpose.

## Focus group discussion

Focus group discussions was carried out to supplement and confirm information that was generated from household and key informants' interview. This information also helps to substantiate image analysis results. Two FGD consisting about 23 participants selected from the municipality, kebele administration, kebele managers and knowledgeable households were participated in and the discussion was facilitated by the researcher using guideline that



were already prepared by the researcher and notes was taken by the help of assistant.

**Key informants:** Key informant interview was conducted with people from different offices with different responsibility, knowledge and experience about the expansion of the town and its impact on natural resource and post displacement livelihood of the dislocated farming community, level of community awareness and participation

in the decision making. These key informants were purposively selected from different offices and kebeles believing that they have deep and relevant information about the issues from their official responsibilities and continue involvement in the issues. Key informants were selected from different sectors of the municipality such as; Ambo town land administration and management office, office of the mayor and technical class (Table 4).

Gender	Migration status		Area of previous residence				Total		
	Non-migrant	%	Migrant	%	Urban	%		Rural	%
Male	17295	20.66	23220	27.72	10583	13	13637	16.28	40515
Female	20691	24.7	22550	26.92	11933	14.38	10229	12.21	43241
Total	37986	45.36	45770	54.64	21904	27.38	23866	28.49	83756

**Table 4.** Status and forms of population migration of Ambo town.

### Data analysis techniques

Data analysis for this study was started by geo-referencing the coordinate system for each GIS data layer thereby ensuring spatial consistency with demarked structure plan of the town. Geo-referencing entailed making sure that all spatial data layers used the same coordinates of the map projection. Therefore, all the data sets were projected to Clarke1880 utm zone 37 N and datum adindan (Ethiopia) to avoid image distortion and have the same geographic coordinate system. In developing land use of the study area, the georeferenced satellite images were used and the study site was delineated using the boundary map study area as Area of Interest (AOI). Ambo town administrative boundary map shapefile was superimposed on each full scene images and only those parts of the images that in the boundary of the shapefile was selected and extracted using for classification. The spatial extent covering the entire Ambo Town was then extracted from the images using spatial analyst tool. All gis shape files were clipped in ArcMap using the 2011 structure plan boundary of the town which was supplied by oromia urban planning institute to ensure that all files covered the same area and to avoid the area out of area of interest (study area). Also used as the principal Digital Image Processing software to classify the satellite images' of the study area independently (Figure 5).



**Figure 5.** Unplanned built up expansion somewhere in Awaro kebele.

After images classification independently, post-classification comparison approach was employed for the detection of land use/land cover changes, by comparing independently produced classified land use/land cover maps' of the study area dependently. The main

advantage of this method was its capability to provide descriptive information on the nature of changes that occur over the time and urban expansion evaluation was employed with supervised image classification. The validation of the generated data was made by kappa's coefficient, which is one of the most popular measures in addressing the difference between the actual and change agreement. The land cover change from what to what land use was also be calculated by the change matrix using erdas imagine 2013 software. The land covers change and change trend over the study years were also calculated. Much of the data collected was subject to descriptive statistics such as computation of percentages of single variables, the standard deviation and average outcomes. Lastly, both the generated spatio-temporal analysis and socio economic data were analyzed and presented using descriptive statistics such as percentage and table [17].

## Result and Discussion

### The spatio-temporal town expansion of Ambo in to urban fringe

In order to satisfy the ever-increasing demand of land for residential and other developmental purpose, it has become mandatory to expand the existing administrative boundary of the town by acquiring land and displacing urban fringe communities from their original residential place and holding plots. The two clipped administrative boundary map of the town indicates that, in 1984 the area of Ambo town was 1020.220 ha and in 2011 it become or expanded to 8371.3262 ha. This shows that assuming everything is constant, about 237 ha of rural land was converting to urban area yearly by declining different land parcels such as agricultural and forest land from the fringes which also identified by de curran and de sherbinin 2004, as natural resource at the urban fringe is converted to residential and industrial areas and weakens ecosystem services and landscape functions. Declining such productive agricultural land is one of the driving forces of land cover change and environmental degradation (Table 5).



Age categories	Frequency	Percent	Valid percent
15-29	11	7.5	7.7
30-49	67	45.9	47.2
50-64	41	28.1	28.9
greater than 65	23	15.8	16.2
Total	146	100	100

**Table 5.** Age categories of affected households.

This analysis period was negatively affected due to the expansion of the town. They were declined by 176.085 and 173.9703 Ha respectively from its previous area coverage. The increased net change land cover was only built up area which was quantified as about 384.5925 Ha over the first analysis period with about 24.04% of trend change in each year.

In between 2000 and 2015, the built-up area expansion was also contributed by 534.015 ha and 22.68 ha converting croplands and vegetation area indicating that the impact of urban expansion on natural resources specifically on productive agricultural land is more significant than the other natural resources identified by the researcher. In this analysis period built up shows the net gain about 510.772 ha when farmland faced about 1264.3885 ha net loss. The built up expansion trend of the town in this analysis period was about 58.04%. This means that the expansion of the town was higher than that of in the first analysis period by 34%. This means that the expansion of the town in the future more is challenging in that more productive farm land are converting into built up and many

households are exposed to socioeconomic problems. This is also triangulated by the household survey in which the majority of respondents (36.30%) approved the expansion of the town and its impact on consuming the productive farmland revealing that the built-up areas are expanding at the expense of farmland areas. The built up expansion indicates that informal land transactions and formal land allocations for built-up areas as the main reason for agricultural land conversion and challenging the livelihood of urban fringe farming community of urban fringe of the town by completely dislocation or reduction of their holding farm land size [18].

### Factors responsible for the expansion of the town

**Population growth:** The level of urbanization in Ethiopia is comparatively low on global scale and even by the African standard. Despite this low level of urbanization, Ethiopia has high rate of urban population growth both at national and regional level. The growth is without proportionate development in the socio-economic service and infrastructure, and the economic capacity of the urban centers to support the increasing population size (Table 6).

Respondent by gender	Frequency	Percent	Valid percent
M	88	60.3	60.3
F	58	39.7	39.7
Total	146	100	100

**Table 6.** Number of respondents by gender.

Ambo, the administrative centre of west showa zone, is one among the transitional town in Oromia Regional State both physically and demographically. The information from household heads and key informant interview indicated that one of the main responsible factors for the expansion of the town is population growth of the town. From the total sampled household heads, 72.6% of them are argued that the main factors for the expansion of the town is population growth followed by infrastructural development which is counted as 22.8% from the total sampled households. This information also strangulated with the population data of the town

and the data from the municipality indicates that the current total population of the town to be about 83,756 excluding the population of the expansion kebeles. The data from the municipality also shown that this increment of population was resulted from both natural increase and substantial migration as shown in table.

From the above table, what we understood is that migrants constituted about 54.64% of the total population of Ambo town indicating the fact that more than half of the residents of the town to be migrants from other areas of which about 27.72% are male. The data on area of previous residence of the number of most migrants from rural areas (28.49%) of which about 16.28% are male (Table 7).

Family size	N	Minimum	Maximum	Sum	Mean	Std. deviation
Total family size	146	2	17	878	6.0137	2.59704
Male	146	1	9	446	3.0548	1.62218
Female	146	1	8	435	2.9795	1.51984

**Table 7.** Respondent's by family numbers.

**Lease policy:** The other factor responsible for urban the expansion of the town is lease policy. It is obvious that the current urban land of Ethiopia was governing by lease policy. This lease policy has its own

contribution on urban expansion into urban fringe in such a way that the price of plot of land in the towns is determined by lease policy based on the zoning and stage of the each town. Accordingly, the lease regulation and directive of Oromia puts the initial lease prize of urban land based on stage of town and zoning. Based on the enacted lease regulation; No 155/2013 of the region under article 33(A-F) indicates the price/m<sup>2</sup> as listed.

From this table, what we understood was that the least or minimum lease price of Ambo town is 222.41 birr/m<sup>2</sup>. But currently the municipality was expropriating the urban fringe agricultural land by about 25.74birr/m<sup>2</sup>. This implies that there are high demands of land from urban fringe of the town and many urban residents and migrants make speculative purchases of land and encourage both unplanned settlement and planned urban expansion in the urban fringe of the town.

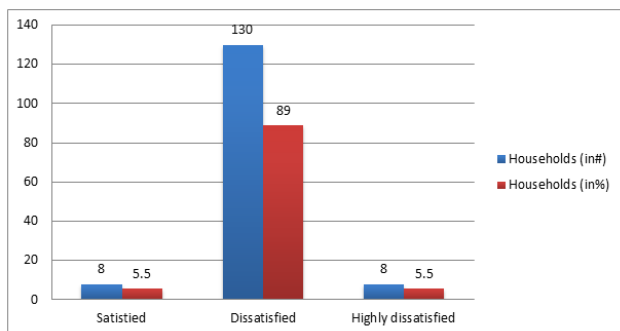
The unplanned settlement had significant impact than the planned one in urban expansion of the town. According to the administration of the town, out of the total housing units built in urban fringe of the town between 1997 and 2010 about, 75.76% of them are constructed without plan. The data from both household and key informant interview also indicates that unplanned settlement was much contributed by the emergences and development of squatter

Categorized respondent's family size	Frequency	Percent	Valid percent
45048	73	50	51.4
45205	59	40.4	41.5
42309	14	6.8	7
Total	146	100	100

**Table 8.** Respondents' by family size.

**Guarding:** One of job opportunity for the dislocated farming community is guarding. According to the surveyed data, a minor household heads engaged in this activity shows that the income is nothing rather than getting time spending place.

**Local alcohol making:** Women are also found to have increasingly involved in local alcohol making which locally commonly known as areki and tella. But the result of interview with women engaged in this activity indicated that the income is very much low which is not beyond subsistence consumption and tedious work that harm the health (Figure 6).



**Figure 6.** Percentages of household heads by level of satisfaction on benefit package.

settlement expansion and hence expansion to urban fringe of the town [19].

Different literatures indicates that “Job opportunity varies according to skills, (e.g., in trading, vehicle repair, brick making), education (e.g., for salaried jobs in business or in government) and by gender (e.g., male wage work in construction or mine vs. female opportunities in trading or textile factories)”. Some other literatures argued that, urban job opportunity that accommodates rural unskilled labor is limited in Africa. In this study, it was found that the employment opportunity of illiterate and inexperienced dislocated farming community is limited. This issue was considered in the feasibility study of dislocation of farmers and a package of rehabilitation program was proposed. Latter in the implementation phases the package program was failed to give proper care and the responsibility for searching job opportunity in the new mode of life has rested on the individual household heads. In this regard, it would be interesting to examine the common livelihood strategies pursued by the dislocated and land acquired households. Guarding, local alcohol making, fattening and dairying milk animals were the main livelihood strategies that were practiced by the dislocated farming community (Table 8).

**Dairying farm and animals fattening:** The other means of livelihood and income earning activity practiced in the study area is carrying milk animals since they used cut and carry system and industrial products for feed during winter and freely raring during summer. The surveyed data shows that most of the respondent household heads argued that still keeping in agricultural activities as a main source of their means of livelihood adjacent to others economic activities. In Livelihood Strategy, the dislocated household used both high birding and domestic species. This activity was mostly supported by Ambo university, college of Agriculture in which one of the most tasks of agricultural departments in the college is upgrading of animals genetic and adopt with local community. Accordingly, the university continues that duty strongly and currently distributing the most qualified genetics to the town dwellers and the hinterland farmers, as the result large number of households engaged in the activity to sustain their livelihood. However, according to key informants and household heads interview results, the sector has some problems like shortage of agricultural land because of the consumption of agricultural land by urban expansion program and lack of urban agricultural extension service (expert) at the town level [20].

## Conclusion

The study was conducted to investigate the impact of urban expansion livelihood of urban fringe of Ambo town. The result of this

study shows that there is considerable impact on farmland around the town. This resulted from the intensified land use transformation due to urban land use encroachment especially that of new residential development in to the fringes of the town.

According to the major findings of the study, which was obtained from the analysis of spatio-temporal study; the rate of built-up expansion was increased from 307.44 Ha in 1984 to 913.05 Ha in 2015 within 31 years. But the result from the affected community indicated that they are not satisfied with the compensation paid and they also argue that, they preferred replacing plot of land rather than compensated in cash. The household surveyed data also indicated that the municipality hasn't done any organized support to the affected farming community. The result of the assessment showed that the majority (83.80%) of the dislocated farmer household heads are within the working age categories of which the highest proportions (25.30%) are illiterate and the impact of urban expansion on these dislocated productive aged households has been significant. In other words about 15.8% of the total sampled household too aged (more than 64 years) and be difficult to survive under such conditions. Generally, the assessed information indicates that the possession assets and hence annual income of these dislocated and land acquired farmers were declined due to declining their asset possessed they had.

The evidence from the sampled house hold shows that the majority (82.90%) of household heads' annual income was below 5000 ETB evidencing that majority of the affected community's livelihood is not beyond subsistence way of life. In other words, most of the affected community practiced different survival strategies by themselves to survive with the change in the mode of life. The livelihood approach adopted by the dislocated and land acquired farming community in urban settlement is largely based on casual subsistence activity that heavily relied on agriculture.

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