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COLLEGE OF DEVELOPMENT STUDIES
CENTER FOR ENVIRONMENT AND DEVELOPMENT

The Influence of Urban Expansion on Physical Environment: the case of Debre Markos Town, Amhara Region, Ethiopia.

By

Tigezaw Lamesegen Addis

Advisor:

Engdawork Assefa (PhD)

A Thesis Presented to the School of Graduate Studies of Addis Ababa University in Partial Fulfillment of the Requirement for the Degree of Master of Arts (MA) in Development Studies (Environment and Development).

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DECLARATION

I **Tigezaw Lamesgen Addis** ,do hereby declare that this thesis is my original work and that it has not been submitted partially; or in full, by any other person for an award of a degree in any other university/institution.

Name of Participant: Tigezaw Lamesgen, **Signature**---------- **Date** 09/8/2014

This thesis has been submitted for examination with my approval as University supervisor.

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APPROVAL

The undersigned certify that they have read and hereby recommend to the Addis Ababa University to accept the thesis submitted by Tigezaw Lamesgen and entitled "The Influence of urban expansion on physical environment " in partial fulfillment of the requirements for the award of a Masters Degree in Environment and Development,

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ABSTRACT

Research title: The Influence of Urban Expansion on Physical Environment: the Case of Debre Markos Town, Amhara Region, Ethiopia.

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Addis Ababa University, 2014

The main objective of this study is to assess the impact of urban expansion on environment, the case of Debre Markos town. It investigated the trend of urban expansion, the causes and impacts of urban expansion and finally recommended some possible alternative solutions. The study employed various techniques of data collection and analysis. The required data were gathered through household survey, key informant interview, observation and document inspection. A total of 119 respondents were involved on the study by using probability (systematic sampling) and 11 government officials and experts by non probability sampling technique (purposive). Descriptive and narrative were used to analyze the necessary data. The finding of the study was presented by using table, figure, maps and photographs. The findings of the study showed that the trend of urban expansion increase through time and mostly forest and cultivated land have been changed into different urban development uses such as residential, industrial, and commercial and other various institutions. The major causes of this expansion in the town are population growth, lack of land information system (cadastres) , availability of different infrastructure and topography. This expansion exerted an adverse impact on environment mainly on cultivated land, forest, wetland, grassland, water bodies and other. Therefore, this study proposes that municipality and city administration of Debre Markos town together with the Amhara National Regional State should develop proper policies that would bring sustainable urban development.

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ACRONYMS

ANRS	Amahra National Regional State
BOWUD	Bureau of Works and Urban Development
BOIUD	Bureau of Industry and Urban Development
CSA	Central Statistical Agency
EGEPO	East Gojjam Environmental Protection Office
EGFEDO	East Gojjam Finance and Economis Office
EFAP	Ethiopian Forest Action Program
GIS	Geographic Information System
KII	Key Informant Interview
KM	Kilo Meter
UNEP	United Nation Environmental Program
UNCHS	United Nation Center for Human Settlement
UNESCAP	United Nation Economic and Social Commission for Asia and Pacific
UNPD	United Nation Population Division

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

The world has been rapidly urbanizing. The global population who lived in cities by 1957 was 30% and increased to 47% in 2000. It is projected that 60% of the global population will live in cities and towns by 2030 (UN-Population Division, 2002). Currently the world's urban population is estimating at 3 billion, of which 2 billion are living in developing cities. With regard to trends, it is estimated that 93% of urban growth will occur in developing nations with 80% of urban growth occurring in Asia and Africa. Particularly, currently African average level of urbanization is 34% while the Ethiopia's is 18% which is even very low in Africa. Different studies have projected that the proportion of urban population in Ethiopia will reach 23% by the year 2030 (Firew, 2010). Hence, the 21st century is likely to be dominating by cities and town that we have not experienced before.

In the developed countries of Europe and North America, urbanization has been a consequence of industrialization and has been associated with economic development. By contrast, in the developing countries of Latin America, Africa and Asia urbanization has occurred as a result of high natural urban population increase and massive rural-to-urban migration (Brinn and Williams 1983).

Population growth in large cities does not usually increase the population density of the inner city, but provokes densification of less populated areas and expansion the urban periphery area. Therefore, the population rapidly grows in the fringe area rather than the core of cities. The cities grow and expand in the urban periphery area and this bring unplanned expansion of cities in developing countries are expanding horizontally and the population is moving to unplanned settlements on the periphery at the expanse of agricultural lands and areas of natural forest (Lowton,1997; cited in Minuyelet, 2004).

The experience in most parts of the world shows that the process of development leads to urbanization. Thus, it will require that cities grow in size and use more land. This process which shifts population from rural to urban and rapid urbanization brings opportunities to new urban developments. But urban also comes with serious loss of arable land, as well as social and environmental change to the urban pages. Rapid urbanization creates enormous stress on the natural environment. The rapid urban development process taking

place in developing countries, leads to fast and radical changes in the physical, economical, social, political and administrative structures of the countries and cities, besides the rapid urbanization and the need of land for development urban areas to day have been expanding for a number of other reasons. Poor planning and poor plan implementation contributed for the present unreasonable land expansion. This leads to the present inefficient conversation of land in far outlying suburbs and natural resource destruction. In spite of the fact that town/cities have been attractive centers of human settlement and engines of economic development, the requirement of land for different urban functions is increasing from time to time. Today, the demand for land increases due to the higher growth of urban population and is expected to continue (UN- population division, 2007).

In Ethiopia land degradation in peri-urban area is a challenge as the pace of urbanization is fastest at standards of Sub Saharan Africa. Environmental degradation which is manifested in land and water resources as well as loss of ecosystem diversity is a major challenge that the country is facing in an endeavor to obtain sustainable development (Demel, 2001)

Rapid urbanization and extensive population increase have resulted in massive forest clearing, over grazing, use of forest for fuel wood, construction materials leads to land degradation in terms of soil erosion, low productivity and loss of biodiversity. The town and cities have been expanding at a higher rate than population growth. This results in high infrastructure cost, deforestation, and land degradation and in efficient service delivery. The deficiencies are not merely a rise from absolute resource constraints but also institutional arrangements and weak implementation of the plan Therefore, efficient land management is the foundation for sustainable urban development. Nevertheless, urban land use planning has been largely suffering from obviously institutional capacity constraints among municipalities. The challenges here is how to make cities/towns instruments of sustainable development, development that is economically viable, socially just, and environmentally sound (EFAP, 1993).

Debre Markos is not far from the existing reality of urban issues across the country. Therefore, it is essential to understand the specific characteristics of urban expansion which adversely affect its environment and infrastructure development that the researcher to explored.

1.2 Statement of the Problem

Ethiopia's urbanization rate is one of the fastest in Africa. The average annual rate of growth from1960-1991 was 4.8 percent and this figure grew to 5.8 percent per-annum from1991-2000. This rate of growth puts Ethiopia among the 23 rapidly urbanizing countries of the world. Rapid pass of urbanization is passing major challenge in front of cities in developing countries. One of the major challenges is urban expansion which is an inevitable outcome of urbanization process (Firew, 2010). According to environmental change and security program report (2004), urbanization is not yet a major problem in Ethiopia. However, the rate of population growth in urban areas is high, the country currently witnessing one of the fastest rates of urban growth in the world, namely an average close to 5% per annum. It is stated that urban expansion occurs at the expense of productive agricultural land and the destruction of forests. If the current pace of industrialization continuous, the environmental damage and impact on agricultural production will be severe.

Many of Ethiopian cities/towns have experienced rapid horizontal expansion; but which was not properly controlled by appropriate planning intervention, weak implementation capacity, weak institutional capacity as well as lack of good governance in cities/towns. As such uncontrolled rapid horizontal expansion of cities/towns towards the agricultural communities resulted in additional social, economical, environmental and political problems (Firew, 2010).

Debre Markos today has faced a problem in relation to natural resource and the environment which are caused by urban expansion. Among others, the conversion of farmland and forest area in to different urban land uses, such as residential, commercial land and other activities are the main ones. With regard to the settlement pattern of the town, it has more of a linear settlement form. The neighborhoods are grouped and jumping large plots of land.

Because of the present physical expansion of the town, various types of vegetation are being endangered. Currently, agricultural lands, wetlands, grasslands are converted into urban land uses. Deforestation has also been taking place at alarming rate due to residential and other alternative investment uses. From 1998 up to 2008 above 2000 hectare of agricultural land converted to urban uses. At the periphery of the town, mining

(such as stone excavation) for construction purposes has also been taking and exerting various adverse impacts on the environment (Grima, 2009).

The recent population growth and the dynamically changing economic activities resulted in reduce natural resource stocks at the periphery of the town. In addition, lack of different infrastructure like water, electricity, road, drainage, sewerage, health center and other services in the expanded area are other problems of the urban sprawl.

In light of the above discussion this study intends to investigate the major impacts of urban expansion on the environment the town of Debre Markos.

1.3 Objectives of the Study

1.3.1 General Objective of the Study

The major objective of the study is to assess the impacts of urban expansion on environment, the case of Debre Markos town, Amhara Regional State, Ethiopia.

1.3.2 Specific Objectives of the Study

Having the above general objective, the research was undertaken with the aim of achieving the following specific objectives

- To examine the trend of urban expansion of Deberemarekos town.
- To identify the major causes that contributed to rapid urban expansion of the town
- To assess the impacts of urban expansion on environment (mainly on cultivated land, wetland, forest land and land degradation).

1.4 Research Questions

- Is there urban expansion in Debre Markos town?
- What are the major causes that contributed to urban expansion in the town?
- What are the impacts of urban expansion on environment (cultivated, grass land, wetland and forest land)?

1.5 Significance of the Study

The study will help to identify the trends of urban expansion and thereby giving empirical data that will help the future activities of the planning of local governments, It is also an important base document (benchmark) for further studies to be undertaken in analyzing the impact of urban expansion on environment. In addition, the finding of the

study will contribute to the city administration to indentify the economical, social, environmental consequence of urban expansion. Last but not least, this study provides an important academic ground for the partial fulfillment of the requirement for the award of a master degree in environment and development in Addis Ababa University.

1.6 Scope of the Study

It is difficult to organize, due to its wideness and various elements included in the environment and broad agenda to investigate all these aspects and problems related to it. To this end and to make the study more specific, it was delimited to more of the impact of urban expansion on cultivated, grass, wet land and forest land. It also emphasized on the causes and trends of urban expansion in the town. To gather manageable and reliable data, the researcher confined the study to the municipal boundary of Debre markos town particularly by focusing on three 'kebeles', 03, kebele 04 and kebele 07 of the town, since to fast urban expansion has been taken place in these kebeles.

1.7 Limitation of the Study

Lack of necessary/ pertinent data and documents in the Municipality was an obstacle. Moreover, bureaucratic procedures to get information from officials and over busy of officials by continuous meeting were also a problem to get information timely. In addition to the above obstacles, answering and returning the questionnaire by the residents were also a problem. However, despite these limitations, the researcher put major efforts and strategy to overcome the challenges and finally succeeded to get the information from the residents and officials

1.8 Operational Definition of Terms

Urban: in this study context, urban (as opposite to rural) refers to areas characterized by denser population settlement per-unit of land, higher heterogeneity of in habitants (in terms of ethnic background, religious adhere-ship, livelihood strategies and sources, and educational levels greater organizational complexities as well as higher formal social control (Firew ,2010). Using the Ethiopian Central Statistical Agency's 2007, definition of urban, which includes towns, has 2,000 and more population and 50% of the population working in non agricultural activities.

Urban Expansion: is the process of urban spatial expansion that results mainly two powerful forces such as growing population and rising income. In this study, it is the physical enlargement of the town due to the increases in number of population residing in the town, in search of land for residential, commercial and other purposes. Urban sprawl is the physical pattern of low-density expansion of large urban areas in to the surrounding agricultural areas. Sprawl lies in advance of the principal of urban growth and implies little planning control of land subdivision (Sonor, 2008).

Peripheral areas: in this study context are areas between densely settlement (urban areas) and less densely settlement (rural areas). These are areas partly sharing the characteristics of both urban areas and rural areas and it comprises the area surrounding the city in the process of being urbanized. Proximity to urban areas and lack of urban attributes, such as urban infrastructures (Dejene, 2011).

Deforestation: Deforestation is the less or continual degradation of forest land that is permanently converted from forest to agriculture, cattle raring and urbanization deforestation is defined as the act of cutting down or burning in an area (Joseph, 2006). In this research deforestation means the exploitation of trees of different kind.

Land Use is the term that is used to describe human uses of the land, or immediate actions modifying or converting land. It includes such broad categories as human settlements, protected areas and agriculture.

Land Cover refers to the natural vegetative cover types that characterize a particular area. These are generally a reflection of the local climate and landforms, though they can be altered by human actions.

Built up area is an area of which have a cover of buildings and network of transport, and other civic amenities of the study area. It is showing incremental change from year to year over the natural environments.

1.9. Organization of the Thesis

The thesis has five chapters. The first chapter is an introduction part. The second chapter was about review of related literature of different books, documents and internet websites. The third chapter is about research methodology; the forth chapter deals with result and discussion. In chapter five conclusions of major findings and recommendation of the study also had been suggested.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2.1 Concepts of Urban Expansion /Sprawl/

Urban expansion/ Sprawl are unplanned, unwanted spreading of urban development in to areas adjoining the edges of a city. Urban sprawl is the physical pattern of low-density expansion of large urban areas under in to the surrounding agricultural areas. Sprawl lies in advances of the principal of urban growth and implies little planning control of land subdivision. Development is putting, scattered and strong out, with a tendency to discontinuity because it leaps flows over some areas, leaving agricultural enclaves. Urban expansion is a dynamic entity, subject to various types of forces, such as physical, social and economical. These forces are mainly responsible for rapid pass of urbanization of human settlement. It is a continuous process which is not mainly associated of industrialization but a associated of all factors underlying the process of economic growth and social change. Rapid pass of urbanization is passing major opportunities' and challenge in front of cities in developing countries .One of the major challenge is urban expansion which is an inevitable outcome of urbanization process (Sonor, 2008).

As the urbanization rate is increasing rapidly, urban centers horizontally expand and consume more land. Since demographic pressure exerted on natural resource base has exceeded its carrying capacity, it is quitc natural to call it as one of the most formidable challenge for attainment of sustainable development (Tersa, 1990).

2.2 Types of Urban Expansion

Cities keep on growing because of its population growth as a place to live in and work, and as a centre of trade, culture, education and technological innovation. Despite this, there is no consensus regarding the shape and size of a growing city. Two major arguments are forwarded as to the shape and size of cities. Urban expansion occurs substantially in different forms across countries and even within countries themselves. In any given city, new urban expansion can take place with the same densities (persons per square kilometer) as those prevailing in existing built-up areas, or with increased densities, or with reduced densities ((Foeken and Mwangi 1998, and Adell, 1999)).

It can also take place through the redevelopment of built-up areas at higher densities, through infill of the remaining open spaces in already built-up areas, or through new "Greenfield" development in areas previously in non-urban use. New Greenfield development can either be contiguous with existing built-up areas or can "leapfrog" away

from them, leaving swaths of undeveloped land that separate it from existing built-up areas. It can encroach upon wetlands, watersheds, forests, and other sensitive environments that need to be protected, as well as upon farms, fields, and orchards surrounding the city. And it can thus reduce, maintain or increase open space in and around the city (Foeken and Mwangi 1998, Adell, 1999). The first argument states that compact cities are important features of sustainable urban development in the future. The compact city has dominated many historic European cities and the European Community was the strongest advocate. A compacting city entails higher density development and helps reduce demand for space and travel distance. Urban residents enjoy lower transport expense and power costs. It also reduces potential farmland encroachment by urban uses and makes most effective use of urban land (Jenks, Burton and Williams 1996; Hillman, 1996). The second argument rejects the compact city and argues that compact city is unsustainable and unacceptable since the benefits obtained from compaction do not overweigh the losses to the social, economic and natural environment. As the study of urban compaction in Australia explained, loss of urban consolidation is higher than losses from extended urban settlement to the periphery (Stretton 1996, cited in Adem, 2010).

Accordingly the solutions lie in reforming transport system rather than imposing compaction to the cities. There are others who favor neither compaction nor expansion of cities rather advocating for elements from both views. This argument promotes urban regeneration strategies and new intra-urban environmental initiatives in line with the compact city argument and favors controlled direction of inevitable expansion to the periphery to support a full range of facilities and to the sites that cause the least environmental damage as for the compaction view of urban expansion. Compact city development strategy has more recognition and is recently accepted for social and economic utilization of resources although developing countries rarely exercise compaction. Urban Expansion is mostly uncontrolled that one often sees overcrowding (slum and shanties) and extended unplanned settlement with acute shortage of infrastructure in one part and unutilized or partially developed vacant land on the other par t(Feyera, 2005).

2.3. Trends of Urban Expansion

2.3.1. Urban Expansion /Sprawl/ in the World

The basic dimensions of the policy debate on the expansion of cities are certainly not new. The debate is weather expansion should be registered, accepted, or welcomed and at one extreme, there have been those who thought to limit the growth of cities by any means. The other, there were those who welcomed it and actively prepared cities for a absorbing the oncoming waves of new migrants (Angel, 2005).

Urban sprawl or expansion has recently become a subject of popular debate and policy initiatives from governmental bodies .however; little has been done on solving such issues. The space taken up by urban localities is increasingly faster than the urban population itself. Between 2000 and 2030, the world urban population is expected to increase by 72%, while the built up areas of cities of 100,000 people or more could increase by 175%. Land area occupied by cities is not in itself large, considering that it contains half the world population. Recent estimates showed that all urban sites, including green as well as built-up areas cover only 2.8% of the earth's land area. However, most urban sites are critical parcels of land. Their increased rate of expansion and where and how additional land is incorporated in to the urban make up has significant social and environmental implications for the future populations. The process of development, the report state that, from what it was 30% in 1950s, urban population will be 70% by 2050, globally (http://www.unfpd.org/swp/2007/english/chapter4).

Therefore, the global urban expansion rate is estimated at 20,000km^2/year. Most of these introduces on agricultural land. It is assumed for that 80% of urban expansion occurs an agricultural land, 10% into forests, and 10% into woodland /grassland. Other conversion to and from urban areas were considered negligible at the global level .As transportation continuous to improve, the tendency is for cities to use up more and more land per person. The built up area of cities population of 100,000 or more presently occupy about 400,000km^2, half of it in the developing world (Angel, 2005).

2.3.2. Urban Expansion in Developing Countries

In developing country the growth of cities is dynamic, diverse, disordered, and increasingly space extensive. Pre-urban areas often lack clear regulations and administrative authority over land use. They suffer some of the worst consequences of

urban growth, including population, rapid social change, poverty, land use changes and degradation of natural resources. In East Asia, foreign investments have transformed rural economic and communities often triggering major changes in social structure and human environment relation. The population in developing-country cities is expected to double in the next thirty years: from some 2 billion in 2000 to almost 4 billion in 2030. According cities with populations in excess of 100,000 contained 1.7 billion people in 2000 and their total built-up area –at average densities of some 8,000 persons per square kilometer2–was of the order of 200,000 square kilometers at that time. If average densities continue to decline at the annual rate of 1.7%–as they have during the past decade the built-up area of developing-country cities will increase to more than 600,000 square kilometers by 2030. In other words, by 2030 these cities can be expected to triple their land area, with every new resident converting, on average, some 160 square meters of non-urban to urban land during the coming years (Buckley,2005).

In Africa unbalanced urban growth observed today. One of the challenges for thus unbalanced urban growth lack of clear guidelines for urban planning and the over whelming responsibility. Therefore, most African governments arrogate themselves in playing leading roles in coordinating both urban and rural development at both national and local level. This appears to contribute significantly to the lack of sustainable development planning and management in Africa. Most urban areas in Africa have experienced urban growth and development worth out corresponding growth and development of the water infrastructure and resource. The quality of water supplied has not always met the standards and has resulted in the spread of decreases in a wide range of Africa, including Kenya and Nigeria to mention some (Mosha, 1994).

With regard to trends, it is estimated that 93% of urban growth will occur in developing nations with 80% of urban growth occurring in Asia and Africa. Particularly, currently African average level of urbanization is 34% while the Ethiopia's is 18% which is even very low in Africa. Different studies have projected that the proportion of urban population in Ethiopia will reach 23% by the year 2030. On the other hand, Ethiopia's urbanization rate is one of the highest in Africa. The average annual rate of growth from1960-1991 was 4.8 percent and this figure grew to 5.8 percent per-annum from1991-2000. This rate of growth puts Ethiopia among the 23 rapidly urbanizing countries of the world (Firew, 2010)

2.3.3 Urban Expansion in Ethiopia

According to environmental change and security program report (2004), urbanization is not yet a major problem in Ethiopia. However, the rate of population growth in urban areas is high, the country currently witnessing one of the fastest rates of urban growth in the world, namely an average 5% per annum. It is stated that urban expansion occurs at the expense of productive agricultural land and the destruction of forests. If the current pace of industrialization continuous, the environmental damage and impact on agricultural production will be severe. In addition, infrastructure provision for urban expansion area is almost non-existent in the country services such as piped water, sanitation; sewerage, road etc. are not adequately available. Generally there is a mismatch between government capacity and the needs of the community with regard to infrastructure provision in pre-urban areas than in the core cities.

2.4 Causes of Urban Expansion

The major causes of urban expansion or sprawl are a response of different sets of economic, social and political forces to the physical geography of an area. The forces or factors include population growth, migration, increasing housing income, fragmented municipal governments, and patterns of infrastructure investments, and the construction of roads. Economic growth is an ultimate goal for every government to achieve in order to improve standard of living and increase the capacity of providing goods and services to satisfy human needs and further states that little attention has therefore been paid to the environment. In the 1970s, people argued that economic growth put too much pressure on the consumption of renewable and non-renewable natural resources and was directly causing environmental depletion (Langston and Ding, 2001).

2.4.1 Causes of Urban Expansion in Developed and Developing Countries

In industrialized countries the causes of urban expansion is different from developing countries. In industrialized countries, where rural-urban migration is now minimal and where most population movement are now inter-urban. Urban expansion taking place worldwide, for example, for the rich countries urban expansion takes place because of evolving from transportation choices car culture. Unlike the developed world, in the developing country, the driving force for urban expansion and fast growth of cities is because of population dynamics and rural to urban migration. For example in Kampala,

Uganda the population dynamics manifested in urban population growth and rural urban migration are by far the most significant driving force of urban expansion (Angel, 2005).

The expansion trend of Ethiopia is similar to developing countries expansion trend. The causes are rapid population growth of urban residents and in-migration due to pulling factors like employment opportunity, provision of social infrastructure, transportation facility aggravate the expansion of Ethiopian urban centers (NUPI,1998).

2.5 Impacts of Urban Expansion

Thorns (2002) identified the following environmental impacts of urban expansion. There are loss of environmentally fragile lands, reduced open space, greater air pollution, high-energy consumption, decreased aesthetic appeal of landscape and reduced diversity of spaces .urban sprawl also increase run off storm water, increased risk of flooding, excessive removal of vegetation, mountainous land regularly in appropriate residential visual environment, absence of mountain views, presence of ecologically wasteful golf course ecosystem fragmentation. It sees from a service and from environmental prospectively. The social impacts include loss of community values, overcrowded schools, higher costs of providing infrastructure and adverse fiscal impact on local governments reduced workers productivity.

According to Berke (2006), the urban expansion and associated activities degrade environmental resource, such as surface water and growth wave, air quality and landscape aesthetic and destroy wild life habitats. These are the effects of urban expansion. The negative effects of urban expansion are most clearly evidenced by increased demand for land to accommodate each new increment of population growth.

Rapid urbanization process is demanding a transformation of land use in surrounding rural area to cater the needs of urban areas. Land is the primary asset that can be affected by intense pressures of land conversion process in peri-urban areas. Changes in land use from rural to urban activities affects the physical form of environment as well as economic and social features of peri-urban interface. The agricultural land is an important source of new land for industry and service sectors. In most cases, particularly in developing countries, some negative consequences that come with land conversion and displacement is not critically considered. Yet, it can have adverse effects on displaced

households in terms of livelihood disruption, and social and cultural consequences (DFID, 1999).

Administration body of developing countries cities expropriates peasant agricultural land by appropriation of minimum compensation. The compensation given for land and removed asset is not valued based up on the market value. That means in most developing countries, the compensation given is valued based on the legal price called 'state price' in that the price is fixed by the government body which resulted very low compensation (Phuong, 2009). On the other hand, the money received as compensation spends quickly on unplanned expenditure and unproductive goods such as consumer able goods (Fayera, 2005). Moreover, lack of education and skill training prohibit them to obtain non- agricultural jobs especially middle age and older people. In sum, loss of land is equivalent to loss of livelihood. Basically, poor people living in peri-urban interface develop multi-stranded, risk reducing livelihood Portfolio that enables them to cope with the changes within interface. However, factors such as lack of education, skills and means to access credit facilities to start new income generating activities limit the poor in peri-urban interface. Therefore, the poor usually engage in low paid casual employment, petty trading and other low return activities.

Research finding on peri-urban Nyhururu, Kenya indicated that agriculture is still one of the predominant economic sectors in the area although its economic significance is declining. According to this finding, the reason for declining economic importance of agriculture sector is due to (1) reduction of agricultural land holding size (2) low returns from investments in agriculture mainly due to declining per unit area and high cost of agricultural input coupled with low market prices for the output. In this area due to sale of part of the household land to new developers and land bequests, land available for agriculture has declined rapidly (Mandere, 2010).

Due to the decline in economic conditions of agriculture, farming community are not solely based their livelihood on subsistence agriculture. Hence, many farm families have sought alternative pathway of farm development. One alternative pathway is diversification of agricultural production such as adopting new types of crops/ livestock and increasing focus on quality products in response to market demand as survival strategy short food supply chain. In addition, farmers have shifted from traditional extensive agriculture towards more intensive agricultural farm practice (Mandere, 2010). However, majority of farmers on area lack sufficient land and resources to purchase all

the production input necessary in order to effectively exploit the possibilities offered by the proximity to urban markets. In most cases, the process of land conversion plays a key role in transfer of resources (land and financial) from poorer farmer to the richer groups such as larger farmer, developer, speculator, and other people (DFDI, 2009). Hence, urbanization disproportionately affects the livelihood of poor people by diminishing the natural resources available to them. The rapid conversion of land for non-agricultural purpose is threatening the dominant agricultural activities that are the main source of livelihood for people who reside in the peri-urban areas (Ampong , 2005).

However, planned and sustainable peri-urban development comes up with various opportunities which enhance to reduce poverty. Due to expansion of the business and market centers, infrastructure such as electricity, roads, telephone services, new schools and health centers are easily access by local people. These all created new employment opportunities and thereby increase immigration to the city. Particularly, road is the main factors that increase the probability for peri-urban community to engage in business and thereby increase the possibility to increase their income. However, the socio-economic opportunities available on peri-urban areas are determined and depend on the level the type of developers involved and their initiatives. Hence, the processes of peri-urban development that accomplish a reduction in poverty for household in turn depend on the level of infrastructure and availability of high productive jobs opportunity. This in turn depends on the government policy and private developers who will be attracted to the region (Mandere , 2010).

2.5.1 Impacts of Urban Expansion on Forest

The most obvious direct effects of urbanization and the human activities on forest are the reduction of total forest area and fragmentation Rate of forest loss are fastest near major urban center, along major transportation route and near recreational areas such as national park. The unplanned expansion of a scattered settlements and having large plot size and development of in compatible services are endangering and destroying important natural resources especially forest resources. Similarly horizontal expansion and leap frog development of urban areas has been endangering and destroying natural resources (Boyee and Martin, 1993).

Urban expansion has also been detrimental to the land in and around cities. Conversion of open space and agricultural lands to concentrated urban development decrease water permeable areas. Upsets natural drainage patterns and has caused serious flood problems

in a many of a regions cities. Sao Paulo is a dramatic example of this uncontrolled conversion of open space resulting in extensive flooding and air pollution problems. Currently, urban spread over the land occurs faster than urban population (Samiti, 1996).

By rapid urban expansion increment destructive exploitation of forest has caused serious economic, social and environmental losses having local, national and global implication. Due to rapid urbanization, primary forests in various part of the world currently estimate 17 million to 20 million hectare of forest are being lost every year in developing countries (Allin, 2002).

UNEP (1995) indicated that, Africa has the highest rate of population growth among developing regions and the greatest reliance on fuel woods an energy source. Like other developing countries the urban people of Ethiopia depend mainly on biomass for energy. Fuel wood accounts for more than 75% of the energy used in countries such as Nepal, Bangladesh, Ethiopia, Burkina-Faso, cooking consumes most of this energy which is supplied by bio mass fuels (fuel wood, cow dung) that are collected freely from local environment. The dependence of large segment of people on bio mass for energy sources has contributed to the degradation of vegetation of different developing countries like Ethiopia. This serious forest loss increased induce course and creates great problems in forest degradation.

2.5.2 Environmental Consequence of Urban Expansion

Urban areas play vital roles in socio-economic development of local, region and national governments. Productive and healthy urban centers are essential to ensure their development potential, and the wellbeing of citizens. Environmental planning contributes to productive and healthy human settlement through identification of priority environmental issues, formulation of issue-specific strategies and projects. The various socio-economic activities that take place in urban areas affect the environment by way of resource depletion and environmental pollution. The bulk of solid and liquid wastes generated from different sectors can be major causes of water, air and land pollution if not managed properly. Pollution of the environment leads to impairment of human health, economic and other welfare losses and damage to the urban ecosystem. Conservation of open green spaces to urban development reduces pervious areas. Upsets natural drainage patterns and causes serious flooding with subsequent damage to dwelling and infrastructure and sometimes involving even human casualties (Zipper, 2002).

As a result rapid uncontrolled expansion of urban centers of cities of developing country: environmental degradation and pollution has become one of the most and the main characteristics of cities towns of developing countries. The main characteristics of the environmental degradations and pollutions, related to agricultural land loss, is pollution of water body such as the rivers and groundwater, air pollution in rural area the pollution resulting from solid waste etc (Sharma, 1992).

Solid wastes generated from the city have greatly affected the agricultural land where the internal road has become open dumping areas, in those peri-urban areas. The behaviors of the farmers have changed and huge amount of non-degradable materials are recorded in village especial plastics in addition to hazard solid waste. This rapid and uncontrolled expansion of urban centers toward the neighboring agricultural land has the negative consequences to the agricultural lands as the solid waste disposed and dumped in the agricultural land, the agricultural land production would decline. The volume of solid waste generated in urban areas in increasing with the growing population in cities and towns, higher consumption level land and the use of more packaging in the retail industrial. Rates of waste generation are out stripping the capacities of local authorities and municipalities to collect and dispose of this solid waste. For example, across only 31% of the solid waste in cities and towns are collected dumped and disposed in the nearby place and to the surrounding agricultural lands (UNCHS, 2002).

2.6 Impacts of Urban Expansion in Ethiopia

According to NUPI (1996), the rapid population growth of cities and towns in Ethiopia creates a huge demand and pressure on urban land use, there is a need of urban land for manufacturing, commence, service, residential, recreation and other activities. The urban land demand is not satisfied mainly due to the problems and constraints in the land allocation system. The cumulative impact of urban expansion in Ethiopia includes, uneconomic use of land, unnecessary conflict of boundary (dispute) between adjacent land owners, illegal land holding of public green buffer zones, and other un occupied plot and left over spaces by individuals and in some cases and organizations.

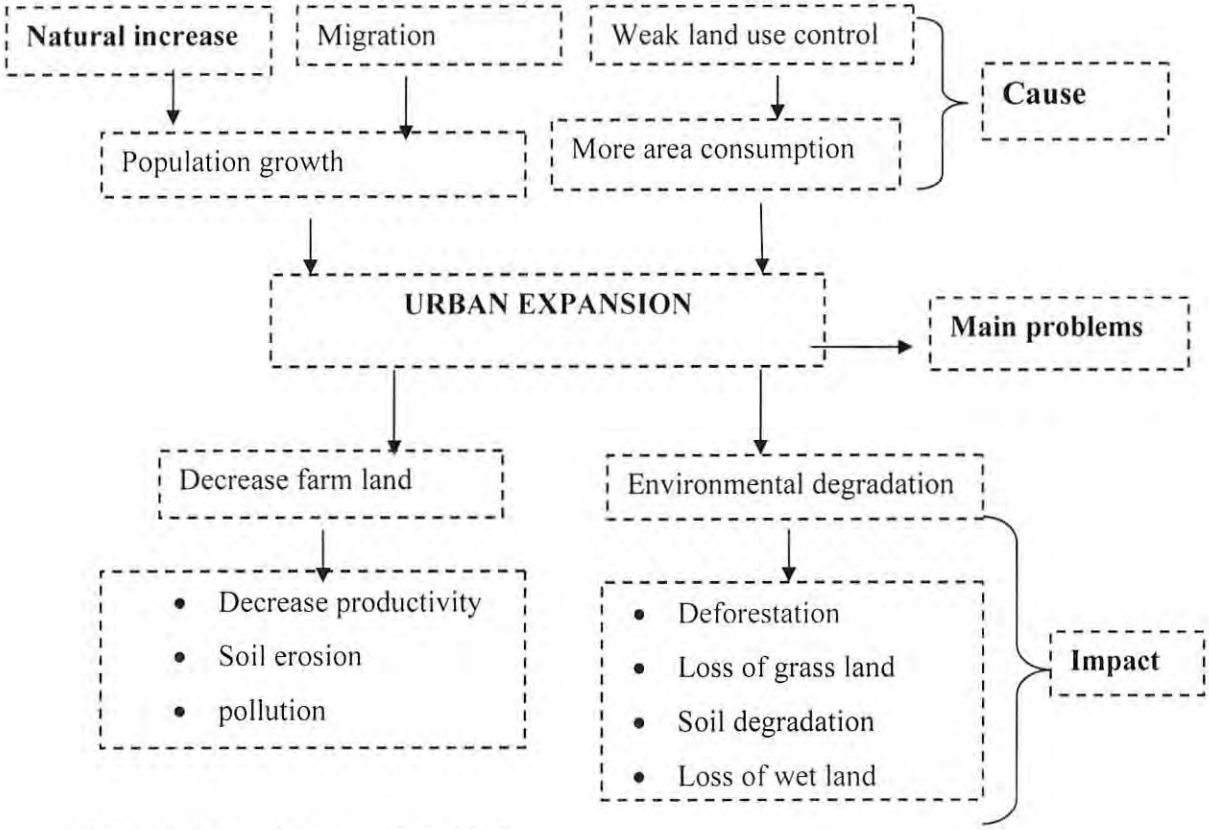
Urbanization and urban growth are considered as a modern way of life and centers of varieties of human opportunities which all can highly contribute to socio-economic growth and development. However, as Tegegne (1999) argues, horizontal expansion of urban areas in Ethiopia causes a number of socio-economic problems including tenure

right violation. Urban expansion in Ethiopia impedes the livelihood elements and strategies of peri-urban communities and hence leads them in to vulnerability shocks. While well planned and managed urban expansion may enhances the common benefits of stakeholders, otherwise, the process leads to high negative externalities particularly to those peri-urban communities by affecting their livelihood.

Urbanization and urban growth of Ethiopia is dominated by a primate city. The 1994 Population and Housing Census indicate that Addis Ababa has 28.4 percent of the National urban population and is twelve times larger than the second largest city, Dire Dawa. This resulted in physical expansion of the city to the periphery affect the ecosystem elements like the environment. A rapid and unplanned expansion and commercial development, along with population pressure, has meant the city environment is deteriorating with time. At present the forests of Addis Ababa are almost transformed to urban habitats accommodating an excessive population due to a high rate of rural–urban migration. In addition, industrialization within the urban areas and conversion of different land use within the city and the surrounding urban areas has caused the rapid depletion of existing tree cover during the past 100 years (Hancock, 1995).

2.7. Conceptual Framework

Figure 2.1:- Conceptual framework of the study



Source: From the researcher, 2014

CHAPTER THREE: RESEARCH METHODOLOGY

3.1. An Over View of the Study Area

3.1.1 Historical Background

The founding of Deber markos town is attributed to Dejazmach Tedla Gualu, the ruler of the Eastern part of Gojjam which was then called Gojjam in 1853. At that period it was called Menqorer, the name derived from one of the land holders who were named Zena and Menqorere sarn. This newly founded site gradually grew physically and was divided in to fourteen safer or quarters. Following the coronation of Ras Adal who was crowned as Tekle Haimanot in 1880 and the establishment of the church of st'mark in Menkorere in 1882, Neguse Tekle Haimanot who was then the king over Gojjam, the size of the town was expanded. During its founding the total extent of the area was 272 hectors today this extent increased 23 fold and reached 6160 ha. Debre Markos was the capital of Gojjam province for long period of time because of; its military strategy and t its temperate climate which was free from the deadly malaria epidemic (Habtamu, 2009).

Despite old age of the town, the socio-economic statuses of the citizens as well as infrastructural developments in the area were almost paused for a number of decades. But now a day's, motivated by the liberalized free market economy and other motivating instruments by the local government, the socio-economic status of the society is showing a considerable progress (kalkidan,2007).

3.1.2 Geographical Location

Debre Markos is found 300 kms North-West of the capital Addis Ababa and 265 kms South- East of the Amhara National Regional state city BahirDar. The geographical coordinates of the town are $10^0$21" Latitude North and $37^0$43" Longitude East. Its total municipal area is approximately 60kms sq. The town is situated at 2420 meters above sea level (Figure 3.1).

3.1.3 Climate

The weather condition of the town is woinadaga (temperate climate) which makes it suitable to live in. The mean annual rain fall is 1308mm and mean annual temperature of 16^0c, while the maximum and minimum recorded temperature are 24^0c and 4^0c respectively (EGFED,2012).

3.1.4 Topography

A slope ranging 2-10% is considered to be suitable for urban development activities. As shown in table 3.1, the majority (66%) of land in Debre Markos is in this range (2-10% and thus suitable topography for urban development. The slope below 2% covers 9% and above 15% covers 8.3% of the total area of Debre Markos town which are considered to be difficult for urban development.

Table 3.1:- Slope Classification

No	Gradient (%)	Area Coverage in sq.km	Area in %
1	0-2	8	8.9
2	2-5	20	22.3
3	5-10	39	43.7
4	10-15	15	16.8
5	Above 15	7.5	8.3
	Total	89.5	100

Source: Debre Markos town municipality, 2009

3.1.5 Population

The population of the town is 62,469. Disaggregated by sex, 29,901 were males and 32,568 females with the sex ratio in percentage of 52.2% (CSA, 2007). Up to 2014, it is estimated to be 107,684 of which 57,791 are females and 49,893 are Males (EGFEDD, 2012).

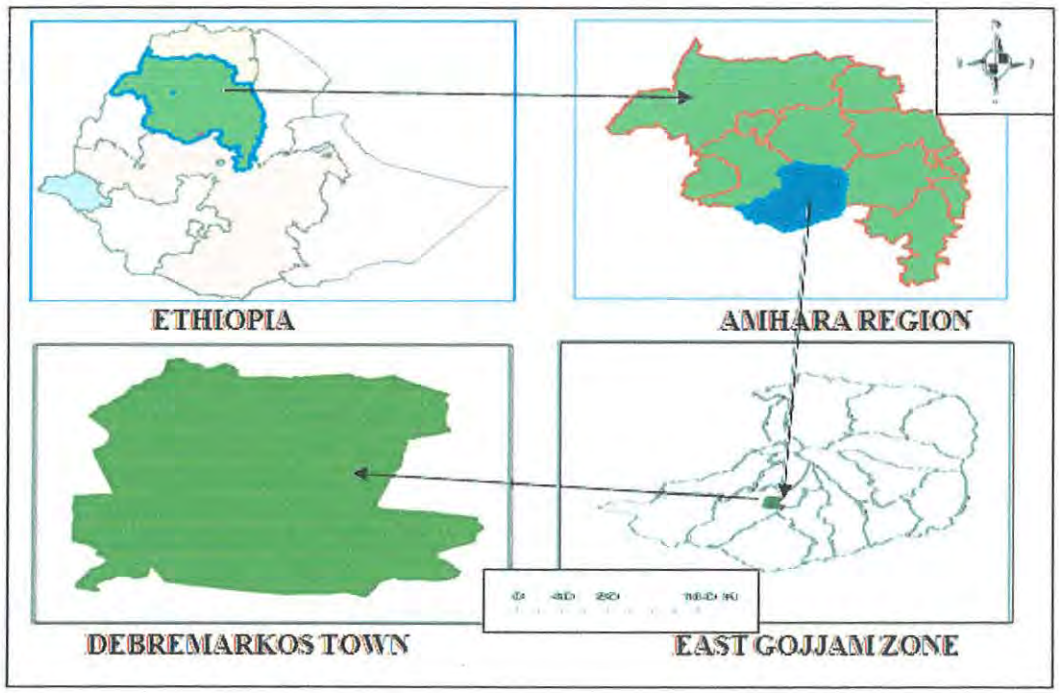
3. 1.6 Economy

Residents are engaged in occupations which have limited returns. These include small trade and industry, government employee, and urban agriculture. Most females predominantly engaged in preparing and selling the traditional 'popular' drink –Tella. A small number of residents are employed in civil services, while others in trading, small scale industries(woodwork, metal work etc) handicrafts(like weaving and sewing)and other petty business(Kalkidan,2007).

As indicated in the East Gojjam Finance and Economic Development Department the economic activity and infrastructure development of the town was low and over all life standard of the inhabitants was not in good condition. This is due to lack of diversified opportunities such as, absence of commercial crops in the nearby areas, traditional

production system, less attention to agricultural sector, lack of commerce, and of entrepreneurship (EFEDO,2012).

Figure 3.1:- Location Map of Debre Markos Town



Source: Ethiopia Geographic Information System, 2007

3.2 Research Design

The primary aim of this research is to assess the impact of urban expansion on forest, cultivated land, and wetland and grass land. To this end, the descriptive research design was employed to generate relevant and pertinent data so as to assess the causes and impact of urban expansion on environment. In order to obtain the relevant data appropriate data collecting tools were employed. These include household survey, key informant interview, observation and document inspection.

The researcher used both quantitative and qualitative research approaches. Quantitative research consists of studies in which the data concerned can be analyzed in terms of numbers and qualitative approach also used to describe events without the use of numerical data. Both types of research approach are valid and useful. The study was used both probability and non-probability sampling methods. Under probability sampling, systematic sampling was used to get desired representatives of households. Under non-probability sampling, purposive samplings methods were also used for

government officials to get valid information. The researcher used questionnaires, interview, observation and document analysis to meet the research objectives and research questions.

3.3. Data Sources

In order to achieve the research objective, the researcher obtained from primary and secondary data source. The primary data were obtained from the households, municipal and city administrators, and experts of east Gojjam environmental protection office and kebele administrators. The secondary data were obtained from Debre Markos development and structural plan, NUPI, books reports, magazines, and journals.

3.4 Data Collection Instrument

The primary data were obtained through household survey, key informant interview and observation. The secondary data obtained through published and unpublished documents review.

Household Survey

In order to collect relevant data, clear and understandable questions were prepared and translated in to Amharic language. To build the respondents confidence and to express their ideas comfortably, the researcher were informing the purpose of the study is only academic. Open and closed ended questionnaires were included to get the data. Questionnaires are easiest ways of collecting data from wider number of respondents by distributing the same questions and it saves time and money. Questionnaires were distributed to 119 households.

Key Informant Interview (KII)

Interview is a face to face or a two way conversation that help to obtain depth , detail information and gather supplemental information by probing with additional questions. Based on the likely data availability, the researcher took a total of eleven individuals who have a deeper and better knowledge about the impact of urban expansion on environment. The informant includes town administrator, head of municipality, east Gojjam environmental protection head and experts, Debre Markos environmental protection work process experts and the three kebeles officials. The town administrator, municipality head and kebele officials were asked questions related to the causes and trends of urban

expansion whereas the environmental protection head and experts were asked questions more of related to the impact of urban expansion on the environment

Direct Observation

Observation is the technique which involves watching and recording of the characteristics of an object or phenomena. During the field work the researcher was directly observing the trend and impact of urban expansion by comparing the past and present and also used photographs as source of data. Data collected through this technique were used to supplement information collected in household, key informant interviews and data from secondary sources.

Document Review

Development and structural plan, annual plans and report official documents and records of city administration and municipality of Debre Markos. In addition report of National Urban Planning Institute (NUPI), East Gojjam environmental protection office report was the main sources of secondary data. Various books, journals, and reports also were used.

3.5 Sample Selection Techniques

The town Debre Markos has 7 kebeles with a population of 62 465 and with 15 675 household (CSA, 2007). From this population 6474 household is found in the periphery. Three kebeles (Keble 03, 04 and 07) are purposively selected. Keble 03, 04 and 07 have households of 1951, 1732 and 495 respectively. Thus totally 4178 households are target population.

According to Cochran, (1977), the formula to get their representative sample size is

$$n = \frac{z^2 pq}{e2}$$

n = is the desired sample size

e = Level of statistical significant

z = is the standard normal variable at the required level of confidence.

P = is the proportion of target population estimated to have characteristics being measured.

Since there is not estimated proportion of defined population characteristics, 50% is recommend to be used, so P = 0.5 and q = 1- 0.5. Considering 95% level of confidence

the corresponding level of significant is e= 0.09 and standard normal deviation is Z = 1.96

Thus the sample size for this study is

$$N = \frac{(1.96)^2 \text{ X } 0.5\text{X}0.5}{(0.09)^2} = 119$$

To choose the sample, both probability and non-probability sampling techniques were used. Probability sampling, especially systematic random sampling was used for households living in the peripheral areas of the selected kebeles of the town. Thus, the samples were selected from the kebeles document list in which all the target population listed. To select residential units from the target population using systematic random sampling techniques, this is the formula.

$$K = N/n \quad \text{i.e., } N = 4178, n = 119 \quad \text{so,} \quad 4178/119 = 35^{th}$$

Therefore, every 35^{th} household on it was taken from the municipality document list. In addition, the researcher used non-probability sampling technique to get the required information about the issues that the research undertaken. Specially, purposive sampling was used for the research to make more viable and reliable about the information gathering and fruitful research.

3.6. Sample Size

The target population of the study was all the residential units (households) found on the 3 kebeles at the peripheries of Debre Markos town which is a total of 4178 (table 3.2). From these household 119 household was selected. In addition to this 11 officials and experts included (table 3.3). So the total sample of the studies is130.

Table 3.2:- Sample size of the household Survey

No	Name of kebeles	Number of house households in the kebels	Sample Size	Proportion
1	Kebele_03	1951x119/4178	55	46%
2	Kebele_04	1732x119/4178	49	41%
3	Kebele_07	495x119/4178	15	13%
	Total	4178	119	100%

Source: Field survey, 2014

Table 3.3:- Sample Size of Interview Respondents

No	Position	Number
1	Town administrator	1
2	Municipality head	1
3	East gojjam environmental protection office	3
4	Debre Markos environmental protection work process	3
5	Kebeles Officials	3
	Total	11

Source: Field survey, 2014

3.7 Methods of Data Analysis

Data collected through primary and secondary sources were carefully tabulated and organized. In order to meet the general and specific objectives of the study qualitative and quantitative approaches of data analysis were employed. The qualitative data was analyzed contextually by narration. The quantitative analyses also use tables, charts, graphs, percentages and figures. Moreover, narration are also used to analysis and summarize the findings where necessary. Microsoft Excel 2007 and AutoCad software were used to analyze the necessary data.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Characteristics of the Respondents

The general information of the respondents such as age, sex, educational background, birth place, and other relevant information were obtained from sample respondents as shown on table 4.1.

Table 4.1:- Demographic Characteristics of the Respondents

General background of Respondents	Specific socio-economic Characteristics	Number of Respondents	Percent
Sex	Female	80	67
	Male	39	33
	Total	119	100
Age of the respondents	18 –39	27	23
	40—59	86	72
	60—79	6	5
	80 and above	-	-
	Total	119	100
Birth place of the respondents	D/Markos town	22	18
	Migrated from other town	59	50
	Migrated from rural areas	38	32
	Total	119	100
Educational status of the Respondents	Illiterate	4	3
	Grade 1—8	40	34
	Grade 9—12	28	24
	Diploma	39	32
	1st Degree and above	8	7
	Total	119	100

Source: Field Survey, 2014

Table 4.1 depicts that 67% of the respondents are male and the rest 33% share is taken by female. Therefore, the major respondents are male.

As it is shown in the above table, out of the total, 72% of respondents are under the age group of 49-59. This implies that greater number of the respondents is at the adulthood age, which helps the researcher to collect more firsthand data about the impact of urban expansion.

With regard to the birth place about 18% of the respondents said that they were born and have grown at Debre Markos town, 50% of the respondents came from other urban areas and about 32% of the respondents migrated from the surrounding rural areas and lived at the town. This means that about 82% of the respondents came from outside the town. Thus it is possible to understand that there is more migration due to different purposes which resulted for high population growth in the town.

With regard to educational backgrounds of the respondents, about 3% of respondents were illiterate, 34% of the respondents were grade 1-8, 24% were grade 9-12, 32% of the respondents were diploma holders and 7% were degree holders. This implies that most of the respondents are literate and able to understand their surrounding and provide real information regarding about their environment that resulted from urban expansion.

4.2 Trend of Urban Expansion

4.2.1 Trends of Urban Land Use Planning and Settlement

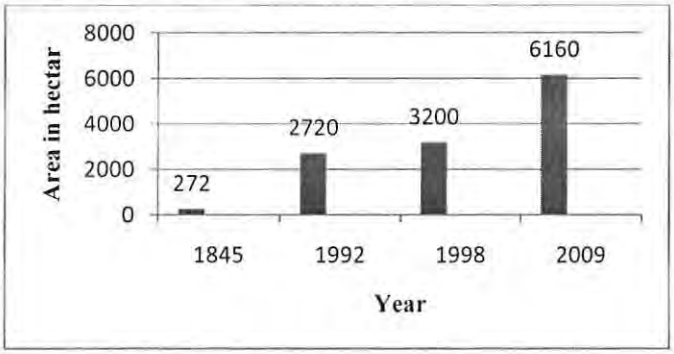
Debre Markos is one of the oldest urban centers of Amhara National Regional State (ANRS). The first Master plan of Debre Markos town was delineated by Italian in 1967 and later in 1992 by the Ministry of Urban Development and Housing (NUPI, 1998). Up on the foundation of Debre Markos, the town was divided into different sub neighborhood settlements. The centers of the settlements were occupied by major chiefs. After the down fall of Emperor Haile Selassie, all these neighborhood villages' names changed into a numbering system. Until 2005, the town had 9 kebeles. In general, these villages (in Amharic "Sefers") were fragmented independently in different directions of the town and the major land is used for agricultural purpose by feudal lords.

Since 2009, the town has expanded by including 13 rural kebeles which surround the town. These kebles are Wonka from north, Dalgaw, Achira, and Yebo from south east, Chemoga from south, Yebragie from north, Endimata from east and Yemeka from west.

The radius of the town was five kilometers at an average before these rural kebeles were incorporated to the town. But after the inclusions of these rural kebeles to the town, the radius was increased to about 10 kilometer.

As indicated in Figure 4.1, when the town was founded in 1845, the area of the town was 272 hectares. With the 1992 development plan, the area of the town was increased to 2720 hectares. In the 1998 development plan, the town was farther increased to cover about 3200 hectares. Now the town is estimated to cover 6160 hectares.

Figure 4.1:- Trends of area expansion of Debre Markos town (in hectare)



Source: Debre Markos Municipality Structural Plan, 2009

The past land use system of the town also contribute to the present fragmentation and linear expansion of the town. The delivery of land with large plot size without considering their land requirement for residintial, governmental and non governmental organization and feudal ownership of land in the form of freehold has contributed to the present outwared expansion of the town .Up to now, development infill in the urban centers has not implemented. Rather, green areas at the periphery have been provided for new settlers for residential purpose. In addition to this, occupancy of vast areas and further expansion by few governmental and non governmental organization has contributed to the present outward expansion of the town.

Table 4.2:- Governmental organization and institution plot size

No	Governmental organization	Total area in m^2
1	Military Camp	300,000
2	Amhara Region Police Traing Center	200,000
3	East Gojjam Administrative Council Office and Palace	160,000
4	Tekele Haimanot Primarey and junior Secondery School	250,000
5	Addis Hiwat Elementary School	150,000
6	Deberemarkos priparatory School	133,000
7	Deberemarkos hospital	120,000
8	Abima Primarey and Junior Secondery school	115,560
9	East Gojjam Prision	117,600
10	Ide Tibeb Primary and Junior Secondery School	48,322
11	East Gojjam Orthodox Office	100,000
12	Markos Church	150,000

Source: Debre Markos Municipality Annual Report,2010

4.2.2 Trends of Urban Land Uses in the Town

4.2.2.1 Land Use Types in 1998 Developmental Plan

The plan boundary of the town was increasing by 117.6% from 1992 to 1998 and by 279.6% from 1998 to 2009. During 1998 the land uses of the town was 3200 hectares of land as it is shown in the table 4.3.

Table 4.3:- The 1998 land use classification of the town

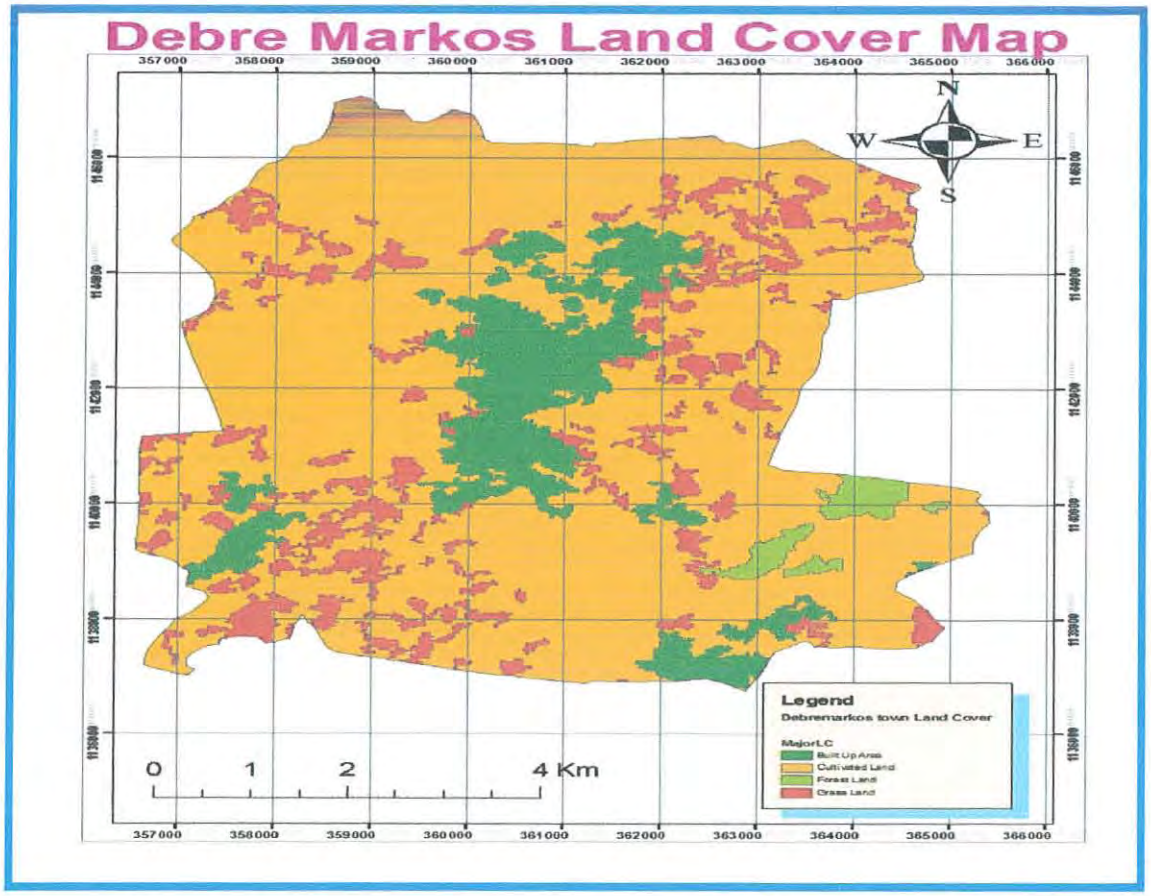
No.	Land use	Area (ha)	Percentage
1	Residence	779	24.34
2	Administration	27.2	0.85
3	Commerce	108.6	3.39
4	Service	281.7	8.80
5	Industry and Manufacturing	2.1	0.06
6	Recreation and greenery	88.7	2.77
7	Transportation and road	267.4	8.35
8	Forest	550	17.18
9	Special area	215.9	6.7
10	UrbanAgriculture	879.4	27.48
	Total	3200	100

Source: Data obtained from NUPI (1998)

As shown in table 4.3, the residential land covered 779 ha (24.34%), where as the administration 27.2 ha(0.85%), the commercial activities 108 (3.39%), the social

services 281.7ha(8.80%), industry and manufacturing 2.1 ha(0.06%), recreation and greenery 88.7 (2.77%), transportation and road 267.4 ha(8.35%), forest 550 ha (17.18%), special area 215.9 (6.7) and agriculture 879.4(27.48%). Among the land use type, agriculture, residential and forest covered large amount of urban land respectively.

Figure 4.2:- 1998 major land use classification of the town



Source: digitized and edited from the 1998 development plan of Debre Markos

Table 4.4:- Major Land uses of the town in 1998

No	Land use classification	Area in hectare	Percentage
1	Built up area	1468	45.88
2	Cultivated land	879	27.47
3	Forest land	550	17.18
4	Grass land	303	9.47
	Total	3200	100

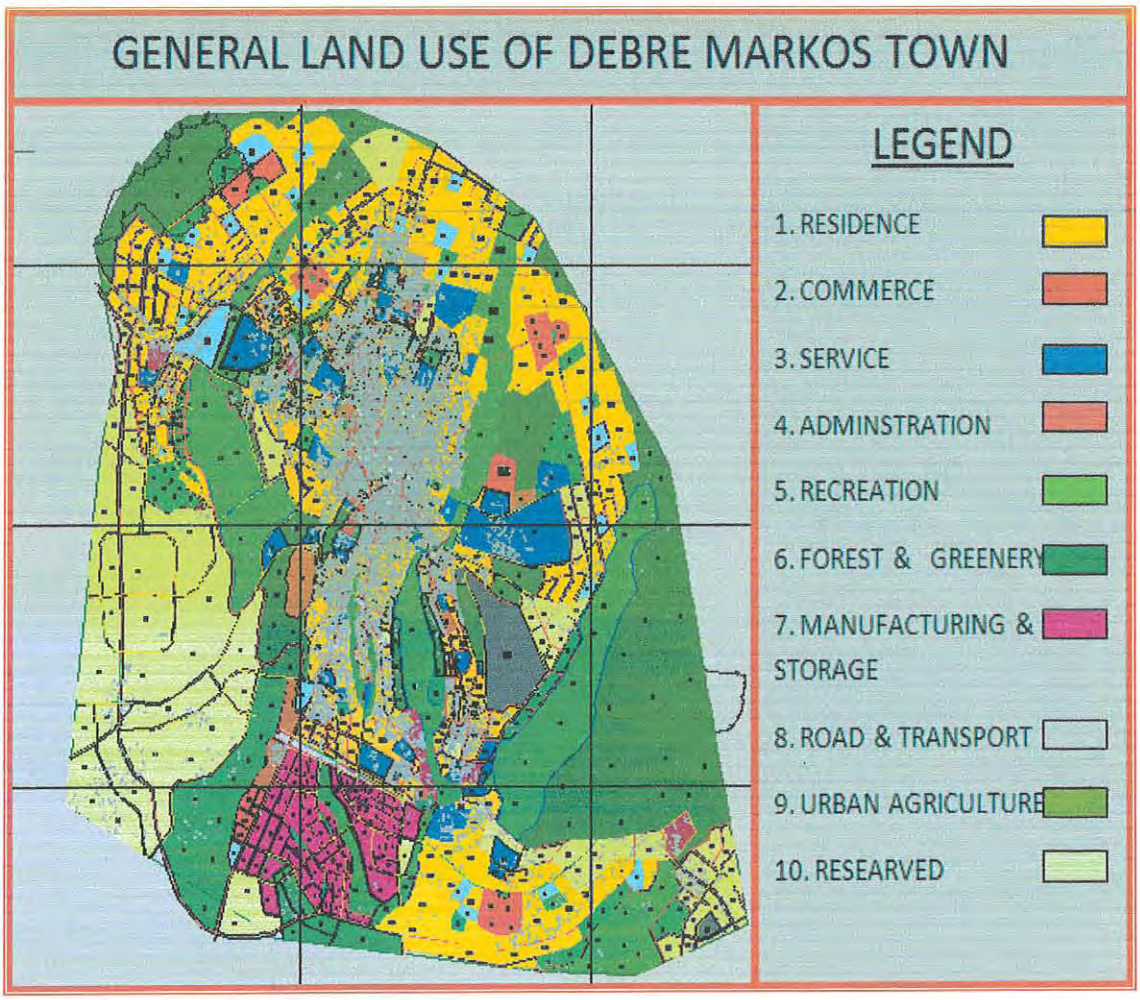
Source: Calculated from the 1998 Development Plan of Debre Markos town

As shown in table 4.4, in 1998 among the major land use types, built up area took the lion share (45.88%) and this implies that there was *high* percentage of built up areas. The built up area included the residential, administration, commerce, social service, industries, transport and road land uses. The second is cultivated land with 27.47%.

4.2.2.2 Land Use Types in 2009 Structural Plan

In the 2009 structural plan, the major land use classification of the town was ten. The following figure shows the area of ten land use classifications.

Figure 4.3:- The 2009 land use map of Debre Markos town



Source: Digitized and edited from the 2009 structural plan of Debre Markos

The structural plan of Debre Markos town showed a land use map with the total land use coverage of 6160 hectare, as shown on table 4.5.

Table 4.5:- The area of the 2009 land use classification of the town

No	Land use	Area in hectare	Percent /%/
1	Residential	2,733.4	44.3
2	Commercial	723	11.7
3	Service	542.4	8.8
4	Administration	61.1	0.9
5	Recreation	137	2.2
6	Forest	362	5.8
7	Manufacturing and storage	220	3.5
8	Road and transport	291.2	4.7
9	Urban agriculture	317.9	5.1
10	Reserved area for different activity	772	12.5
	Total	6160	100

Source: Calculated from the 2009 land use map of Debre Markos town

As shown from table 4.5 out of the total land use proposed, the residential use has covered 2733.4 ha (44.3%), a reserved area has covered about 772 ha (12.5%), commercial areas 723 ha (11.7%) and administration areas has covered 61.1 ha (0.9%). Out of the 2009 land use types, the residential land have taken the lion share (44.3%) and this implies there have been a high percentage of land use for residential.

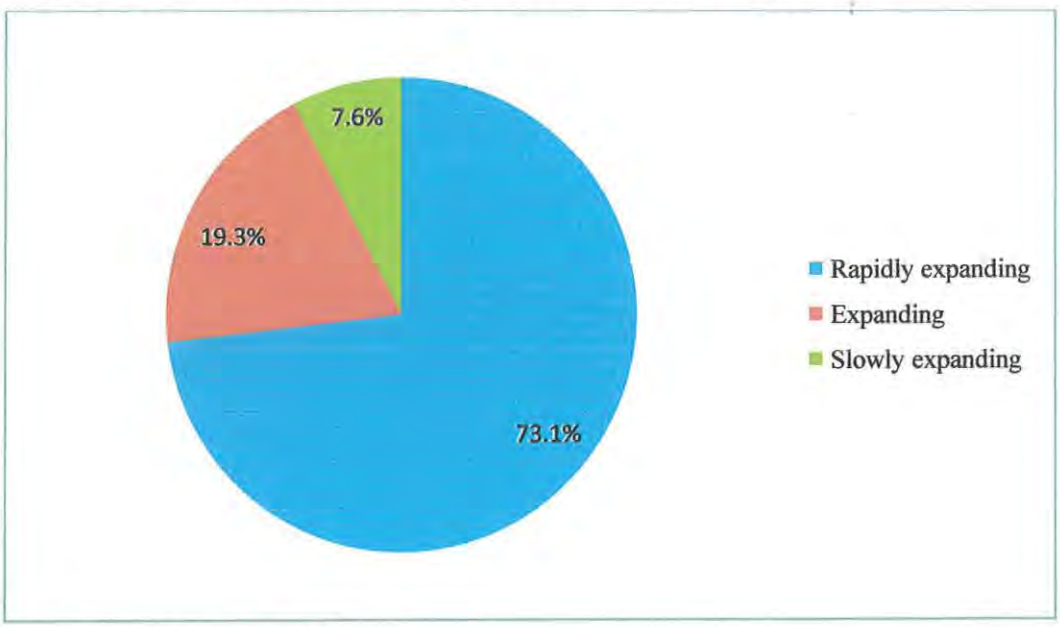
Table 4.6:- Trends of land use change between the 1998 Development plan and 2009 structural plan.

No	Land use classification	1998 land use types in (hectare)	%	2009 land use type in (hectare)	%	Land use change from1998 to 2009 Area(hectare)	%
1	Residential	779.2	24.34	2,733.4	44.3	1954.2	+350.8
2	Commercial	108.6	3.39	723	11.7	614.4	+565.7
3	Service	281.7	8.80	542.4	8.8	260.7	+92.5
4	Administration	27.2	0.85	61.1	0.9	33.9	+12.4
5	Recreation	88.7	2.77	137	2.2	48.3	+54.4
6	Forest	550	17.18	362	5.8	`-188	-34.2
7	Manufacturing and storage	2.1	0.06	220	3.5	217.9	+10376.1
8	Road and transport	267.2	8.35	291.2	4.7	24	+8.9
9	Urban agriculture	879.4	27.48	317.9	5.1	-561.5	-63.8
10	Reserved area	215.9	6.7	772	12.5	556.1	257.5
	Total	3200	100	6160	100	2960	+92.5

Source: Data obtained from NUPI (1998) and Debere Markos land use plan (2009)

As shown on the above table the land use changed from the 1998 to 2009, all land uses show an increment by more than 50% except forest and agriculture land which was reduced by 34.2% and 63.8% respectively. During ten years period about 2960 hectare of land was included to urban land use. Among those land uses, residential took the lion share, indicating that the demand for housing increased whereas the demand for agricultural and forest land coverage decreased. Generally, the demand for the built up cover (residence, commerce, administration, services, manufacturing and industries, transport and road land uses) have been increasing from time to time than the forest, recreational and agricultural land use. Robert (2005) also confirmed that the built-up area of developing-country's cities will increase to more than 600,000 square kilometers by 2030. In other words, by 2030 these cities are expected to triple their land area, with every new resident converting, on average 160 square meters of non-urban to urban land.

Figure 4.4:- Respondents attitude on trends of urban expansion



Source: Field survey, 2014

As shown in the figure 4.4, the majority of sample respondents, 87(73.1%), said that the town expands rapidly, 23 (19.3%) agree that the town expands moderately, whereas 9 (7.6%) said that the town expands slowly. In addition, different officials (city administrator, municipality head and kebele officials) agreed that the town is rapidly expanding.

4.2.3. Direction of Expansion of the Town

Debre Markos has natural and manmade constraints that forced the town to develop in fragmented and dispersed urban pattern. From physical observation, the town's expansion direction is not only in the north part of the town as the previous plan had indicated. But in reality, there are expansions to the north-western and eastern directions following the main roads. Areas south of the town, especially south of Shebel hotel, do not show any significant development.

According to Debre Markos 2009 structural plan, the expansion areas of the town were located in different directions within a walking distance from the main arterial roads. The main expansion area was a large tract of land situated in the northern and north western edges of the town between *Abma Mariam* (kebele 03)and *Bahirdar* roads (kebele 04). In addition to this area, the two important housing areas that would have significance in shaping the urban pattern of the town were located left and the right side of the *Debere Markos* university road. The town gnerally expand horizontally year to year like other fastest growing cities of the country . When one sees the entire area of the town, it shows a scattered development both urban and rural characteristics.

4.3 Causes of Urban Expansion

Among others, the rapid population growth of urban residents and migration due to pulling factors like employment opportunity, provision of social infrastructure, and transportation facility aggravated the expansion of Ethiopian urban centers (NUPI, 1998). Similarly, the causes for Debre Markos town expansion are population growth, availability of different infrastructure, absence of land information systems (LIS) or Cadastre, and topography. These are further discussed below.

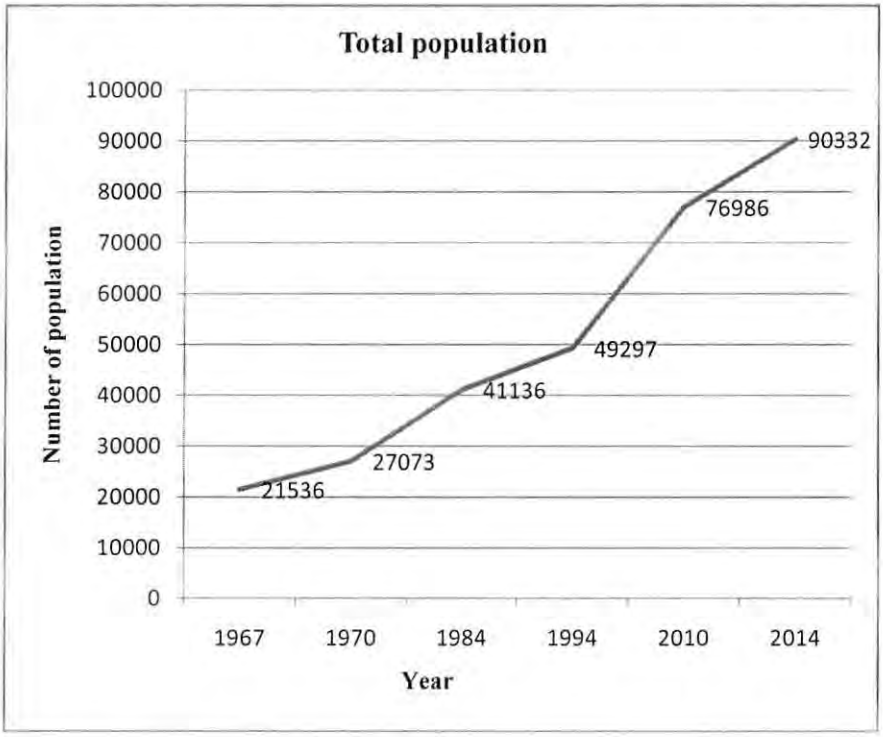
4.3.1 Population Growth and Migration

Population Growth

The expansion of Debre Markos town is at the expense of agricultural and forest land. The urban expansion is highly associated with population growth of the town. There are two factors for the population growth, birth rate increment and migration. In 1967 the town population was 21536; and the figure has been observed to increases by 25.71% (27073), 91.01% (41136), 128.9% (49297) during the years 1970, 1984, and 1994 respectively. According to CSA(2007) estimation/forcast of the 2014, the town's

population growth would have reached 90332,male 43316,female 47016(the detail is in the appendex). The town's population increament is shown in figure 4.5.

Figure 4.5:- Trend of population growth in Debre Markos town



Source : From NUPI, 1998 and Debre Markos town adminstration office,2013.

As indicated in Figure 4.5, in 2007 the urban population of Debre Markos town was 62497. This figure was projected to increase to 90332 by the year 2014. The high rate of population growth in the town is attributed to migration from rural areas, and nearby town. In addition, the natural increase of population within the town played a role in population growth of the town. As population increase in the town, the demand of land for different purposes as well increases. This situation results in diminishing the forest resource and cultivated land that creates other environmental problems at a rapid rate in the town.

Migration

Migration is one of the basic components (factors) of population growth and redistribution, particularly for urban areas. It has a direct effect on both receiving and sending areas in conjunction with population growth rate. It affects economic growth, social welfare and the political environment of an area. According to Debre Markos municipality head, migrants in the town accounted for 30.34 percent of the current

population and out of all migrants living in the town, 54.9 percent came from rural areas and the rest 45.1 percent from other urban areas. To cross check this fact, residents who are living at the peripheral areas of the town were asked whether they are migrants or not. Among 119 housing units interviewed during field survey 97 (82%) of respondents were migrants and 22 (18%) of the respondents were non migrants.

4.3.2 Avilability of Infrastracture

Avilability of infrastracture has long been a pulling factors for the creation of Ethiopian cities and towns. According to the interview of municipality head, Debre Markos is a town adiministration as well as a capital town of East Gojjam zone. Hence, it has both town administration and different zonal governmental offices. This leads to consume large amount of land for construction. Because of this, it has different infrastracture especially social infrastractres like school and health centers that pulls the people. In the town there are 17 kinderngartens, 23 primarey schools, three secondery schools,11 colleges and one universty. In relation to health, there are 1 hospital, 3 health centers and 7 health posts. Due to increasing of their number and large amount of land which they required, these have contributed to aggravate the urban expansion.

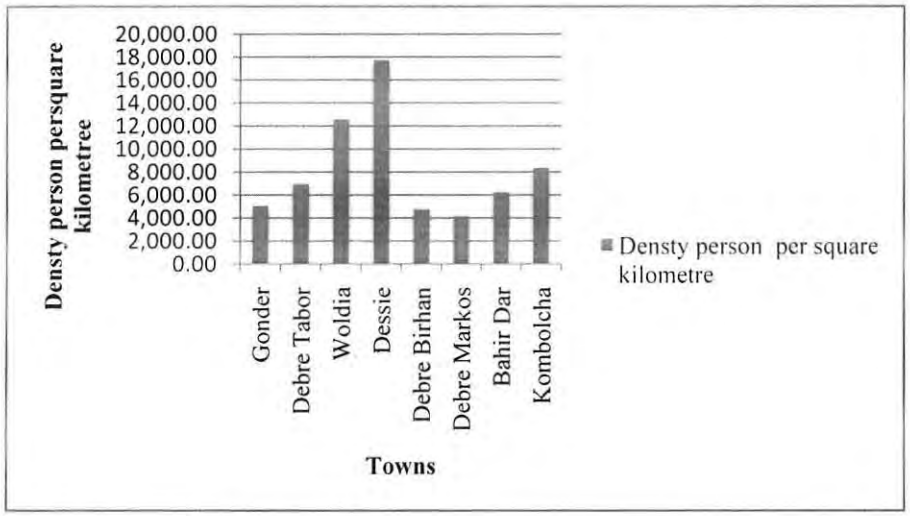
4.3.3. Absence of Land Information System (LIS), Cadaster

The other cause of the present horizontal expansion is absence of urban land information system. According to the municipality head's explanition there was a trial to use a land information system but not quite completed. Today the data in the municipality is not well documented. Nowadays, it is obvious that with out a cadastral system, urban land management is unthinkable to implement and operate effectively. Cadaster is an official public record registering ownership rights of urban land in a given territory. In the municipality also lack of up to date technology (GIS,maps, documentd data, lack of urban cadaster) are also the causes of the present horizontal expansion of the town.

In addition to these, lack institutional capacity and intergration at the municipality also contributed for the present inefficient land delivery system. Today, the municipality has delivered the green field areas at the urban fringe especailly the North, North-west and South-east of the town respectively kebele 03, 04 and 07 for housing. Starting from 2002 up to 2007, 1060 people constructed residential house in kebele 03 and 106 in kebele 04. The town expands horizontally instead of vertical development. As compiled from 2007

population projection, population density of Debre Markos was low as compared to eight known cities in Amhara National Regional State. This is shown bellow in the figure.

Figure 4.6:- Population density of eight towns in Amhara National Regional State



Source: Compiled from CSA ,2007

As municipality expert, in the town, explained it is estimated that there is 10 hectares of vacant land which is not efficiently utilized by the municipality. Vacant lands found in the infill areas have been serving as temporary sold waste disposal and illegal damping areas.

Plate 4.1:- Vacant land in the area of the town

Source: Field servey, 2014

4.3.4 Topography of the Town

The other reason that aggravated the development of the scattered pattern in the town,

in addition to man-made constraints discussed above, are the nature of topography. Based on the researcher's observation and municipality strategic document (2011), Debre Markos consists of swampy areas, gullies, ridges and escapments as shown in the table below.

Table 4.7:- Slop analysis.

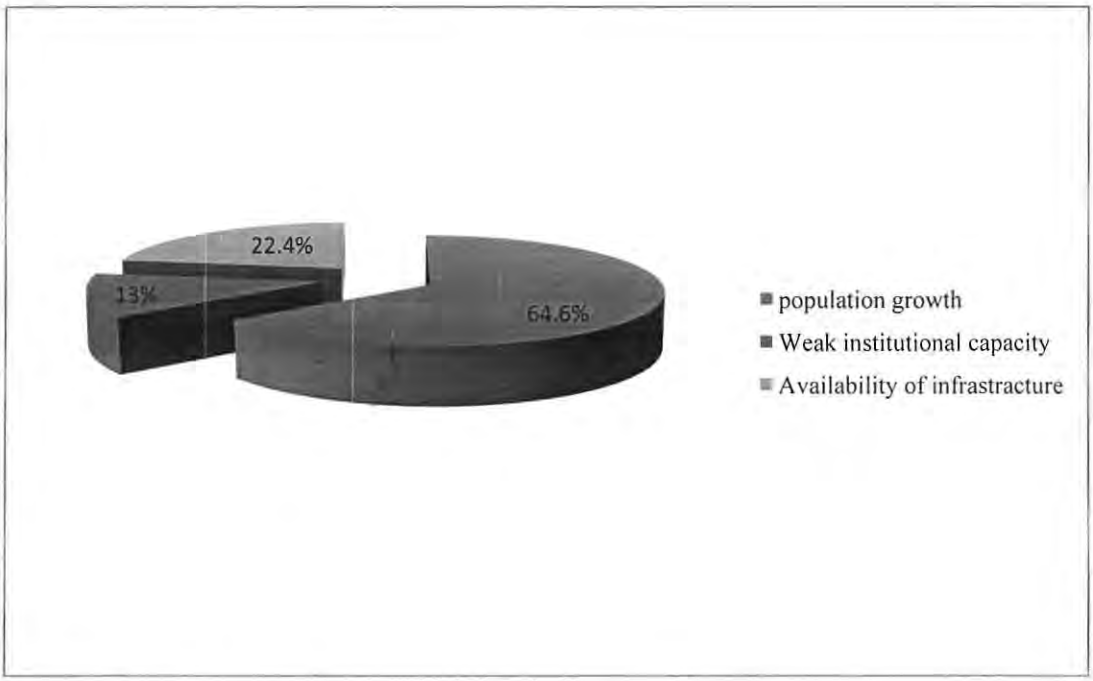
Slop in %	Characteristics of the area	Coverage area in %	Coverage area in hectare	Usage
0—2.5	Swampy	20	640	Unbuiltable area
2.6---20	Occupied by existing structure,vegetation, rural settlement and farm land	74	24000	Builtable
Greater than 20	Gullies,ridges and escarpment	6	192	

Source: Debre Markos municipality stratagic plan,2011

The slope 0-2.5% and greater than 20% which covers 20% and 6% respectively in Debre Markos is considered to be difficult for urban development. This natural constraint also leads to the present expansion of the town.

To summarize the main drivers for the expansion of the Debre Markos town, related question was asked to the samples respondents. Among the respondents 75 (64.6%) of them answered that population growth is the major factors of the present expansion of the town, 26 (22.4%) agree that availability of different infrastructure is the cause for urban expansion, 15 (13%) respond that weak institutional capacity of the local government is the cause of the present expansions of the town (see figure 4.7). This implies that population growth is the major driving factor for urban expansion. With the interview of the municipality head, the head also assured that the major cause of urban expansion is population growth and availability of infrastructures.

Figure 4.7:- Respondents attitude on the Causes of Debre Markos Town Expansion



Source: Field survey, 2014

4.4. Impacts of urban Expansion on Environment

Table 4.8 shows the sample respondent in relation to impact of urban expansion on environment. Respondents stated that even though urban expansion has a positive impact on urban development there are many negative impacts on the environment. As it was answered by the respondents, cultivated land and wetland are very highly converted due to urban expansion, 66% and 62% of respondents answered respectively. 58%, 48% and 24% of respondents said that forest, grass, and soil were highly affected due to urban expansion respectively. The interviewee of east Gojjam environmental protection office has also confirmed that urban expansion affects forests, agricultural lands and wet lands. For example, around kebele 03 and 04 people were affected by erosion during rainy season, which are recent phenomena due to the urban expansion. According to them the main cause for run off storm water is because of excessive removal of vegetation and conversion of farm land to urban use. Environmental protection expert also explained the adverse impact of urban expansion on environment mainly related to temperature. It has been pointed out that the average temperature increases to 19^{o}c in 2012 whereas the average temperature in 2002 was 16^{0}c. This shows that the temperature has increased by 3^{0}c within ten years.

Table 4.8 :- Responses of the interviewees on the impact of urban expansion

Impact of urban expansion	Very high	%	High	%	Mediu m	%	Low	%	Very low	%	No chan ge	%	Tota l No	Tota l %
Forest land	13	11	68	57	32	27	4	3	2	2	-		119	100
Cultivated land	79	66	27	23	10	8	3	3	-		-		119	100
Grass land	19	16	57	48	28	24	9	8	5	4	-		119	100
Soil	10	8	50	42	44	37	10	9	5	4			119	100
Water	19	16	30	25	55	47	8	7	4	3	3	2	119	100
Wetland	74	62	22	18	21	18	2	2	-		-		119	100

Source: Field survey, 2014

4.4.1 Impacts of Urban Expansion on Forest

Horizontal expansion and leapfrog development of the town has been endangering and destroying important natural resources. Deforestation, conversion of agricultural land and land degradation are found to be the major effects of Debre Markos town's expansion.

Table 4.9:- The trend of forest coverage of the study area from 2001-2013

Year	Name of kebeles and forest coverage in hectare			Total
	Kebele 03	kebele 04	kebele 07	
Before 2001	2.57	2.1	450.5	455.17
2001-2004	2.1	1.72	390.9	394.72
2005-2008	1.2	0.4	362.7	364.3
2009-2013	0.6	-	322	322.6

Source: East Gojjam Environmental Protection Office, 2013

As indicated in table 4.9, the forest coverage in three kebeles was decreasing. Kebele 07 had the highest forest coverage in the town which includes Yeraba forest. However, Yeraba and other forest areas in kebele 07 were declined enormously. Before 2001 the forest coverage in kebele 03, 04 and 07 was 2.57, 2.1 and 450.5 hectare respectively. Whereas in 2013 there was a decrement by 1.97 hectare in kebele 03, 128.5 hectare in kebele 07 and almost all forest cleared in kebele 04.

According to Debre Markos municipality head and different documents one of the deforested area is around Debere Markos University with more than 72 hectares cleared. The forest was cleared and the buildings were constructed. (See Plate 4.2A showed that, Debre Markos University). Another deforested area was kebele 03, before 2007 kebele 03 was covered by forest, but after 2007 the forest at Kebele 03 was cleared for residential purpose (see plate 4.2B).

Plate 4.2A:- D/M University **Plate 4.2B:- Some parts of kebele 03 after 2007**

Source: Field Survey, 2014

Rapid urban expansion and destructive exploitation of forest has caused serious economic, social and environmental losses having local, national and global implication. In Debere Markos town at this time, Yeraba forest (the biggest forest area in the town) was cleared by Amhara forest enterprise. (See plate 4.3A yeraba forest and the rest plate showed the deforestation of this forest.) The literature also confirm that due to rapid urban expansion primary forests in various part of the world, currently estimated 17 million to 20 million hectare of forest, are being lost every year in developing countries (Allin, 2002).

Plate 4.3A yeraba forest

Plate 4.3B Deforest area

Plate 4.3C

Plate 4.3D

Source: Field survey, 2014

4.4.2 Impacts of Urban Expansion on Cultivated Land

In the presence of urban plan, there is a possibility that urban space expands beyond plan's limit for self organization due to population increment. According to the 2009 structural plan documents of Debre Markos, it is an increment of 2440 hectares of land from1998 to 2009. This additional land was agricultural land and above 2000 hectares of land for residential purpose. The trend of land use also shows that in 1998, 779 hectares were used for residential of land whereas in 2009 for residential purpose were 2733.4 hectares.

In 2014 there were large amount of land distribution for construction of residence by changing agricultural lands and giving compensation for farmers. Around 1354 of urban dwellers were registered and get 200 meter care for each individual. Due to this, totally 270800 meter care (270.8 ha) agricultural land will be converted in to residential land in one year and in the future became one part of the town administration. By this process 123 farmers have lost their fertile and productive agricultural land. The town administration and concerned bodies gave for each farmer around 6000 birr. (See plate 4.4).

Plate 4.4:- Cultivated land changed for residential

Source: Field Survey, 2014

Generally the town expand horizontally year to year rather than vertically and consume large tract of rural land. Population growth and the prevailing urban development practice in different urban centers of the country contributed significantly for the rapid horizontal expansion. And this has resulted in, the loss of the arable land, and most importantly the loss of the agricultural livelihood of the formers in the urban fringe of cities/towns. According to Minwuyelet (2004) in many urban centers of Ethiopia, urban expansion is at the expense of productive and fertile agricultural farmland and forest

4.4.3 Impacts of Urban Expansion on Wetlands

According to UNEP (2006), Wetland are land areas that are wet due to a close relationship to a body of water or groundwater, or land areas that are flooded regularly;

they support vegetation adapted for life in saturated soil condition. Wetland is the valuable and multifunctional natural environment of the land cover in the study area and is intervened by human induced activities like settlement. As wetlands are multifunctional natural ecosystem areas, wetlands need to be conserved because they perform vital functions and provide important services.

A wise use and sustainable utilization of wetlands for the benefit of human kind in a way compatible with the maintenance of the natural properties of the ecosystem are important for human life. According to Debre Markos municipality documents in 2007, in three kebeles 63 hectares of wetland and grassland was provided for residential. In addition to this, the two big rivers of the town Witren and Westa River found near to this area and decreasing year to year. The above data, from 1998 development plan to 2009 structural plan shows that agricultural land and forest land showed decreasing trend whereas built up areas showed increasing trend. This implies that the human induced activities like the settlements are consuming and dominating the valuable natural environments (like wetlands, grass land and water bodies) and the potential fertile areas of the study area. The following figure also shows wetlands and grass lands changes to residential and commercial.Plates 4.5 Wetlands in Debremarkos town

Plate 4.6:- Commercial areas around Debre Markos University

Source: field survey, 2014

The above plates showed that wetlands and grasslands have changed to different activities. Plate 4.6.A, B, C, D are wetlands and grass lands that was changed for residential whereas plate 4.7 shows wetland that was converted for commercial purpose. In this area147 micro and small enterprises were found.

4.4.4 Land Degradation in the Town

As it is mentioned earlier, the town of Debre Markos is now rapidly expanding and growing. But this development has brought about a heavy burden on the environment in general and on the natural resource in particular. To mention some of them, many quarry sites have been opened in all directions particularly in river banks, hillsides, and escarpments covered with thick bush lands (See plate below)

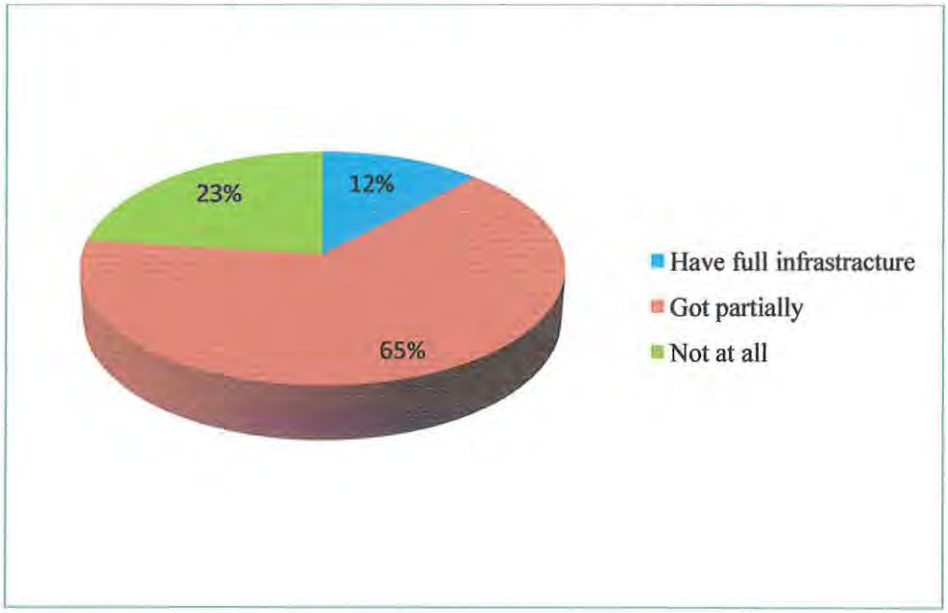
Plates 4.7:- Some photos of land degradation in kebele 03 and 04

Source: Field survey, 2014

Due to lack of proper land husbandry deep Gullies are formed in farm lands. Debre Markos was better in vegetation coverage with natural indigenous as well as exotic trees. However, with the expansion of the city and growth of the population the forests including the indigenous species are being removed to meet their demands as well as due to land use change for different urban infrastructure and services. Nowadays, few natural forests have remained on the ridges, river banks, around old churches, palace, in the compounds of old private houses, schools and recreational parks. Due to those challenges soil erosion has affected more than three- quarter of cultivated land. Urban expansion & infrastructure development such as road construction with that of other major prevailing problems have drastically reducing the productive potential: vegetation which is vital for the maintenance of the fragile ecosystem is being cleared at an alarming rate (Girma, 2009). Plate 4.8A and B land degradation & sever gully formation around Wonka and Witrin River, plate C shows land degradation formed at the back of Debre Merkos

Stadium and plate D shows cultivated land degradation and highly gorge formed around kebele 03.

Figure 4.8:- Respondents view on infrastructure provision



Source: Field survey, 2014

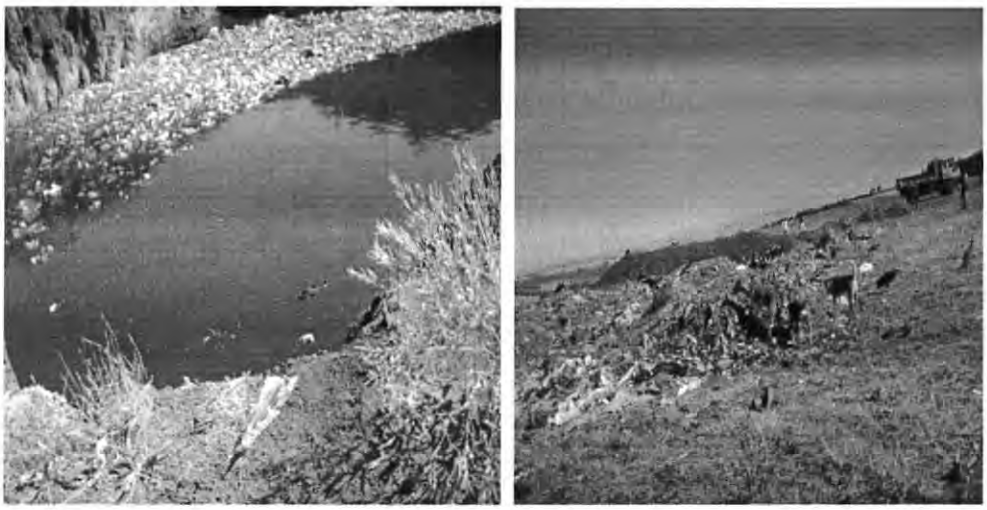
The respondents were asked about availability of infrastructure. From the above figure 15(12%) of respondents have got full physical infrastructure like road, water, electricity, 77(65%) have got partially like road and 27(23%) have got nothing. The unplanned expansion of scattered settlements, having large plot size and the development of incompatible services are endangering and destroying important natural resources and at the same time incurring unnecessary environmental costs. The horizontal expansion of the town especially towards north, north east and west of the town, created another problem that is physical infrastructure provision such as road, water, electricity and construction of drainage lines. According to information obtained from Debre Markos municipality, 84% of housing units do not have any drainage lines.

The scattered development and horizontal expansion also created another problem that is solid waste disposal. According to a data obtained from Debre Markos municipality beauty and sanitation annual report, 2012, 26.9% of solid wastes dumped on to free pace around the house, 22.4% use garbage containers, 12% burn solid waste and 38.7% dump outside the compound on open spaces.

Waste management at present time is a major environmental problem in Debre Markos town. In many cases, wastes are either not collected or the collected wastes are disposed

in an environmentally harmful manner. Waste dumping sites are often a significant source of pollution to ambient air, soil, and water and also a significant risk for human health & public welfare. Feyra (2005) also conform that, urban expansion has not been accompanied by environmental protection system. Urban waste has been disposed on open spaces; open drains in the road side and holes in the ground are common features of waste disposal particularly in expansion areas. This exposes the dwellers to sanitation related disease and air pollution. In addition to the farmland, environmental resources such as clean air and water, access to the countryside and recreational facilities are environmental values that the rural farming communities loose due to urban expansion in the periphery.

Plate 4.8A:- Liquid waste disposal site **Plate 4.8B:-** Solid waste disposal site



Source: Field survey, 2014

The above plates show solid and liquid waste disposal sites of Debre Markos town. According to the 2009 structural plan of the town, these areas are found in the newly industrial zone, topographical drains directly to the nearby stream, the tributary of Weseta River, near to zonal prison compound and it is also very close to the farm areas as well as to the rural settlement. Topographically of this site seems more vulnerable for surface & ground water pollution, due to the slope condition and soil type and other site situations.

According to interviewee with municipality head and my observation, the place of solid waste disposal has caused great problems in the communities that are found in the areas. These problems were created due to site selection and inability to solve this problem by the town administration and concerned bodies.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Urban expansion has both positive and negative impacts on urban development. On the one hand it is a way of civilization and engine of development; on the other hand its consequences affect the urban environment particularly in developing towns like Debre Markos. The town is rapidly expanding into the surrounding rural areas.

The study finding reveals that the planed boundary of the town was increasing by from 1992 to 1998 and by from 1998 to 2009. In the year from 1998 to 2009, all land uses of the town showed an increment except forest and agriculture land which was reduced. During ten years 2960 hectare of land was included to urban use. Among those land uses residential land use took the lions share and this indicates the demand for housing is increasing whereas agricultural and forest land coverage is reduced. Generally the coverage of the built up area (residence, commerce, administration, services, manufacturing and industries, transport and road land uses) rises from time to time but the coverage for forest and agricultural land is reduced.

The main cause for urban expansion of Debere Markos town is high population growth. Other factors for the urban expansion include: availability of different infrastructure, absence of land information systems (LIS) or Cadastre, and topographic nature of the town. The driving force of population growth is migration and natural increase through birth.

The above discussed causes of urban expansion brought the following unintended negative effects. The unplanned expansion of scattered settlement having large plot size and the development of incompatible services are endangering and destroying important natural resources and at the same time incurring unnecessary environmental costs. The present unprecedented expansion and scattered development also incurred infrastructure costs especially in the provision of water, electricity, road drainage lines and waste disposal problems that affect the natural environment.

5.2 Recommendations

Bringing the development of urban areas in harmony with natural environment and over all systems of settlement is one of the basic issues to be achieving a sustainable urbanized world. The tools for achieving a physically more balanced development include not only

considering investment and economic policies, but also taking the environment into consideration. In line with the present investment and economic development the environmental aspects of the town should be taken into consideration to bring sustainable urban development in the town. Based on the above discussed findings, the following recommendations are forwarded.

- Bureau of Amhara Industry and Urban Development and the town administration together develop policies that will bring compact urban development (vertical growth of the town).

- To avoid unbalanced, unhealthy and unsustainable growth of human settlements, Debre Markos town's municipality and town administration promote development that minimizes the present fast rate land use change (conversion) of agricultural land and forest land. In addition to this the provision of development for residential purpose with medium density development should promote.

- Debre Markos town forest resources are declined due to prioritized developments i.e., residential, industrial and commercial activities. Such activities are very important for town developments regarding to urban poverty reduction and solving housing problems in one way. But according to this research findings, focusing only on above mentioned developments were adversely affected the town forest resources. Therefore, with the realization of this problem, the concerned body particularly Debre Markos town municipality and city administration incorporate environmental issues in their different plans and give more attention to reforestation and conservation program in particular.
- The present excessive and leap frog development reduces wet grass, forest and farm lands, therefore vacant lands occupied which is not still shown any development and vast areas occupied by few governmental institutions need to redevelop by the municipality in collaboration with the town administration and Bureau of Amhara Industry and Urban Development.

- Land is limited resource, which has reached a stage of scarcity in certain areas today because of rapid urbanization. In the study area, however, rural urban migration has been in efficiently exploiting the land. Thus, in order to control the problem, the municipality and the city administration of Debre Markos town

practice proper policy that enacted regarding to the management of migrants and conversion of forest and wetland to urban use.

- Lack of institutional capacity and intergration at the municipality also the causes of urban expansion in the town. Threfore, Bureau of Amhara Industry and Urban Development and the city administration build the capacity of municipality by material and human resource.
- Getting complete and accurate secondary data from Municipality, city administration and environmental protection office is very challenging particularly regarding to information on urban expansion and environment. Therefore, those sectors integrate and give more attention to documentation of data about the urban expansion and environmental issue.
- The municipality fulfills adequate equipment necessary for proper implementation of the plan. Provide each job process with basic equipment such as computers, vehicles, printers, and also the staff should be empowered for different soft ware such as GIS and Auto CAD.

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APPENDICES

Appendix-I

Questionnaires for households found at the peripheral areas of the town

The following interview is prepared to produce a research paper for the partial fulfillment of Masters Degree in environment and development specialized in development studies given by Addis Ababa University in titled, an assessment of the effects of urban Expansion on Environment in Debre Markos Town.

Thank you for your cooperation with time, energy, and efforts.

PART-I General Background

1. Sex A. Male B. female
2. Age A.18-39 B. 40-59 C. 60-79 D. 80 and above
3. Place of Birth A. D/markos town B. Migrated from other towns
   C. migrated from rural areas D. other specify
4. Educational level
   A. Illiterate B. Grade 1-8 C. grade 9- 12
   E. Diploma F .Degree and above

PART-II Questions

1. What is the trend of urban expansion?
   A. Rapidly Expanding B. Expanding
   C. Slowly expanding D. No change
2. If it is expanding what is the impact specify?

   _____

   _____

   _____

3. What is the trend of forest coverage in and around the town?
   A. increasing B. decreasing C. no change
4. If your answer for Q.3 is decreasing, what is the effect specify

   _____

   _____

5. Do you know agricultural land converted to other land use? A.Yes B. No
6. If your answer in question No.5 is: yes: for what purpose

A. Residential purpose B. for commercial area C. for industrial area D. any other (specify)_____

7. Does the city expand to the peri-urban area every year?
   A. Yes B. No
8. Is there any environmental effect on the peri-urban areas of the town?
9. Is there any conversion of agricultural land at the peripheral areas of the town?
   A. Yes B. No
10. What are the environmental effects observed because of conversion of land to urban uses?

    _____

    _____
11. Is there deforestation because of land use change due to urban expansion in the town?
    A. Yes B. No
12. What are the major causes of urban expansion in the town?
    A. Population growth B. Availability of different infrastructure
    B. Weak institutional capacity of the city administration/municipality
    C. Other specify
13. In your residential area, is there any infrastructure development like water, electricity, drainage and so on?
    A. fully full field B. partially fulfilled C. No any infrastructure
14. Please put ✓ mark on the table provided below

Impact of urban expansion	Very high	High	Medium	Low	Very low	No change
Forest land						
Cultivated land						
Grass land						
Soil						

Water						
Wetland						

Appendix-II

East Gojjam Environmental protection office and Debere Markos Environmental protection work process officials and Experts

The following question is prepared to produce a research paper for the partial fulfillment of Masters Degree in environment and development specialized in development studies given by Addis Ababa University in titled, an assessment of the effects of urban Expansion on Environment in Debre Markos Town.

Thank you for your cooperation with time, energy, and efforts.

PART-I General Background

1 Sex A. male B. female

2. Age ----------

3. Place of Birth A. D/Markos town B. Migrated from other areas

C. migrated from other woredas D. other specify

4 Your profession in the organization _____

PART-II Questions

1. Is there any conversion of agricultural land at the peripheral areas of the town?
2. What amount of agricultural land is converted into residential or any other urban land use in m^2? _____
3. What are the environmental effects observed because of conversion of land to urban uses?

   _____

   _____
4. Is there deforestation because of land use change due to urban expansion in the town?
5. What amount is defrosted? In m^2 ..... or in hectare of land_____
6. Does the city expand to the peri-urban area every year?

   _____

7. What are the major environmental consequences observed due to urban expansion in the town?
    a. positive effect_____
    _____
    b. Negative effects _____
    _____
    _____
8. What is the general trend of forest coverage, grassland coverage, and wetland coverage in your town for the previous years and now?
9. Who is responsible for the management of urban forest in the town?
10. Is there deforestation because of land use change due to urban expansion in the town?
11. What amount is defrosted? In m^2 ..... or in hectare of land_____
12. What problems do you observed due to deforestation
13. What are urban Environmental management system to conserve the environment in the town?

Appendix-III

Interview for: Municipality head and experts, the town administrator and kebele officials

The following questions is prepared to produce a research paper for the partial fulfillment of Masters Degree in environment and development specialized in development studies given by Addis Ababa University in titled, an assessment of the effects of urban Expansion on Environment in Debre Markos Town.

Thank you for your cooperation with time, energy, and efforts.

PART-I General Background

1. Sex A. male B. female
2. Age ----------
3. Place of Birth A. D/markos town B. Migrated from other areas
   C. migrated from other woredas D. other specify
4. Your profession in the organization _____

PART-II Questions

1. What is the pattern and trend of urban expansion in the town
2. What is the major cause of the present expansion?
3. What is the impact of urban on cultivated, grass, wetland and forest land?
4. Total area coverage of the town in hectare or Km^2during past and present planningperiods?_____

   _____
5. When does it was prepared the development plan of the town? _____
6. What section of the development plan incorporates the management of environment in the town?
7. Who is responsible for the management of urban environment in the town
8. Is there any urban environmental management system to conserve the environment in the town
9. What are the major existing lands uses in the town?

   _____

   _____

10. Major existing land use in percentage of the total area.

A. Residential____ G. transportation____

B. Administrative ____ H. Forest cover ____

C. Commercial_____ I. agriculture_____

D. Service_____ J. Road_____

E. Industry and commerce___ K. Others_____

F. Recreation and greenery ___

11. What amount of land was provided by the municipality for different land uses today?

For residential_____

Others_____

12. Does the city expand to the peri-urban area every year?

13. What effect is observed in the peri-urban areas because of urban expansion?

_____

_____

_____

14. Is there any vacant land in the city center? Yes ☐ No ☐

If your answer is "yes" how many square meters?_____

Why is it Vacant

_____

_____

_____

Appendix-IV

Observation

1. The extent of urban expansion
2. Deforested area in the town
3. Change of agricultural land to other land use

Appendix-V

Trend of population growth and projection of Debre Markos town

No	Year	Male	Female	Total population
1	1967	9768	11768	21536
2	1970	12537	14536	27073
3	1984	18543	22593	41136
4	1994	22745	26552	49297
5	2007	29921	32576	62497
6	2008	34101	36994	71095
7	2009	35483	38497	73980
8	2010	36923	40063	76986
9	2011	38424	41695	80119
10	2012	39988	43396	83384
11	2013	41618	45168	86786
12	2014	43317	47015	90332

Source: From NUPI, 1998 and Debre Markos town adminstration office report, 2013.