Population Dynamics and its Impact on Land Use / Cover in Ethiopia: the Case of Mandura District of Metekel Zone, Benshangul-Gumuz Regional State

By

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DECLARATION

I declare that **Population dynamics and its impact on land use and land cover in Ethiopia: The case of Mandura District of Metekel Zone, Benshangul-Gumuz Regional State** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

_____   04 April 2014

Tegegne Sishaw Emiru   Date

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DEDICATION

This work is dedicated to the memory of my mother Belaynesh Alemu, the late, whom I missed in 1995 during my MA study at Addis Ababa University. Always you are in my heart. Let your Soul rest in peace.

TABLE OF CONTENTS

vii

LIST OF FIGURES

LIST OF TABLES

LIST OF ANNEXES

LIST OF ACRONYMS

AOI	Area of Interest
BGNRS	Benshangul-Gumuz National Regional State
CSA	Central Statistical Agency
DFID	Department for International Aid (United Kingdom)
EDHS	Ethiopian Demographic and Health Survey
EHRS	Ethiopian Highlands Reclamation Study
EMA	Ethiopian Mapping Agency
EPA	Environmental Protection Authority
EPE	Environmental Policy of Ethiopia
FAO	Food and Agricultural Organization
ha	hectare
iied	international institute for environment and development
LULCC	Land use/cover Change
MEA	Millennium Ecosystem Assessment
MoA	Ministry of Agriculture
MoARD	Ministry of Agriculture and Rural Development
NGO	Nongovernmental Organization
PRA	Participatory Rural Appraisal
RMS	Root Mean Square
UNDP	United Nation Development Program
UNFPA	United Nations Population Fund
UNIDO	United Nation Industrial Development Organization
UTM	Universal Traverse Mercator
SPSS	Statistical Package for Social Sciences
SSI	Semi-structured Interview
TFR	Total Fertility Rate

ACKNOWLEDGMENTS

ABSTRACT

It is evident that Ethiopia is one of the countries of Africa that is experiencing significant population growth as well as land use/cover dynamics. Land use/cover induced degradation of natural resources is a major challenge to the country's development. The main objective of this study was to investigate the impact population dynamics has had on land use/cover in Mandura district. Data on population over time were taken from the CSA during the 1984, 1994 and 2007 national census results. A total of 210 farm households from three kebeles: 105 from the local people and 105 from migrants were surveyed in May 2011 to acquire data on socioeconomic, land use, resource use and management. Aerial photographs of 1957, 1982 and SPOT-5 image of the 2006/07 were used to generate data on land use/cover changes. The results indicate that population has substantially increased, more than fourfold between 1957-2006/07, mainly due to migration from the surrounding areas, government sponsored resettlements, and flourishing of new urban centers. No less important is mortality has decreased due to immunization and the birth rate has been increasing due to improved maternal and child care as compared to the situation prior to the 1990s. The change on land use/cover show that from the total land use/cover conversions, which totals 58,403 ha of land, farm land constitutes 90.1 %. The study finds natural population increase, migration, urbanization, agricultural extensification, institutional weakness, land tenure insecurity, famine and drought, and poverty as root causes. The study further identifies existence of all weather road, resettlement, Tana-Beles project, expansion of agriculture, land colonization, wood extraction for fuel, and soil fertility decline as direct causes of land use/cover changes. As a result of change of customary land tenure system, the local population has been forced to engage in extractive economic activities that have never been practiced in the past. Therefore, the study calls for coordinated efforts for resources use and management at different levels, land use policy formulation, devising alternative sources of livelihoods and fuel, regulating migration and involvement of the wider community in policy formulation and implementations.

Key Words:

 Land use/cover; population dynamics; local population; migration; shifting cultivation; government policy; Mandura; Metekel; Benshangul-Gumuz; Ethiopia

CHAPTER ONE

INTRODUCTION

1.1. Background

Many developing countries are using their natural resources at rates faster than the natural rate of replacement to sustain their rapid population growth; to generate foreign exchange; and to produce raw materials for industries. Land, water and forests are among those valuable resources under excessive pressure due to human exploitation. Millions of poor farmers destroy vast tracts of forest lands to make room for agricultural activities that will provide sufficient food for their household, community or country (Drechsel, kunze and Vries, 2001; McNeill, 2006; Appiah *et al*., 2007).

Agriculture is still the main focus of national development plans of many developing countries, particularly in Africa. Land policies and reforms have been widely instituted in several countries in an effort to improve the performance of the agricultural sector. However, it has not always been accompanied with success. In most countries, traditional agricultural practices and low productivity still persist despite major reforms and large monetary investments to transform the sector. Where agricultural innovations have been introduced, short-term successes have often been followed by long-term problems on natural resources and the environment (Miay, 1976; Drechsel, kunze and Vries, 2001; MEA, 2005; Appiah *et al*., 2007).

Environmental degradation is the most frequently occurring and rapidly accelerating problem related to agricultural activities. In practice, most agricultural programs tend to place a heavy emphasis on increasing productivity and less attention on resource management and conservation as a result of which the social and environmental implications of increased pressure on natural resources remain overlooked until a serious

1

degradation occurs (Miay, 1976; Fischer, 1993; Davol, 1998; Makhanya, 2004; Long *et al.*, 2007).

There is rising concern that much of Sub-Saharan Africa's natural resource base and ecological environment are deteriorating mainly due to high loss of vegetative cover resulting from deforestation and conversion of savanna to cropland (Bielli *et al.*, 2001).

In Ethiopia, agriculture is the backbone of the economy and plays key role in creating employment and generating foreign currency. It supports some 85% of the working force, produces about 41 % of the gross domestic product and generates over 90% of the country's export earnings (Waldyes, 2013). Because the sector is overwhelmingly dominated by subsistence endeavors, land degradation is widely prevalent (Aredo, 1990; Zeleke and Hurni, 2001). This problem is further exacerbated by the heavy concentration of population, livestock and economic activities on climatically favored highland areas of the country. In Ethiopia, the highlands[1] constitute 43% of the total area of the country, 95 % of the regularly cultivated land, 90 % of annual national crop production and nearly 45% of the grazing land, and support about 80% of the livestock and 90% of human population (MoARD, 2008). This is so because the highlands are less infested with fatal tropical diseases like malaria and trypanosomiasis as compared to the lowlands (Kloos and Adugna, 1989). As a result, these areas, specifically the north, happen to be the most vulnerable and degraded physiographic regions in the country (Bruene, 1990; Wolde-Mariam, 1990; Berisso, 1995; McCann, 1995; Nyssen, Simegn and Taha, 2009). As a consequence of population and livestock growth, and heavy economic activities concentration, land suitable for cultivation is running short in much of the highland regions of the country. Furthermore, heavy concentration of both human and livestock population accentuated biophysical loss and eventually induced overgrazing and soil erosion that in turn led to land degradation (Nyssen, Simegn and

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[1] *In Ethiopia, the highlands are defined as areas above 1,500 meters above the mean sea level.*

Taha, 2009). Studies so far made convincingly confirm that the land use/cover changes occurred in Ethiopia have reached its climax in the highlands partly due to the factors mentioned above (Tekle and Hedlund, 2000; Zeleke and Hurni, 2001; Tegene, 2002; Bewket, 2003; Amsalu, 2006; Garedew *et al*., 2009; Nyssen, Simegn and Taha, 2009; Tsegaye *et al*., 2010).

Increased population pressure, the degradation of agricultural land and the prevalence of natural calamities which led to droughts resulted in population relocation from one part of the country to the other. The lowlands of Ethiopia where population size and densities are relatively low have been the destinations of this endeavor by the government over the past years.

1.2.   Statement of the Problem

The impact of population dynamics, especially the absolute increase in human numbers each year due to natural increase and/or mobility, has had a crucial effect in the state of natural resources. As population continues to expand in number, it exerts increased pressure on the proper functioning of the ecosystem and natural resource stocks. One of the reasons for the shrinking size of land holdings as well as the degradation of forest, soil, and water resources in many areas of the developing world is the direct result of rapid population growth (Arnon, 1987; UNFPA, 1991; Drechsel, kunze and Vries, 2001; Etter *et al*., 2006; Pabi, 2007; Boone *et al.,* 2007; Nguyen, 2008). The Millennium Ecosystem Assessment (MEA) contends that "humans are fundamentally, and to a significant extent irreversibly, changing the diversity of life on earth, and most of these changes represent a loss of biodiversity" (MEA, 2005:18). According to Rees (2011), much of the population growth in the next forty years will take place in less developed countries, particularly those of sub-Saharan Africa. In Africa, the transition to a lower fertility regime is still in progress; total fertility rates still exceed 6.0 in some countries, and there is little evidence that a downward shift in fertility is about to occur (Newbold, 2010).

Natural resources have to be properly utilized and managed to meet the changing and rising demands of the people now and in the future. The larger the number of people, the greater the density and the more will be the pressure on resources. Various studies indicate that there is a marked resource loss because of population pressure in Sub-Saharan Africa (Drechsel, kunze and Vries, 2001), Eastern Madagascar (Kull, 1998), China (Long *et al*., 2007) and Dominican Republic (Sambrook, Pigozzi and Thomas, 1999). Turner, Meyer and Skole (1994) also contend that land cover changes stemming from human land uses represent a major source and a major element of global environmental change. The same authors underscore that human actions are altering the terrestrial environment at unprecedented rates, magnitudes, and spatial scales. Further, the Millennium Ecosystem Assessment (MEA) states that over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fiber, and fuel (MEA, 2005:16). Ehrlich and Ehrlich (1990) and Bassett and Zuéli (2000) also state that Africa is overpopulated now because, among other indications, its soils and forests are rapidly being depleted and that implies that its carrying capacity for human beings will be lower in the future than it is now.

In Ethiopia, too, rapid population growth and uneven spatial population distribution have been putting immense pressure on the natural resource base, leading to a gradual deterioration in both quantity and quality. According to Mamo (1995), Embaye (2000), and Teferra (2009), population growth leads further to unnecessary natural resource exploitation such as forest clearing both for farming and settlement purposes, short fallow periods, and land fragmentation which has a direct adverse effect on agricultural output.

Most of the population of Ethiopia have settled on the highlands, with the northern and central highlands being the oldest settled regions of the country. These regions are the most exploited and environmentally degraded areas in the entire country. In the highlands, due to the shortage of arable land, land is continuously utilized year after year

thus leading to diminishing yields (Kebbede and Jacob, 1988; Assefa and Zegeye, 2003). This condition, coupled with the occurrence of recurrent droughts and famine, has forced people from the northern and central highlands to move to the southern, southwestern and northwestern parts of the country for resettlement both in a planned and spontaneous manner. These resettlements have resulted in population pressure and consequent environmental and of natural resources depletion or degradation (Assefa and Zegeye, 2003; Paterson, 2007).

As a result of the movement from north to south, a noticeable population change has gradually prevailed in the Metekel region of Ethiopia, one of the areas to which population shifts have taken place. However, this decision has brought about complex changes in the socio-cultural, economic and ecological conditions in the Beles valley of Metekel (Woldemeskel, 1989; Abute, 2002, 2004). Yntiso (2003) and Abute (2002) document these changes by indicating how massive resettlements in the 1980s have impoverished the local population[2] and created hostility among ethnic groups particularly in the Beles valley of Metekel area. Moreover, Woldemeskel (1989) points out that vegetation and forests in Metekel were cleared indiscriminately during resettlement for house construction and other purposes. These studies, however, give less emphasis to population dynamics and land use/cover changes resulting from these processes. Assessing ongoing changes in population dynamics and land use/cover in this region is vital given the fact that more development endeavors namely, hydropower generation, irrigation, and mechanized agriculture are being undertaken by the government. This area also has one of the highest population growth (3%) rates in the country (CSA, 2008a). Furthermore, the region has recorded one of the highest total fertility rates (TFR) which was 5.2 in 2011, higher than the national average which was 4.8 (CSA, 2012). The consequences of all this on natural resources degradation and management need further investigations. Recent studies have also revealed that due to improvements in socio-economic conditions, i.e. for example, construction of an all-

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[2] Local population/people refers to the indigenous Gumuz population of the area.

5

weather road and government-led development programs, population size has increased in the northwest lowlands of Metekel resulting in considerable changes in the patterns of land use/cover. Furthermore, the migration of people from the highlands to the lowland areas, voluntarily or otherwise, has caused changes in the socioeconomic relations between migrants and the local people by intensifying the conflicts over natural resources (Pender, 2001; Taddese, 2001; Yntiso, 2003; Abute, 2004, Patterson, 2007).

Over the past four decades, quite a lot of studies related to resource degradation have been carried out in many places of the Ethiopian highlands (Such as FAO, 1986; Abate, 1994; Tekle and Hedlund, 2000; Zeleke and Hurni, 2001; Tegene, 2002; Bewket, 2003; Woldetsadik, 2003; Amsalu, 2006; Garedew *et al*., 2009; Tsegaye *et al*., 2010; Bantider, Hurni and Zeleke, 2011; Ayalewl, Kassahun and Woldetsadik, 2012; Bewket and Abebe, 2013). On the contrary, studies related to population dynamics and land use/cover changes in lowland areas of the country have been scanty or do not cover the different contexts of the country. Firstly, studies made so far at national and international levels convincingly indicate that the relationship between population changes and land use/cover dynamics is an enduring debate (see Jolly, 1994; Stock, 1995; Muriithi, 1996; Panayotou, 2000; Drechsel, kunze and Vries, 2001; Perz, Aramburu and Bremner, 2005; Sherbinin *et al*., 2007; Hummel *et al*., 2009; Tsegaye *et al*., 2010; Bantider, Hurni and Zeleke, 2011). Such unanimous need for further debate calls for additional empirical evidences, and the replication of these studies through the analysis of proximate and underlying factors of land use/cover dynamics in the study area would shade light on the ongoing debate on population-land use- resource interface. Secondly, of the few available studies conducted in the study area, the method of data acquisitions were gravitated more towards the ethnographic and historical methods (Yntiso, 2003; Abute, 2004; Endalew, 2006, Mekuria, 2008). While those studies are important for acquisition of qualitative information on the ground, they fail to capture and quantify changes in the biophysical variables of the study area. This research attempts to fill these gaps by employing a range of data acquisition methods, viz., aerial photographs, satellite imageries, field surveys, and group discussions. Furthermore, the previous studies in the

study area did very little to unravel the complex factors and linkages between population dynamics and environmental changes on one hand and non-demographic factors on the other hand.

The Environmental Policy of Ethiopian (EPE) was formulated and issued in 1997. Policies have also been set up in several agencies and specific institutions to address the environmental dimensions raised in the EPE. Some examples are the formulation of a Water Resources Management Policy, a Biodiversity Strategy, and a draft entitled 'Land Administration and Land Use Policy'. However, it has been reported by McKee (2007) that there are significant gaps between policy formulation and implementation in Ethiopia. So far, the existence or the lack of such gaps is not investigated in the context of the study area. An assessment of the processes and factors leading to population dynamics and the resultant land use/cover change becomes indispensable and timely to promote sustainable economic, social and ecological development in the study area in particular and the country in general. Such a study would also serve as a basis to influence development interventions and policy discussions related to population changes and natural resources degradation and management.

1.3.   Objectives of the Study

The main objective of this research is to investigate the impact that demographic and non-demographic variables have had on land use/cover in Mandura district, northwest lowland of Ethiopia. More specifically, it tries to:

a) analyze the extent and patterns of population dynamics since the 1957;

b) investigate land use/cover changes since the 1957 in the study area;

c) examine the perceptions and responses of farm households on the trends and drivers

of   land use /cover carnages and population dynamics in the study area;

d) appraise the effects of policy changes on livelihoods, land use/cover and population dynamics.

7

1.4.   Research Questions

Based on the stated objectives above, the research is intended to address two key questions:

❖   What major land use/cover changes have occurred as a result of population dynamics over the past four decades?

❖   What were the major responses to these changes and to what extent have those responses help to address the problem?

1.5. Significance of the Study

Many African countries including Ethiopia are experiencing rapid and accelerating population growth which has induced adverse effects on the natural resources and environment. This study is designed to thoroughly assess the degree and extent of demographic and non-demographic factors that induced adverse effects on the natural resources and environmental changes and will attempts to provide insight on the possible direction(s) to address the problems.

This study is designed to contribute to the debate on the effects of population environment nexus by generating evidences using different methods of data collection like aerial photograph and SPOT (satellite image) analysis to unveil how the natural environment has changed through time in the district. Consequently, land use/cover map of the study district will be developed which in turn would be used by experts at different levels for resource inventory, future appropriate innervations, and basic document for future references. The study will also contribute towards the understanding of the magnitude of change from the point of view of resources degradation, economic activities dynamics and, livelihoods change thereby indicates directions how smallholders could cope up with these problems.

Furthermore, the results of the study will generate relevant information that will contribute to the development plans of the region in terms of planned population

relocations and land use planning and management. The lowland areas of Ethiopia are the least studied parts as compared to the highlands. The result of the study can be used to inform and influence policy makers at different jurisdictions on development interventions and policy discussions related to population environment nexus.

1.6. Scope and Limitation of the Study

The study was conducted in Mandura district of Benshangul-Gumuz national regional state (BGNRS), Ethiopia. It was restricted in three rural kebeles[3] (out of thirteen) for detailed demographic and socio-economic survey. However, detail land use/cover study has been undertaken for the entire district. Moreover, the land use/cover and population dynamics was considered between 1957-2006/07 based on the available aerial photographs and satellite image (SPOT), almost over a period of half a century. As Ethiopia has conducted the first census in 1984, there is no official population data. Thus, population size of the district prior to 1984 was projected based on results of the first census. The third population and housing census was carried out in 2007 after thirteen years which makes comparison of population changes difficult. Moreover, the field work has been carried out while the villagization program was on progress. As a result, some farmers were suspicious as to the intent of the study and have largely shown some level of reluctance (mainly underreporting) to tell the correct information on land under their holdings, amount of yield produced and number of livestock possession. This was partly due to the coincidence with the documentation prepared by the regional government for rural land administration and use in February 2011. On top of that, the memory lapse pertaining to what has happened long ago (ten to twenty years back) on land use/cover and population changes, partly emanated from low status of education, were one of the limitations of the study.

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[3] Kebele is the lowest administrative unit in Ethiopia.

1.7. Thesis Chapter Outline

This thesis has eight chapters. Chapter one is concerned with the preliminary section of the study including: introduction, problem statement, objectives, research questions, significance of the study, scope and limitation of the study, and operational definition of terms. Following this is review of past works (theoretical contexts and empirical evidences) on issues related to population dynamics; land use/cover changes, development and policy contexts at international and national levels were appraised so as to identify knowledge or methodological gaps. Chapter three deals with research methodology embracing research design, population, sampling and methods of data analysis and description of the study area which discuses about physical, socio economic and demographic aspects of the study area. Demographic and socio-economic characteristics of the surveyed population were presented under the fourth chapter.

One of the objectives of this study, population dynamics over time was presented in chapter five. Chapter six devoted for farming system and land use/cover dynamics since 1957 in the study district. Moreover, major human drivers of land use/cover were furnished in the same chapter. Under chapter seven farmers perception on trends and drivers of land use/cover changes, major environmental problems and correlates of resources management practices were discussed. Chapter eight synthesizes the major findings of the study. It summarizes the major findings of the study in line with the objectives stated and unveils the palace of this research work in view of existing theories reviewed in the literature. Moreover, it presents concluding remarks of the study and puts forward recommendations and future research directions.

1.8. Conclusion

Land use/cover changes are widely experienced events in many developing countries including Ethiopia. The reasons for this change are multifaceted factors one of which is population dynamics. Studies so far conducted acknowledge population dynamics with

other factors as one important driving force (Zeleke and Hurni, 2001; Tegene, 2002; Bewket, 2003; Amsalu, 2006; Garedew *et al.*, 2009; Tsegaye *et al.*, 2010). Ethiopia as one of the developing countries cannot be an exception to this fact. The regional state under study similarly experience one of the fastest population increase, 3% (CSA, 2008b) and accelerated land use/cover changes. Though the reasons for environmental changes are many, population dynamics mediated by other factors is supposed by the researcher to be the most important one. The study tries to uncover how population dynamics and other non demographic factors over time have impacted the land use/cover in the study area.

CHAPTER TWO

LITERATURE REVIEW

2.1.   Introduction

The review literature of this study has appraised existing debates on population and environment nexus, empirical evidences at international and national levels, and causes of land use/cover changes. It further incorporates issues like changes that mediate population as driver, migration, agricultural practices, resettlement, land tenure, and government policies as agents of land use/cover dynamics particularly focusing on Ethiopia.

2.2.   Theoretical Framework

2.2.1. Perspectives on Population Change and Environment

Population experts offer different perspectives and models regarding population dynamics, consequences and ways of overcoming its effects on natural resources and the environment. These perspectives include the models of classical economists, neo-classical economists, dependency, intermediate variables, and Boserupian hypothesis (Jolly, 1994; Stock, 1995; Kalipeni, 1996).

Classical economists argue that high population growth results in environmental degradation. Their theory is grounded on the work of economist Thomas Robert Malthus (1873) who argued that population grows faster than food supply. He suggests that humans have to take actions to reduce fertility. Consequently, he recommended as remedy abstention from sexual intercourse and chastity. If population growth is left unchecked, he argued, natural checks such as famine, pestilence, and war will reduce population growth. Today, neo-Malthusian population experts like Paul Ehrlich and

Hardin (1968) believes that Malthusian prophecy is currently happening in Africa where the pace at which population is growing is higher than the rate at which the economy is growing (Jolly, 1994; Stock, 1995; Muriithi, 1996; Panayotou, 2000; Drechsel, kunze and Vries, 2001; Perz, Aramburu and Bremner, 2005). These experts suggest fertility reduction as the key to preventing environmental destruction and to improve living standards (Jolly, 1994; Sherbinin *et al*., 2007). The Malthusian view is described as linear perspective which means that it assumes direct, causal linear relationship between population and environment, and thus, simplifies the population environment interaction (Hummel *et al*., 2009).

Neo-classical economists, on the other hand, stress that inefficient market and inappropriate pricing policy as the causes of environmental degradation (Jolly, 1994; Sherbinin *et al*., 2007). In other words, inept government policies are responsible for this problem. Jolly (1994) and Panayotou (2000) suggest a course of actions like reducing subsidies that encourage over exploitation of resources, make people to pay full costs of using common resources that make the market more efficient and effective as the best way to overcome this problem.

The proponents of the dependency model argue that uneven distribution and consumption of resources is more culpable than population size and growth. In this case equitable distribution and consumption of resources is the obvious solution to tackle the problem (Jolly, 1994; Stock, 1995; Kalipeni, 1996; Perz, Aramburu and Bremner, 2005; Sherbinin *et al*., 2007).

Theorists known as the proximate determinists argue that high population growth alone does not cause environmental degradation. They contend that population increase should be linked to other mediating factors to result in environmental degradation. In other words, high population increase aggravates resource loss in conjunction with other factors like level of technology, consumption, institutions, poverty and policies (Jolly,

1994; Turner, Meyer and Skole, 1994; Barrow, 1995; Carr, Suter and Barbieri, 2005; Perz, Aramburu and Bremner, 2005; Harte, 2007; Pabi, 2007; Sherbinin *et al.*, 2007).

Boserup, a Danish economist, has also developed a framework known as Boserupian Hypothesis. This hypothesis shows the link that exists between population change and agricultural development. According to her hypothesis, population growth is not a hindrance for agricultural development, rather she argues that, population growth stimulates new agricultural techniques through agricultural intensification, livelihoods diversification and stimulating out migration so as to cope up with the changing situation (Harrison, 1992; Drechsel, kunze and Vries, 2001; Carr, Suter and Barbieri, 2005; Demont *et al.*, 2007; Sherbinin *et al.*, 2007). For example, population pressure through time transforms shifting cultivation which demands more land to practice to land saving and labor intensive type of agriculture such as annual cropping system (Boserup, 1965). But it is stated by Otsuka (2001) that her argument is lacking the incorporation of relevant investments like construction of irrigation facilities, terracing and tree planting that intensive farming requires. Such investments, in turn, are dictated by land tenure institutions prevailing in the area.

The above discussions evidently indicate that different schools of thought have different arguments and perspectives pertaining to the relationship between population growth and environmental change. This clearly indicates the fact that the debate on population and environment is fluid and yet requires further scrutiny and understanding with new empirical evidences.

2.2.2. *Population Dynamics and its Implication on Environment*

Under this section population dynamics which include changes occurring on population size, growth, distribution, and composition and their corresponding effects on the environment will be briefly discussed.

Population Growth and Size

The World's population started to increases fast since the mid 1600s following improvements in commerce, food production, security and nutrition (Rees, 2011). In particular "the past fifty years have witnessed two simultaneous and accelerating trends: an explosive growth in population and a steep increase in resource depletion and environmental degradation" (Panayotou, 2000:1). Population size is supposed to increase for the future though fertility rates in many countries are falling down. All of the projected population growth is expected to occur in the developing world (MEA, 2005; Sherbinin *et al*., 2007). Such increasing population means corresponding demand for resources on planet earth: air, water, and land environments (MEA, 2005). Moreover, increasing population size as it was stated by Cuffaro (2001: 118) also results:

> *…under the pressure of fast population growth and/or when population densities are very high, the process may not go from balanced management of communal property to a complete definition of individual property rights, but rather may result in a breakdown of traditional systems into de facto open access, with the associated environmental degradation.*

Furthermore, most severe desertification is found in areas where rapidly increasing human populations are contributing to rapidly changing land use patterns (Ehrlich and Ehrlich, 1990; MEA, 2005). The effect of fast and accelerated population increase on the environment was best summarized by the work of Bewket (2003:26) as "whereas natural effects such as climate change are felt only over a long period of time, the effects of human activities are immediate and often radical". To this effect, countries have devised policies and strategies so as to reduce fast increasing population. But reduction of population size alone is not sufficient to combat human induced environmental changes (Hardin, 1999). Rather many other factors aggravate human induced environmental changes. Factors like consumption as well as volume of pollutants that have produced in the process alter the environment (Hardin, 1993). Population growth varies over space. Accordingly, over 80 % of the world population as well as 98 % of world population

growth is currently occurring in developing countries (Newbold, 2010)**.** The same source further reveals that, Africa, and particularly Sub-Saharan Africa, has growth rates in excess of 2.5 % and total fertility rates that exceed 5.00 (Newbold, 2010; Population reference bureau, 2012). The net result of all these are relatively high population growth to exist which eventually resulting population size to remain high the years to come in many developing countries of the world.

Population Distribution and Composition

Population distribution at international, regional or country level never has been equal. Different factors explain this spatial and temporal inequality. Physical (natural), socio-economic, political and demographic factors are those affecting population distribution over time and space. One of the most important factors that shape the temporal and spatial distribution of population in a particular area is migration. This is so because the push factors persuade migrants to leave their area of origin and move to other localities. Equally important is the pull factors that attract migrants to a particular destination. Whatever the reasons are the trend in many developing countries including Ethiopia is such that internal population movement is high. For instance, in Ethiopia the redistribution is from long settled and degraded highlands to lowlands where there exists ample agricultural land triggered by different push- pull factors. There is likelihood in some instance that migration has simply shifted economic and environmental problems from one locality to another. In due course, this problem will increase its spatial scale (Hunter, 2000). The same source further contends that because of population redistribution pressure will mount on the existing resources. For example, wood cutting for fuel in developing countries has increased in alarming rate. Case in point is rate of consumption exceeds rate of sustainable supply by 70 % in the Sudan, by 150 % in Ethiopia, and by 200 % in Niger (Hunter, 2000). That was why Comenetz and Caviedes (2002) reported that Ethiopia appears to be a good example of climatic and political agents interacting to elicit significant changes in population distribution.

Age composition has important implications for future population growth because younger population possesses greater growth momentum (Ehrlich and Ehrlich, 1990; Miller and Spoolman, 2010). The majority of population in Africa including Ethiopia is young. Propensity of migration varies by age, with young adults showing the highest likelihood of moving for different opportunities. Especially those moving to rural areas increase pressure on the existing natural resource stocks including forest, land and water in an effort to satisfy their different needs (Hunter, 2000).

2.3. Mediating Factors: Science and Technology, Institutions and Policy

The relationship between population and environment is not simplistic; it is rather complex and non-linear. The influence population has on the environment is mediated by different factors including science and technology, institutions and policy (Sherbinin *et al*., 2007). According to Bielli *et al*., (2001), mediating factors should be viewed and analyzed for their influence at multi-level scales such as household, community, national, and international levels. Moreover, Sydenstricker-Neto (2012:87) states that "Population environment relationships are better understood if conceptualized as being mediated by economic, social, cultural, and institutional factors."

Technological change has impacted the environment since the pre-historic time. Hunter (2000) demonstrates the situation in four simple events. Discovery of fire made pre-historic society stable; the agricultural revolution that enabled humans to use draft animal for farming; utilization of wind energy for ships stimulated population mobility; through time human beings widely utilized coal and electricity which in turn, triggered flourishing of urban centers (Hunter, 2000). These and subsequent technological and scientific advances have mediated population to considerably alter the natural environment (Sherbinin *et al*., 2007). This is so because land use/cover changes in many parts of the world are the result of agricultural technological transformations. Population which has changed the environment is moving from one area to another in response to improvements in transportation infrastructure (Witherick, 1990). The same source

further argues that energy consumption is the other way of looking into how technology mediates population and environment. For example, prior to the 1960s developing countries use little amount of wood and biomass like cow dung (Hunter, 2000). Study conducted in Ethiopia indicates that nowadays cow dung, which once has been dominantly used for improving soil fertility, becomes one of the most important sources of income for rural households and important source of fuel for urban dwellers (Amsalu, 2006).

Policy contexts also mediate population and environment as policies may positively or negatively affect the environment. In this regard Hunter (2000) states that policy plays a key role in determining the final effect of humans on the environment. Geist and Lambin (2002) identify 78 % of tropical deforestation is constituted by institutional factors including policies on land use, economic development as related to colonization, transportation, or subsidies for land based activities. The same source further underscores that land tenure arrangements and policy failures such as corruption or mismanagement in the forestry sector are important drivers that mediate population and environment (Geist and Lambin 2002). Another land use/cover change study in China, Daqing city indicates that policy intended for fast economic growth resulted in built up and agricultural land areas increase and decline of wetlands and forest cover due to population increase, indicating how policy options mediate the environment and population (Yu *et al*., 2010). Likewise, a study in Bangladesh, Greater Dhaka indicates that rapid urban expansions through infilling low-lying areas and clearing vegetation policy have negatively affected the environment (Dewan and Yamaguchi, 2009). Absence of detailed study and policy has resulted in forest area decline and land degradation in Hindu Kush Himalayan region of Pakistan (Qasim *et al*., 2010). Another study in Tanzania also indicates that the settlement policy of the government has influenced the current land use/cover changes in Haubi area and other parts of the Irangi Hills (Kangalawe, 2009). Land use/cover changes assessment in Nepal, Roshi watershed, also reveals that changes in the physical environment may be linked with policy and its implementation (Gautam, Webb and Elumnoh, 2002). In an attempt to

classifying typology of the causes of land use/cover changes, Lambin *et al*., (2003) put policy issues as one of the most important driving forces in tropical region. In Nepal absence of clear policy guideline eventually yielded gradual deterioration of the forest ecology in the Bardiya district (Conway, Bhattarai and Shrestha, 2000).

International and national experiences convincingly show that institutions and policies enacted and implemented serve as intervening factors between population and environment either to affect positively or negatively the natural environment.
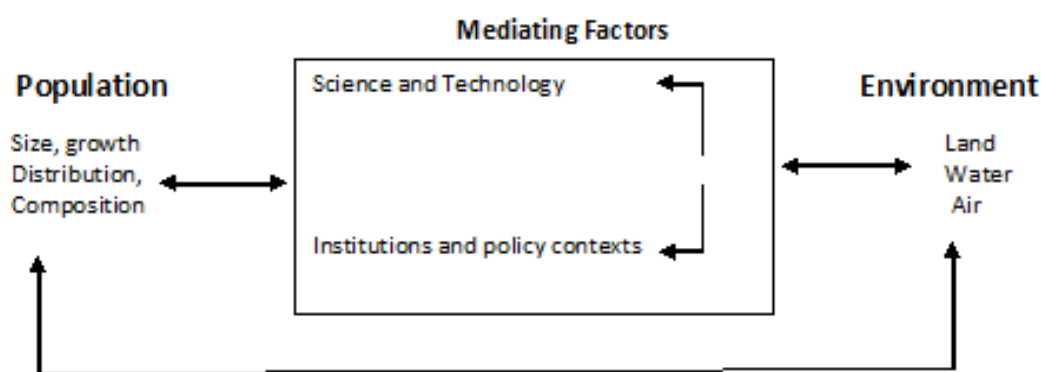
Figure 2. 1. Mediating Factors and their Interaction
Source: Mackellar *et al*., 1998 (Cited in Hunter, 2000)

2.4. Migration: Process and its Impact

People are moving from one area to another for different reasons. The two principal forces that play prominent role in this regard are the push and the pull forces which work at area of origin and destination respectively. Push forces which work in the migrant's home area, are pressures which persuade the person to move away and might include the impact of natural disasters (drought, floods, and famine), low wages, persecution and civil war. The pull forces are those which attract the migrant to a particular destination. Good social and welfare services, a pleasant environment and political freedom are

typical pull factors. Broadly speaking, push and pull factors fall into four categories: physical, economic, social and political. Quite often, sorts of complementarities exist between particular push and pull factors (Witherick, 1990; Carr, 2009; Newbold, 2010). Whatever the cases are these processes and actions eventually result population gain or loss to the area of destination and origin respectively. The area that receives population without any question experiences population pressure, and consequently environmental problems. That is why Amacher *et al.*, (1998) state that migration is a temporary outlet for population pressure, but often it only creates new population pressures and new environmental degradation in the region of in-migration.

Migration itself creates migration networks and migration systems; a process described by Haas (2010) migration often leads to more migration. The same author further states the situation as follows:

> *Besides financial and human capital, social capital needs to be recognized as a third crucial factor determining people's motivation and ability to migrate. The formation of an established migrant community at one destination will increase the likelihood of subsequent migration to the same place. The cost and risk-reducing role of networks makes migration, once set in motion, notoriously difficult for governments to control (Haas, 2010:1590).*

This means that once there are migrants in a particular destination they attract others through social networking and other attachments, especially kinship. According to Haas (2010), social capital, in the form of strong kinship and social bonds, facilitates the migration of group members.

The type and volume of migrants in the world is given in Zelinsky's work (1966) where he puts forward five Phases. He argues that as a nation or region progresses through the various stages, there are orderly changes both in the types and amount of mobility, as well as changes in the types of migrant. The general transition is from very limited geographical and social mobility towards much wider more complex from of movement (Zelinsky, 1966).

The first phase of the pre-modern industrial society is characterized by high rates of fertility, mortality and low rate of natural increase. At this stage, the society is associated with traditional subsistence practices, such as hunting, shifting cultivation and food gathering, and pastoralism. As a result, there is little migration. In the second phase of the early transitional society there is combination of a slight rise in fertility and marked decline in mortality rates which in turn results in a higher rate of natural increase. The need to feed an increasing total population encourages people to colonize new areas for agriculture. Zelinsky described this as frontier ward migration into more remote and hitherto unused parts of the country. Moreover, at this stage, there is a growing volume of rural urban migration stimulated by its associated urbanization.

The third phase of the late transitional society is characterized by decline of natural increase rate, principally due to a major fall in the fertility rate. Frontier ward migration begins to decline as colonization gradually spreads to almost all parts to the national territory; the stock of unused land becomes exhausted. On top of that, rural to urban migration becomes the dominant movement. There is also a marked rise in inter-urban and intra- urban migration. Circulation continues to increase with continuing growth in the structural complexity of both the economy and society. The Advanced Society, which is put as the fourth phase in the model is characterized by fairly stable fertility and mortality causing little natural change to prevail. With static population number, there is no longer frontier ward migration. The volume of the movement from countryside to city continues to decline in absolute and relative terms. It is migration between towns and cities and within large urban centers making a significant contribution mainly associated with leisure, recreation, and increase in affluence. Transport improvements encourage considerable growth in the volume of commuting.

Finally, under the fifth phase of future super advanced society, he suggests that advances in communications technology would reduce the need for some forms of circulation particularly in the world of business and commerce, what Zelensky called it potential circulation absorbed by communication. Transportation improvements, trends in the

pattern of urbanization and social changes are certainly helping to sustain the level of circulation. They are contributing to more and even longer distance commuting. Movements that formerly required a change of residence might not be undertaken without any such change. Zelensky described this as potential migration absorbed by circulation (Zelinsky, 1966).

In view of this, most of the developing world falls within the second stage of the mobility transition (the early transitional society). This stage is characterized by a combination of a slight rise in fertility and marked decline in mortality rates results in a higher rate of natural increase. The need to feed an increasing total population encourages people to colonize new areas for agriculture, also called frontier ward migration into more remote and hitherto unused parts of the country (Zelinsky, 1966; Carr, 2009; Newbold, 2010). Asia and Africa remain at an earlier stage of migration regime, in which rural to rural migration dominates instead of rural to urban migration Bilsborrow and Carr, 2001; Newbold, 2010). Carr (2009) further contends that not only population pressure, unemployment and land scarcity at areas of origin (push forces) but also low population pressure is a pull force to a frontier. Consequently, Amacher *et al.*, (1998) argue that availability of undeveloped land like forest land with insecure right with the existing tenure is important attractor of migrants. On the other hand, Liang and white (1996) indicate that migration decision by people is not so much because of an individual rational calculation of costs and benefits of migration, but rather in response to the government's strategic and economic policies and sometimes because of wider political changes. Indeed, in Vietnam large scale frontier ward migration triggered by the government has resulted in negative environmental consequences on forests, undermine local people resource management, and environmental resource base (Locke, Adger and Kelly, 2000).

Migration is selective in nature. Socio-demographic or socio-economic characteristics such as age, race, income, housing tenure, education, and marital status of the individual dictate the decision to migrate to a certain place (Newbold, 2010). The same source

further underlines that the most important determinant of migration is age, with the young consistently more likely to migrate than older individuals (Newbold, 2010). Similarly, Carr (2009) argues that young, unmarried, or recently married adults are the most likely to migrate, often to establish an independent household. The same source further states that rural-frontier migrants are poorer, less educated, and have less wage-labor experience (Carr, 2009).

The above discussion testifies that the reasons and consequences of migration are diverse and complex and the explanation given should be based upon demographic, economic, political, social, and cultural conditions prevailing in the area of origin and destination or characteristics of migrants.

2.5. Population and Environment: Empirical Evidences

2.5.1. Population Change and Environment

It is generally assumed by many experts that land use/cover changes to be one of the most important environmental concerns at national or international level. This is so because it has direct links on the planet's climate change, biodiversity loss, loss of wetlands, land fragmentation, livelihood change, an increase of diseases and desertification (Grau *et al.*, 2003; Campbell *et al*, 2005; MEA, 2005; Zhao *et al.*, 2006; Falcucci, Maiorano and Boitani, 2007; Haque *et al.*, 2008; Kamusoko and Aniya, 2009; Kangalawe, 2009; Ayalewl, Kassahun and Woldetsadik, 2012; Bewket and Abebe, 2013). Hence, decision makers at different levels need to be acquainted with the main causes of land use/cover changes so as to devise strategies of interventions ahead of the occurrence of problems. Surprisingly, there are no uncomplicated factors that can be classified as drivers and effects of land use/cover changes (Campbell *et al*, 2005). Accordingly, McNeill (2006) indicates that there is no simple relationship between population and environmental degradation. He further argues that whenever the relationship between the two is considered necessary attention should be given to its

intricacy. For this reason, there is no point of consensus among scholars and experts on what population dynamics results on the natural environment.

Studies so far conducted in different parts of the world reveal different results. The study conducted in Costa Rica shows that propensity of deforestation increases with accessibility as well as desirability of the land for agriculture (Rosero-Bixby and Palloni, 1998). The same study further reveals that deforestation is found to be high in areas where there is high population concentration. Mcneill (2006) reaffirms that population exerts unprecedented pressure on the natural environment directly or indirectly. He further argues that the speculations that much of the world's cropland will be changing to nature will not be materialized for the reason that many of the poor farmers in developing countries will continue clearing forestland. The study by Drechsel, kunze and Vries (2001) in Sub-Saharan Africa similarly shows that fast growing population has been exerting substantial stress on natural resources and the agricultural populations are moving to hitherto unoccupied and protected areas resulting in biophysical deterioration like soil fertility and deforestation. FAO data (cited in Drechsel, kunze and Vries, 2001:414) indicate that, in Africa there is "much more land under cultivation and much less under fallow than required for soil regeneration" emanating from population pressure. In the same manner Mather and Needle (2000) argue that there is a general trend of forest cover decline in areas of fast population growth and spreading out forest cover in areas of low population increase. The same authors further contend that countries with fast and accelerating agricultural yield greater than population growth appeared to experience shirking size of forest cover. Study by FAO (2012) indicates that in recent decades the tropics, specifically South America and Africa have been considered the largest source of net   forest loss. The MEA (2005) on the other hand, forecasted that land use change, primarily the continuing expansion of agriculture, is projected to continue to be a major direct driver of change in terrestrial and freshwater ecosystems.

On the other hand, the study in southeast Kajiado district, Kenya, unveils that government policy on agriculture and land tenure was one of the reasons for land use and cover changes between 1970s and 1980 (Campbell *et al*, 2005). Gao, Liu, and Chen (2006) made a study in the northeastern part of china and came to identify that change in government's agricultural policy (food self sufficiency) is the main reason for land use/cover changes in the region. Being as an important grain producing region and area of policy experimentation identified by the central government, the situation triggered land use/cover changes to remain high in the area (Gao, Liu, and Chen, 2006). Other findings in the same way show that "land use and cover change is an indicator of changing human demographics, natural resource uses, agricultural technologies, economic priorities, and land tenure systems" (Wolter, Johnston and Niemi, 2006:607). A study by Campbell *et al*, (2005) in Kajiado district Loitokitok area, Kenya shows that the rapid land use and cover change in the district is the result of complex factors emanating from economic, cultural, political, institutional and demographic processes (Campbell *et al*, 2005). Supporting this argument Lambin *et al*. (2003) assert that land change is the result of complex interacting factors operating at different levels in the human environment system. The diverse driving forces are different at different places. This necessitates area specific assessment of drivers of land use/cover changes (Lambin *et al*., 2003).Contrary to what has been stated so far the case study in Machakos, Kenya shows that "rapid population growth does not necessarily lead to a Malthusian catastrophe"(Tiffen *et al*., 1994 cited in Drechsel, kunze and Vries, 2001:415).

In an attempt to test theoretical assertions of Malthus and Boserup, Woldetsadik (2003) carried out study in west Gurageland (Ethiopia) and identified that population growth has led to both land degradation or enhancement, or aspect of both. Woldetsadik further underscores that land degradation and habitat modification was seen during the early days of population increase(the Malthusian theory) but thereafter residents started to practice agricultural intensification in a way of maintaining soil fertility and environmental conservation enhancement(Boserupian hypothesis). Nyssen, Simegn and Taha, (2009) associate the recent positive changes in irrigation development and forest

regrowth in Bela-Welleh catchment with the Boserup's thesis. The same source further summarizes the situation as:

> *Before 1965, there was only rain fed farmland, grass land, rural settlements, shrub land and a single small church forest. In Bela-Welleh catchment the optimistic views of Boserup are in place since the irrigation development is growing and comes with yield-increasing and value-added innovations that improve the standard of living of the people by way of economic diversification, improving basic infrastructure and market opportunities which ultimately leads to intensification and improves productivity.*

The government of Ethiopia has taken the first initiative to this positive change and development but later on the initiative has been taken up by smallholders as same source indicates (Nyssen, Simegn and Taha, 2009). Marquette (1997) contends that the Malthusian perspective alone has deeply influenced development policies and led to a major emphasis on family planning and fertility control in many developing countries. Contrary to this, there has been little development of the policy implications of Boserup's work yet.

In sum, there is no simple co-relation between population dynamics and degradation of natural resources and the natural environment. It is, however, very important to consider critically the relationship between environment and population and the impacts as a result of demographic and non-demographic variables.

2.5.2. *Land Use/cover Changes and the Causes*

Since 1930, the world population grew more than tripled. As a result, energy and food demands have increased, which has resulted in more land cover changes for food production and settlements (Mölders, 2012). Land use/cover changes are often the results of interplay among many factors. The simple assumption that land use/cover changes are caused by few factors may not correct. Rather, many interrelated complex factors best explain the processes of land use/cover changes (Lambin *et al*., 2001;

Liverman and Cuesta, 2008).The same authors further contend that "Identifying the causes of land-use change requires an understanding of how people make land-use decisions and how various factors interact in specific contexts to influence decision making on land use" (Lambin *et al.*, 2003:216). Decision making processes how and for what purposes the land in question to be used, in turn, are affected by different factors prevailing at local, regional and global level.

Different researchers have put the reasons for land use/cover changes in two broad categories as proximate or direct and underlying or indirect / root causes (Geist and Lambin, 2002; Liverman and Cuesta, 2008). Lambin *et al.*, (2003) further contend that proximate factors occur at local or household/farm level whereas underlying factors emanate from regional, country or even global level. As a consequence, proximate variables are context and region specific while the root causes on the other hand are the result of complex political, economic and social conditions occurring at a distance. Farm level analysis allows to address proximate causes and to interpret them in reference to underlying causes (Mottet *et al.*, 2006). Long, *et al.*, (2007) identified industrialization, urbanization, population growth, and China's economic reforms as major factors of land use changes in Kunshan. Another study in Zimbabwe also recognized that pressure for agricultural land, building materials and fuel wood triggered land use/cover changes (Mapedza, Wright and Fawcett, 2003). Study by Brink and Eva (2009) also reveals that there is a significant degree of land use/cover change in Sub-Saharan Africa. These changes have resulted due to manmade and natural drivers related to high rate of population increase, economic development and globalization on one hand and natural hazards such as floods, landslides, drought and climate change on the other end of the spectrum.

The study in landscape change in Tahuladare Warada ,Wello by Crummey (1998) indicates the existence of fast population increase but little expansion of cultivated land and an increase in woody vegetation (mainly eucalyptus trees). A similar trend has been identified by Bewket (2003) in Chemoga watershed case study where it appears that

27

population has increased but woodland recovery was high in 1998 due to eucalyptus tree plantation. Nyssen, Simegn and Taha (2009) observe land use/cover dynamics for the last four decades in Bela-Welleh catchment, Wag, Northern Ethiopian Highlands, due to population pressure. Gebreyohannis *et al*., (2013) in forest cover change study in the Blue Nile basin has observed forest cover increase particularly in Gilgel Abay or little Abay watershed due to eucalyptus tree expansion. A study conducted in Afar, Ethiopia identified more than fifteen factors as the cause for land use/cover changes (Tsegaye *et al*., 2010). The driving forces documented in the study include migration from nearby highlands triggered by drought, land tenure and government policy changes only to mention some (Tsegaye *et al*., 2010). Another study in the Central Rift Valley of Ethiopia reveals that population growth, decline in agricultural productivity, land tenure change and erratic rainfall have the major drivers of land use/cover in the area (Garedew *et al*., 2009). The land use/cover dynamics study in the northwestern Ethiopia reports that population dynamics, exiting land tenure, institutional and socioeconomic conditions should be critically examined too put in place any land related policy (Zeleke and Hurni, 2001). On top of that, another study in Ethiopia contends that one of the reasons for land use and cover changes in Derekolli catchment is change in population size in the surrounding urban centers whose charcoal and fuel wood consumption has equally increased (Tegene, 2002). Temesgen *et al*., (2013) also observed that in main Ethiopian rift valley, one of the reasons for net reduction in woodland between 1986 and 2000 was due to institutional weakness observed during the transition period, i.e. Military government to the present regime.

In sum, the factors that affect land use/cover changes are complex and at times interrelated. Thus, the study of land use/cover changes demands a careful investigation of these complex and interrelated factors at local, national and global levels.
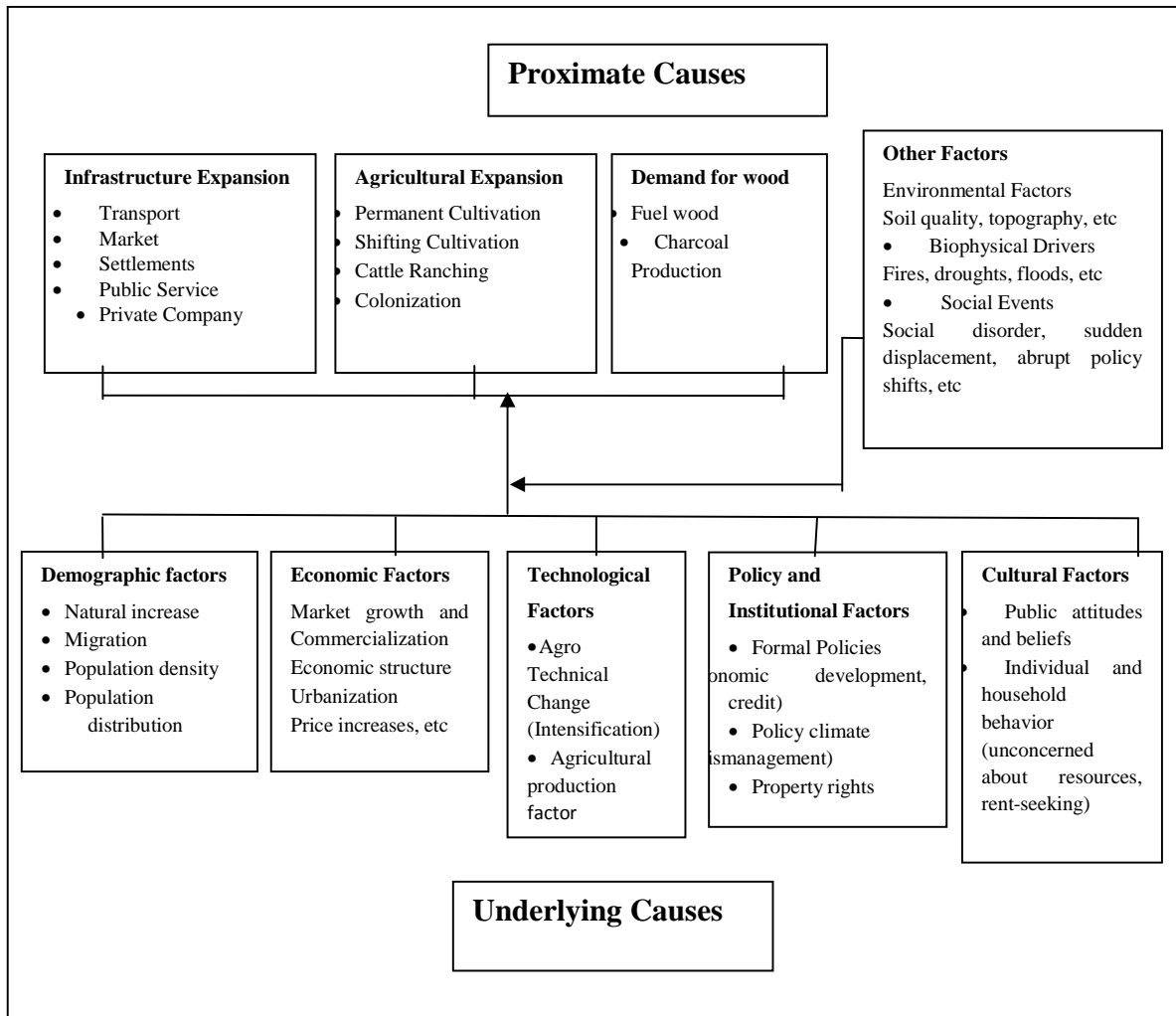
Figure 2. 2. Proximate and Underlying Causes of Land Use/Cover changes
(Source: Geist and Lambin, 2002, figure 1, p. 3)

2.6.   Population and Agriculture in Ethiopia

According to the 2007 population and housing census, about 84 % of the country's population resides in rural areas primarily engaged in subsistence agriculture. In Ethiopia agriculture supports some 85% of the working force, produces about 50% of the gross domestic product and generates over 90% of the country's export earnings and

is, thus, credited with being the single largest source of employment and foreign exchange(CSA, 2008a) .

Ethiopia is a country endowed with a variety of resources. Of these, land on which millions of rural residents depend on is the most important one. The country has extensive marginal and non-arable land which approximates 62%, leaving the remaining 38% of the total area being potentially cultivable. Of the latter, vertisols and steep slopes, which together account for 11%, are cultivated in areas of heavy population pressure whereas the remaining 27% of the land is appropriate for cultivation. The lowland parts of the country are drained by major rivers. Ideally, this area, which is estimated to cover 3,495,795 ha or 3% of the total area of the country, is suitable for irrigation. This would increase the arable land stock of the country to 33,685,795 ha or nearly 30% of the total area (UNDP/FAO cited in Gebregziabher, 1994).

Despite the majority of the population engage on agriculture and availability of ample agricultural land, the agrarian population is characterized by critical shortage of food, income, wide spread poverty and destitute. As result of this fact, the country is net importer of food crops. The root causes of this backwardness, destitute, and widespread land degradation according to Tsighe (1995), is attributed to the power structures and political economic processes that created exploitative forms of property relations, governed the distribution of produce, and regulated access to resources, especially land. Woldemeskel (1989) shares this argument and asserts that unbalanced power relations between the government and smallholders such that the relation eventually resulted in landlessness, landlordism, and fragmentation of land that in turn aggravated natural resources and ecological degradation.

The majority of Ethiopia's human and livestock population, and other activities are concentrated in the highlands which puts heavy pressure on natural resources that has led to degradation over the past several decades. Degradation of resources in Ethiopia is the result of extensive and intensive, mainly physical and chemical degradation, use of

land for agriculture. Smallholders inherently increase their yield through bringing more land under cultivation. As much of the land used for agriculture is exhausted over time, expansions are taking place to marginal lands including forests, wetlands, and steep slopes. This eventually resulted in resource degradation both in the highlands and lowlands. Not only agricultural activities but also smallholders struggle for survival and to get source of fuel also triggers environmental degradation. Since the rural population principally use wood and charcoal as source of fuel, resource loss with increasing population is imminent. That was why Mutunga and Hardee (2009:179) reported that in Ethiopia rapid population growth is "a cause of decline in resources base." In view of this Harrison (1992:23) has summarized the problems that could crop up due to fast population growth as follows:

> *As population grows, plots cannot be left fallow as long as before. Everything began to change. Trees don't get time to regrow. Shrubs, and latter grasses come to dominate the fallow, leaving their seeds and massive root systems to create weed problems for crops. The soil is exposed to sun and rain for longer, and gets harder to work. Soil fertility is no longer fully restored. Yield start to decline.*

But population growth alone does not necessarily destroy the natural resources and the environment rather when it occurs in conjunction with certain socio-economic circumstances (Tsighe, 1995). The same author further states that history of agricultural policy in Ethiopia did not evolve in response to internal demand rather it was dictated by external pressure (Tsighe, 1995). Resource degradation in Ethiopia is often the result of many interplaying factors. Studies so far point out population dynamics, land tenure, institutional and socioeconomic conditions, and government policies as the most prominent factors of degradation (Tsighe, 1995; Embaye, 2000; Zeleke and Hurni, 2001; Garedew *et al*., 2009; Rahmato, 2009; Tsegaye *et al*., 2010). Rahmato (2009) also shares this assertion and contends that high population growth and increasing shortage of land, is a serious concern to many peasants in the country.

The above discussions clearly show that with increasing rural population in combination with other factors like past agrarian relations resulted in arable land insufficiency and resources degradation. These problems are gradually shifted to the lowlands.

2.7. Land tenure, Policies and Resource Management Practices in Ethiopia: An Overview

Increased agricultural production and sustainable land use depend on fair and equitable land distribution, suitable social institutions and the attitudes and aspirations of the farmers. All these factors are linked directly to land tenure system (Gebreselassie, 2006; Bekele, 2008; Rahmato, 2008a). According to Upton (1976), land tenure institutions are the laws or customs relating to the control and use of land.

The state's intervention in the utilization of land has never stopped throughout the history of Ethiopia. Prior to the 1974 Ethiopian revolution, the land tenure system encouraged "absentee landlordism and the neglect of peasant agriculture to the advantage of landlords and the absence of political will on the part of the government to bring about the profound political and economic change needed to stimulate peasant agricultural production" (Bruene,1990:20).

Public ownership of rural land under the slogan "land to the tiller" was proclaimed in March, 1975, following the 1974 revolution. The reform has more or less eliminated the basic agrarian problem in the country with the abolition of tenancy. Many measures were taken with the aim of modernizing the agricultural system so as to increase production.

The government has increasingly intervened in the rural economy (Bruene, 1990). The cropping pattern has been changed to food crop production as opposed to the situation that prevailed prior to the revolution which was biased towards crops that could be marketed (Cloutier,1984). Despite this, the post-revolution agrarian policy has not

succeeded in improving the agricultural sector or food production, or in solving problems like land fragmentation, per capita farm size increase and the choice of technology only to mention a few (Gemechu, 1990; Bruene, 1990; Rahmato, 1990, Scott, 1998; Bantider, Hurni and Zeleke, 2011). Rahmato (1990:100) underlined the fact that "...it (the land reform) has not tackled the root causes of peasant poverty and rural underdevelopment." As many experts rightly put, most of rural policies, strategies and laws like collectivization, villagization and resettlement, which were carried out on a large scale in the 1980s, were accompanied by extensive deforestation and soil erosion (Tafese, 1995; Scott, 1998; Bekele, 2008; Kassa, 2008; Rahmato, 2008b). This indicates that strategies and action plans put in place by the government were without the involvement of the wider community. This was partly the reason why soon after the downfall of the military government smallholders start to dismantle conservation structure that were constructed in a top-down process by forcibly mobilizing the farmers. Contrary to this argument, the study by Nyssen *et al.*,(2004) indicate that most conservation units like stone and soil bunds established in the 1980s are still in place. The same source further contends that their destruction (stone and soil bunds) is not as stated by Rahmato in 1994 where small holders on the other hand accepted these conservation structures (Nyssen *et al.*, 2004).

Increases in agricultural production and the conservation of natural resources are possible if and only if the land policy of the government guarantees land security to the farmers at large. That was the reason why Harrison (1992:262) contends that "land is best cared for when it is in the freehold of the person who operates it." Land ownership or security of tenure encourages good husbandry, investment in farm improvement and a concern for future possibilities (Harrison, 1992; Boserup, 1994; Berisso, 1995; Bekele, 2008). The absence of a clear land policy on tenure security has an adverse effect on rural land-use, specifically on the management of natural resources (Wood, 1990; Abegaz, 1994; Berisso, 1995; Bekele, 2008). Sutcliffe (1995) and Rahmato (2008b) also argued that in Ethiopia land tenure, or rather the insecurity of tenure, is often listed as a major factor in land degradation and the lack of investment by farmers in soil

conservation and soil management measures. Under this condition, the objective of the farmer is to grab as much land as possible. Tsighe (1995) also shares this assertion and argues that transfer of land to the land lords prior to 1975 and to the state after 1975 has resulted smallholders to engage in activities that quickly exhaust soil fertility, diminished ecological and economic flexibility.

The post-May 1991 land policy of the government has also the same defect. Bekele (2008) has stated that the shift from unitary to federal state in 1991 had created a power vacuum during which time destruction of resources took place on a large scale. The state-sponsored land redistribution program that has been took place a decade ago, increased rural poverty and peasants vulnerability by reducing and overusing holding size (Gebreselassie, 2006). The land redistribution further undermines farmer's incentive to invest in land improvements and soil fertility but partially facilitate access to land for landless farm households (Benin and Pender, 2001). There is no clear legislation that protects and secures rural farmers until the government introduces rural land registration in 2003, i.e. after 12 years in some regional states. The principal objective of this program was to create a kind of security of land. But the land certification does not bring any sense of security to small holders as it was presumed to be. A study by Rahmato (2009:224) in Dessie Zuria district, South Wollo, and Wollaita zones reveals that "the land certification has failed to assure farmers robust security that they had been searching for a generation." Rahmato further argues that smallholders should be empowered socially, politically and economically so that they can negotiate with those who have the upper hand (the state/political apparatus) at various levels (2009). Contrary to this the assessment made by Belay (2010) and Tsegaye, Adgo and Gebreselassie (2012) indicate that the land certification has positive effect in securing land rights and improve investments in land improvement among smallholders in Amhara region.

Ethiopia has officially launched population policy in 1993. The policy was put in place by the government following the time the country has faced rapid population growth, occurrence of repeated famine and drought, wide spread food insecurity and poverty

(Lemma, 2005; Minas, 2008). The national policy has the goal of "harmonization of the rate of population growth and the capacity of the country for the development and rational utilization of natural resources to the end that the level of welfare of the population is maximized overtime" (The Transitional Government of Ethiopia, 1993:26). The purpose of this policy is to control growth of population in way that resource utilization could become wise and consequently enhance development. However, the policy could not address its intended goal (Minas, 2008). Furthermore, the policy has been proposed to close the gap between high population growth and low economic productivity through integrated development programs; reducing rural urban migration; improving carrying capacity of the environment; raising the social and economic status of women and other vulnerable groups through education and awareness creation. As opposed to the aim of the policy, the environment in many parts of the country has deteriorated at unprecedented rate. To materialize the aims and objectives stipulated in the document the government has not put detail programs and action plans so as to monitor and evaluate the achievements and challenges. Consequently, this has caused the alarming deterioration of natural resources in Ethiopia emanating from population growth and movement (Minas, 2008).

The foregoing discussion shows that policy issues need an urgent solution for better agricultural production and proper management of natural resources. Bruene (1990:19) states that "...the agricultural sector's multi-faced role within the national economy, agriculture and agrarian policies have to reconcile complex and sometimes conflicting aims and interests, by the active participation of the users (farmers) at the grass-root level."

2.8. Resettlement in the Northwestern Lowlands

Resettlement is not a new phenomenon in Ethiopia. Even in the pre- revolution period it was carried out through individual initiatives of local governors. By the time of the revolution (1974) some 20 settlement sites had been established to resettle 7,000

household units (Pankhurst, 1988). The same author has further stated that after the revolution the resettlement process became very important and by the end of 1970's 45,849 households had been resettled on 88 sites in 11 regions (1988).

Three factors can explain such an alarming rate of resettlement in Ethiopia. Firstly, the Land Reform Proclamation that entitled the nationalization of rural land had removed the greatest obstacle hindering the implementation of earlier plans and proposals. Secondly, the two successive nation-wide famines triggered such a panacea. Thirdly, the establishment of the Relief and Rehabilitation Commission in 1974 and the Resettlement Authority in 1976 (which were merged in 1979) paved the way (Pankhurst, 1988).

Possessing medium growing season, having good vegetation cover (due to good amount of rainfall) and relatively low population density and fertile soils, the northwestern lowlands were considered by the government as a target of economic development plans. Among the many development projects that have been undertaken in the region the 1984/1985 resettlement scheme was one example. The aim of the project was to decrease the pressure exerted on the degraded, densely populated and drought-prone northern and central highlands by relocating them in the northwestern part of the country. For this purpose, 13.7% (82,000) of the nearly 600,000 settlers from the north and central parts were placed in this [Metekel] region (Yntiso, 2002). Despite government's justifications regarding the suitability of Metekel area in the northwestern lowlands for resettlement, Woldemeskel (1989) observed that the selection of the area for resettlement was made not only without any scientific study, but also without any due regard to the consequences of the resettlement program on both the environment and the local people in the region. According to Comenetz and Caviedes (2002), the resettlement process had a much larger effect on the composition of the population in the receiving Metekel region. There are basically two forms of resettlements: integrated and conventional. In the former, farmers (settlers) were allocated land in kebele with previous settlement and with sufficient cultivated land while in the latter new villages were constructed in sparsely settled areas by displacing

the local population. Nearly all of the settlers in the northwestern region are included under the conventional settlement scheme (Yntiso, 2002).

The response to the increased demand for food following such an increase in population was to intensify agriculture so as to increase crop production. In a subsistence agricultural system with limited or no modern inputs, crop production is increased by expanding the area of cultivated land. This has resulted massive deforestation and expansion of agriculture into marginal areas. Tsighe (1995) also observed a similar trend and contends that land degradation in Ethiopia was further aggravated by resettlement policy of the government. The specific cases of Metekel show that the Gumuz are slowly being pushed aside by new settlers and the natives traditional agricultural systems and natural resources management practices were endangered (Piguet and Dechassa, 2004). The same authors further state that resettlement programs took away important resources from the local and native people to the point that their traditional livelihoods, their economy and habitat are now being fading away. Similarly Woldemeskel (1989) reported that resettlement in Metekel has brought suffering to settlers and impoverishment to the Gumuz and consequently led to environmental degradation. Furthermore, the existence of many migrants yielded critical shortage of farmland. This, in turn, pushed the local people to extend their farm land to marginal lands and increase charcoal production and wood selling as risk management strategy for income generation. These states of affairs eventually resulted in deterioration of the last remaining forests, woodlands and other resources (Piguet and Dechassa, 2004). It is worth to quote the account of Woldemeskel (1989:374) in relation to resettlement policy of the government and it's far reaching consequences:

> *The government's effort to tackle the problems of land scarcity, famine, and ecological degradation in the highlands has resulted in the spread of these problems to regions which were previously unaffected. It seems, therefore, that the resettlement strategy is not only self defeating, but also has brought grave consequences which outweigh the justifications for its implementation.*

37

The above discussions undoubtedly indicate that the resettlement program, which was a top down move, has an effect on the environment as well as the local population.

2.9.   Conclusion

Population and environment interactions have been widely reviewed from the point of view of different school of thoughts. The various studies so far carried out indicate that there was no simple relationship or link between environment and its drivers including population dynamics in the form of growth, size, distribution, migration, and urbanization. Hence, drivers of environmental changes are diverse and never been the same. They vary considerably from one area to another depending upon the prevailing economic, social, political and cultural conditions in the area under consideration or influenced by the same factors at distant places. In view of this, human driving forces like population dynamics are usually mediated by factors like technology and science and institution and policy issue, best explain population and environment relationships. The conclusion is that major deriving forces like population dynamics alone are not changing the environment. Specific to the Ethiopian situation, it is evident that land tenure, government policies like resettlement and institutional setups are relevant for accentuating population dynamics and consequential land use/cover changes. At this juncture, proper understanding of drivers intricacy is crucial to fully explain and speculate future circumstances of environmental changes.

CHAPTER THREE

DESCRIPTION OF THE STUDY AREA AND RESEARCH METHODOLOGY

This chapter presents background of the study area's   including its location, size, climate and biophysical and demographic characteristics. Moreover, detail procedures of the methods employed to collect, compile and analyze data is presented.

3.1.   Description of the Study Area

3.1.1. Location and Size

The study is conducted in Mandura district of Metekel zone in Benshangul-Gumuz regional state. Mandura is situated between $10^0.50$'.743 N latitude and $11^0.10$'.766'' N and $36^0.02$'.48''E and $36^0.32$'.42''E longitude, at about 546 kilometers away from Addis Ababa, the capital of Ethiopia. The total area of the district is about 1,005 square kilometer (100,500 ha). Physiologically it is part of the northwestern lowlands where many development endeavors including the Grand Renaissance Dam construction is currently underway (Figure 3.1).
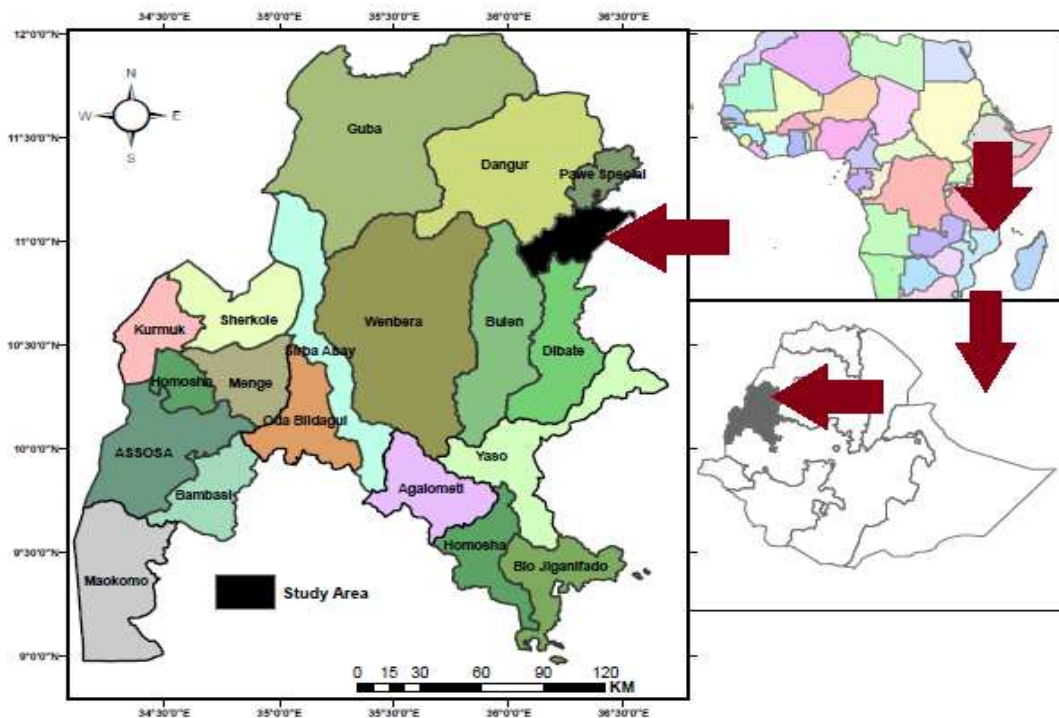
Figure 3. 1. Location of Mandura District

3.1.2. *Climate*

Rainfall and temperature records for the last twenty five years (1972-1991 and 2000-2006) are computed based on data obtained from the National Metrological Service Agency (NMSA). The mean annual rainfall received amounts to 1,941.61 mm with a little more than 53 % of the total annual rainfall concentrated between June and August. More than 98.4 % of the total annual rainfall occurs in seven months (from April to October). The main agricultural activities are carried out during these months.

The average annual temperature of the area is 24.5^{o}C. The corresponding amounts of maximum and minimum temperatures are 27.4 ^{0}C and 16.83 ^{o}C respectively. In general, the study district is classified under the wet tropical (wet *Kolla*) agro-climatic region. Altitudes range between 1,015 and 1,480 meter above mean sea level.
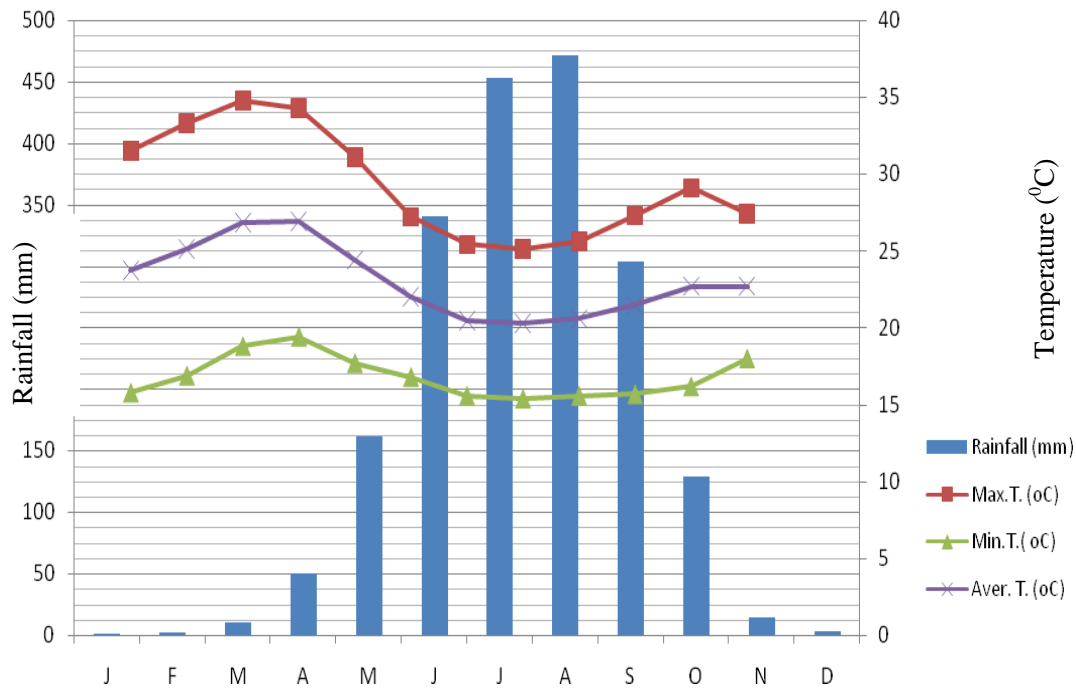
Figure 3. 2. Rainfall and Temperature Distribution (1972-1991 and 2000-2006)

3.1.3. Geology, Soils and Drainage

The rocks of the study area belong to the upper and lower middle Proterozoic Precambrian which is mainly composed of Granite diorite, Quartz diorite, Andesite lava, tuffs, tuffaceous slates, greywackes, Chlorite Schists, quartzites, graphitic rocks and intermediate metavolcanics (Kazmin, 1972). According to the District Agriculture and Rural Development Office (2011), the soil of the district is constituted of red laterite (60%), black vertisol (10 %) and brown soil (30 %). The study area is drained by three major rivers namely Libit, Gilgel or Little Beles and Beles. The first two rivers are major tributaries of Beles river which eventually drains into Abay River (the Blue Nile).

3.1.4. *Population Size and Composition*

According to the 2007 housing and population census of Ethiopia, Mandura district has a total population of 4 0,746. Of these 21, 241(52.1 %) were males and the remaining 19,505(47.9 %) were females. The age-sex structure of the district is indicated in Table 3.1. As shown in Table 3.1 the overall dependency ratio[4] of the district was 95.1 %. This means that every 100 persons in the working age must bear the burden of 95 (young and old) persons. There is a significant difference between urban and rural areas where the ratio is high in rural area (105.7 %) and low in urban area (58.7%). The same source further reveals that the corresponding values for young and old age indices were 92.45 % and 2.59 %, respectively. This, in turn, means hundred persons in the working age must bear the burden of 93 and 3 young and old persons respectively. High young age dependency ratio implies, as it is true for Ethiopia and some other developing countries especially in Sub-Sahara Africa, the population is predominantly young. This, in turn, indicates the existence of high fertility rate and ultimately the population experience rapid growth for the future (Ehrlich and Ehrlich, 1990; Miller and Spoolman, 2010; Newbold, 2010). Likewise, low old age dependency ratio indicates existence of small proportion of old people and incidence of high mortality in a population before reaching old age.

Pertaining to sex composition, Table 3.1 further reveals that in all cases there were excess of males over females. Accordingly, the overall sex ratio of the district was 108.9 %. The corresponding values for urban and rural areas were 111.8 % and 108.3 % respectively.

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[4] *It represents the ratio of the combined child population and aged population to the population of intermediate age. It measures the burden of dependency that the working age population must bear.*

Table 3. 1. Population by Age, Sex and Place of Residence

Age Group		Rural		Urban		Total	
		Number	%	Number	%	Number	%
0-14	Male	8987	86.9	1356	13.1	10343	100.00
	Female	7643	85.2	1326	14.8	8969	100.00
	Both Sex	16630	86.1	2682	13.9	19312	100.00
15-64	Male	8037	75.9	2546	24.1	10583	100.00
	Female	8117	78.7	2192	21.3	10309	100.00
	Both Sex	16154	77.3	4738	22.7	20892	100.00
≥ 65	Male	249	79.1	66	20.9	315	100.00
	Female	195	85.9	32	14.1	227	100.00
	Both Sex	444	81.9	98	18.1	542	100.00
Total	Total	**33228**	**81.6**	**7518**	**18.4**	**40746**	100.00

Source: CSA, 2008b

The other most important issue to be inferred from the 2007 housing and population census is the size of child bearing women, i.e. age 15-49 was 9859 out of 19505 and constitutes a little more than fifty percent of the total female population in the district. This population group has a profound bearing on fertility characteristic of the study area as fertility will continue in the years to come.

3.1.5. Brief History of the Gumuz of Metekel Zone

Metekel zone can be described as melting pot of diverse ethnic groups. The Gumuz, Sinasha, Agaw, Oromo, Kembata, Hadiya, and many other ethnic groups reside in the area for the past several years in harmony. The last two ethnic groups arrived during the 1984 resettlement program. During the imperial and the Military (Dergue) regimes, Metekel was part of Gojjam region constituting 46 % of the total area. It embraces the four language families of Ethiopia including Semitic (Amhara), Cushitic (Agaw and Oromo), Omotic (Shinash) and Nilo-Saharan (Gumuz) (Endalew, 2006). Since the 1991

government change, Metekel has become one of the three zones of Benshangul-Gumuz national regional state (BGNRS). The other two are Assosa and Kamash zones.

The original settlers of Metekel zone are the Gumuz. Studies so far made indicate that the Gumuz have occupied an area to the east of Metekel up to Lake Tana (the source of Blue Nile), an area currently occupied by the Agaw and Amhara (Yntiso, 2003; Endalew, 2006). The same sources further contend that the Gumuz occupied the present day Gojjam including Dur Bete, Dangla, Koso Ber (Enjibar) until they were pushed to the lowlands. As elsewhere in the tropics, the Ethiopian lowlands are characterized by high temperature, erratic rainfall, prevalence of different tropical diseases that affect both human and livestock population. It is to these inhospitable geographic areas that the Gumuz were pushed by the highlanders, i.e. the Agaw and Amhara. The Gumuz were also pushed from the south by the Shinasha who forced them to pay tributes in kind, i.e. in the form of meat, cereals and honey (Endalew, 2006). The frequent pressure on the local population is summarized by the work of Yntiso as follows:

> *Pressure on the Gumuz people and their land continued even after they were pushed to the harsh lowlands. Farmers from the neighboring highlands, the central government, and large investors are attracted by Metekel's potential for agricultural production (e.g. cereals, oil seeds, and cotton), mining and extraction (e.g. marble, gold, incense, and honey) (Yntiso, 2003:55-56).*

The Gumuz were forced to leave their areas of origin since time immemorial and the same situation continued to exist in modern times. This is expressed in terms of government sponsored resettlement programs and the Tana-Beles development Project which displaced thousands of the local population in the mid 1980s. This has continued and still foreign and domestic investors are doing the same in the region.

3.1.6. An Overview of the Villagization Program

Villagization is not a new phenomenon in Ethiopia. The military government launched a nationwide villagization program in the mid 1985 following the 1984 famine and drought. The objective of the program was to bring together scattered rural households in a village (selected and fixed by government agents) and thereby provide modern socio-economic services like electricity, pipe water, school, health institutions and basic infrastructure (Tafesse, 1995; Scott, 1998). Villagization is an ongoing activity in many parts of Benshangul-Gumuz regional government including the study district. Yntiso (2003) indicates that the plan was put in place in 1999 with the intension to sedentarize the Gumuz and other shifting cultivators. The same source further underlines the purposes of this sedentarization as it would be planned to provide smallholders with modern agricultural inputs and other services and in the mean time shifting cultivators learn ox plough from migrants and ultimately abandon shifting cultivation.

During focus group discussion farmers mentioned that they did not involve in the whole planning processes of the villagization program. Rather it was a top-down instruction where every decision was made by government agents and farmers obliged to implement it.

The very inception of the idea was also a top-down one where Yntiso (2003:59) summarizes the process as "the decision was made based on a rapid rural appraisal report. No thorough environmental, social, or human impact assessments were made." It is too early to study and report about it as well as beyond the scope of this study to make detail analysis on villagization program in the district.

Figure 3. 3.Villagization, Typical Thatched-Roofed House under Construction in Photo Manjare, 2011

The actual village construction has started in 2010 and expected to be completed in 2012 (Figure 3.3). Farmers have been waiting for land redistribution, i.e. five to ten hectares to the Gumuz and three hectare to migrant farmers to be made by district and kebele officials. However, development agents as well as district officials at different levels did not put it into practice until the end of 2012. Past experiences convincingly indicate that villagization has far reaching negative consequences on the natural environment and agricultural yield (for details see Tafesse, 1995; Tsighe, 1995; Scott, 1998). For some farmers their plot is far away from the village already identified and difficult to pursue agricultural activities as before. In this case, pests and predator, animals scaring, investment on land resources, and tree planting would definitely be a problem.

3.2.   Research Design, Method of Data Collection and Analysis

Mixed method, specifically the concurrent triangulation approach was selected as research design. The concurrent mixed approaches enable to gather quantitative and qualitative data, and are gathered at the same time (Creswell, 2003; Gay, Mills and Airasian, 2009). This approach is preferred over others due to its merits to substantiate, cross-validate, or confirm findings within a single study as the research under consideration is complex and needs to be examined from various angles (see Creswell,

2003; Gay, Mills and Airasian, 2009). In addition, it demands the employment of diverse data collection instruments to capture the most important factors as possible that impact land use/cover in sufficient detail. Furthermore, this strategy enables the researcher to collect data in a short period of time (Creswell, 2003; Gay, Mills and Airasian, 2009).

3.2.1. Sources of Data

Data were drawn from both primary and secondary sources to achieve the objectives set.

Primary Sources

Primary data were obtained through questionnaire survey, analysis of remotely sensed image and aerial photographs to generate information about land use/cover changes over time in the study area. Questionnaire surveys were provided to households to collect information on household characteristics. The questionnaire was pretested by interviewing 20 households (ten from the local and ten from local migrant) during the pilot survey in May 2011. The final questionnaire was then revised by omitting some redundant and unclear questions and by incorporating some additional information like, shifting cultivation, type of crops cultivated, which was not included in the first draft. In-depth interview and focus group discussions were carried out to generate qualitative information to complement data generated through questionnaire survey, analysis of aerial photographs and remotely sensed images. The utilization of the first four methods with aerial photograph and satellite image interpretation can give deep understanding about the timing and causes of land use and land cover changes than aerial photograph and image(SPOT) analysis alone (Crummey,1998; Mapedza, Wright and Fawcett, 2003; Ayalewl, Kassahun and Woldetsadik, 2012). Crummey (1998:38) emphasized the importance of using mixed method as "future studies will have to have a solid grasp on the intentions and strategies of local farmers, which will mean an integration of image analysis with historical and socio-economic information."

The sample size and profile of households included in the study is presented in Table 3.2.

Table 3. 2. Sample Size and Profile of Household Respondents in Mandura

Characteristics	Sample Size
Number of Kebeles	3
Household heads interviewed	210
Male	161
Female	49
Percentage of total household heads	16.2 %
Age range (years)	22-80
Average age (years)	41.7
Average family size	6.2
Average land holding size(ha)	1.2

Source: Field Survey, 2011

Population and Sampling

The three study sites, i.e. kebeles selected, Jegeda Selasie, Kutir Hulet and Photo Manjare are located in Mandura district, Metekel zone. The three study sites were selected on the presumption that there exists high degree of human interference in terms of land use/cover changes as compared to other sites in the region. The selection of the households to be interviewed was undertaken through systematic random sampling technique involving the following steps: First, households were categorized into two strata: local households and local migrant or settler households. Then, households were selected randomly using random table from each stratum. Accordingly, out of 1295 household heads, 210 (16.2%) (70 from each study sites; 35 for each stratum) were randomly selected and surveyed using structured and pre-tested questionnaire. A sample size of 35 is believed to be adequate for analysis because with a sample size of 30 or more observations, it is possible to have estimates of accuracy from the mean (Clark and

Hosking, 1986; Cohen, Manion and Morrison, 2000). Moreover, number of respondents to be drawn from the total 1000 population as suggested by Stoker is 14% (White, 2005).

Population changes between two census periods (Inter-censal) were estimated using linear interpolation method, given as $P_t = P_0 + t/n (P_n – P_0)$ so as to examine population dynamics in the district. In the equation $P_{t\ =}$ the population in question at time t, $P_{0\ =}$ population size of the initial census, $P_{n=}$ population size of the latter census, t= the time interval between P_0 and P_t and n= the time elapsed between the two census periods.

Land Use/Cover Dynamics: Method of Data Acquisition and Analysis

The use of medium scale black and white aerial photographs to map land use/cover has been an accepted practice since the 1940's. Recently small-scale photographs and satellite images have also been utilized for acquisition of data. Sequential aerial photographs that could cover the study area of Mandura were obtained from the Ethiopian Mapping Agency (EMA) to analyze the land use/cover changes. The oldest available Aerial photographs were for the years 1957 and 1982 with a scale of 1:50,000 while the recent available single year satellite image was 2006/07(SPOT_5 2006/07). The time interval between these photographs that are 25 and 24 years respectively, are acceptable for change detection as well as land use/cover change analysis.

Data on the type and characteristics of the past and present land use and land cover change were generated from aerial photographs (1957 and 1982) and satellite image (SPOT_5 image 2006/07) at 5 m spatial resolution. On top of that, toposheets with scale of 1:50,000 were scanned and used for geo-referencing the aerial photographs. Field observations, interviews and discussion with the land users were also employed to substantiate the information.

Aerial photographs contain a detailed record of features on the ground at the time of exposure. In order to obtain the desired information from the series of photographs, interpretation should proceed on a systematic way. The pre-photo interpretation phase was done based on visual interpretation in relation to the study area. Once the overall aim was defined, the level of details and the categories of land use/cover that needed to be distinguished were determined. Interpretation and analysis of aerial photographs as well as the SPOT image has been made in the Photogrametry and remote sensing departments of Ethiopian Mapping Agency (EMA) following the procedures given below:

a) The 1982 aerial photographs selected for the study were converted into a transparent media (die-positive) and scanned using VX-4000 scanner in a Tag Image Format (Tiff). The 1957 aerial photographs, which do not have camera calibration data, were scanned using VIDAR Tru/Info Scanning Solution and stored in Tiff format.

b) The digital aerial photographs of each year were geo-referenced into a map coordinate system using the Universal Transverse Marketer (UTM) geographic projection using clearly observed and selected control points on 1:50,000 topographic map using ERDAS imagine 9.1 with 0.5 Root Mean Square (RMS) error. Then the VIRTUOZO software is used for removing all the errors in the aerial photographs and geo-referencing the images to UTM projection. Editing of the original image files was enhanced through sharpening with Adobe Photoshop Ver.5.0.

c). In order to extract the study area and fix the area of interest (AOI) for all years the digital photographs of each year were transferred from Tiff into image format using ERDAS IMAGINE 9.1 software. Since the digital photo formats were changed into image and each image had to be rectified and referenced into UTM coordinates done because the coordinates were discarded when the image was imported from Tiff format to image format.

50

The study area was delineated based on the administrative boundary, and the images were again transferred back into Tiff format because Map/Info needs such format of image in order to process and extract the needed information. Using the 1957 and 1982 aerial photographs and 2006/07 imagery digital image of photographs screen digitizing was done for the land use/cover features as polygon coverage in a vector format using ArcGIS version 10.

The identification and classification of land use/land cover types from the aerial photos require intensive use of mirror stereoscope for visual verification, because the photographs were black and white. The visual interpretation of various features on the characteristics of aerial photographs, i.e. tone, texture, shape, pattern and aspect as well as location of the features was done with the support of field verification of each land use/cover features . However, the satellite image was interpreted with the aid of field collected ground truth using global positioning system (GPS) and ERDAS IMAGINE 9.1 software. Using the 2006/07 land use/cover map, field verification and GPS data collection were conducted in January 2012 at a season comparable with that when the satellite image was acquired at selected ground control points of various land use/ cover categories. Moreover, supervised classification, using the maximum likelihood algorism, was used to classify the 2006/07 SPOT image and generate distinct land use/cover types. According to Perumal and Bhaskaran (2010) the maximum likelihood algorism is the most powerful classification methods when accurate training data is provided and one of the most widely used algorithm. Training data for the supervised classification were established from the author's knowledge of the area, and with the help of other supporting data sources, such as aerial photographs, topographic maps and interviews with elderly people of the area.   As stated above, the data input for land use/cover was done by screen digitizing using ArcGIS software which has a capability of vector and raster processing. Based on the LABEL file columns in the PAT (Polygon Attribute Table) of ArcGIS automatically creates ITEMS containing the internal record number, the perimeter, and surface area for each polygon, i.e. the land use/land cover features. In order to prepare an output map, theses classified coverage features were transferred in to

Thematic Map module of ARCGIS as coverage map. Based on the map composer module grid, legend of each features with their colors of the respective years, area of each class and percentage share, scale, all texts, etc. was incorporated.

Focus Group Discussion, In-depth Interview, and PRA

A group containing 8-10 (three groups from each Kebelle) elderly people with very good knowledge of the study area were selected for an in-depth interview and focus group discussions on issues like population changes and its consequences on land use/cover, ecological transformations during the three regimes, past and present economic activities. Likewise, series of discussions and in-depth interviews were made among group of experts from different offices (agriculture and rural development, health, district and zonal administrators and experts, kebele development agents, kebele chair persons, and key informants) on similar matters. Qualitative data were analyzed following procedures given below. First, the data collected were transcribed and thematically organized. Then the data were connected with each other depending upon their similarities and differences. "Classification is concerned with identifying coherent classes and connection on the other hand involves the identification and understanding of the relationships and association between different classes" (Kitchin and Tate, 2000:235).

Furthermore, PRA (Participatory Rural Appraisal) tools were also employed to generate information at community level. Accordingly, data pertaining to livelihood changes due to population changes over time and space, history and change of economic activities and so on were obtained using PRA tools depicted in the Table 3.3. PRA has proved to be useful at producing information in resource and watershed development and management, assessing livelihoods (Chambers, 1992 cited in Abbot, 1997) and in exposing the social differentiation of land-use and management in terms of gender, age, wealth and other indicators of rural inequalities (Mukherjee, 1992 cited in Abbot, 1997;

Amsalu, 2006). Details of PRA tools used in farmer participatory research are given below.

Table 3. 3. PRA Tools and Issues Assessed

Tools	Issues Assessed
Historical Analysis	History of livelihood changes, History of population and land use/cover dynamics, land tenure
Seasonality Analysis	Cropping calendar and rain fall patterns
Proportional piling	Land use/land cover as perceived by farmers (past and present)
Semi-structured interview	Uses of resources, crop-rotational sequence, land tenure
Farm Maps	Cropping patterns and land use

a) Historical Analysis: Historical profiles were used (often in conjunction with other tools) to provide an overview changes in a particular aspect of relevance (e.g. land use change) over a particular time. The events or aspects of concern are investigated in relation to particular time periods or eras, but are not tied to specific dates.

b) Seasonal diagramming and Analysis: were used for investigating annual events such as cropping and labour calendars. They start with the construction of benchmark indicators of seasonal change (such as monthly rainfall). The activities are then plotted on the diagram, which is then used as a tool to analyze seasonally manifested problems, connections, changes and possible interventions.

c) Semi-structured Interview (SSI): The SSI a guided interview where the major topics a few key questions are prepared but many new topics may be discussed based on the responses to key questions. In most cases, these were held as group interview, with at least 8 participants. Key informant interviews were also made where specialist information was required.

d) Proportional Pilling: was used to indicate importance, priority or amounts to issues events and changes that were being investigated.

e) Farm Maps: were undertaken by individual farmers or farming families and are used to describe a farm in detail. They provide a visual tool around which specific land use practices and cropping patterns can be discussed.

Secondary Sources

Official documents and reports produced by governmental and non-governmental organizations provided secondary data at different jurisdictional levels. For instance, the Central Statistical Agency (CSA), various regional state documents and FAO, UNDP, UNIDO provided information on land resources and land-use patterns. Books and other relevant published and unpublished documents were also assessed.

3.3. Methods of Data Analysis

Initially statistical analysis was needed for the testing of the data. The analysis incorporated a number of steps such as: data exploration, data checking and editing, description of data parameters and variables, determination of relationships between variables, and identification of important variables.

Analysis of the data was undertaken using the statistical computer package "SPSS" version 16.

3.3.1. Descriptive Analysis

Descriptive analysis procedures were used to check, edit and clean the data set and to identify important variables for further analysis. The socio-economic data was initially subjected to simple descriptive analysis. This involved computation of simple frequency tables, correlations and contingency tables. In order to determine the appropriate

statistical test for continuous data, the distribution of the data sets were treated using the "SPSS" version 16, and by superimposing normal distribution curves on the resultant histogram. This procedure was also used in getting continuous data sets.

3.3.2. Chi-Square Analysis

The chi-square test was used to determine the presence of an association between two variables. It does not measure its strength, and the size of the chi-square statistic being determined by the sample size. If the probability value generated from these statistics is less than 0.05, the model would show significant association between the variables. The model is not functional if in the expected frequency there are cells less than one and 20% of them less than 5. Using this test determinant of resources management practices and perception of land productivity decline between the local and migrant population were analyzed.

3.3.3. 2-Way Sample Comparisons

Non-parametric tests for sample comparisons were used as most of the data did not satisfy the rule for parametric tests (normally distributed interval data). The non-parametric version of the 2-sample t-test, the Mann-Whitney 2-sample comparison, was used to compare the distribution of a variable between two independent samples. In this case, the actual value of the data is related by ranks and only limited assumptions are needed about the distributions from which the samples are selected. The model shows significant mean difference when the probability value is less than 0.05. Existence of difference in mean land holding size and households working age population between the local and migrant population were analyzed using the Mann-Whitney 2-sample comparison.

3.4. Conclusion

Physiologically, the study district is part of the northwestern lowlands where many development endeavors, including the construction of the Grand Renaissance Dam, are currently taking place. Biophysically the study district receives well distributed rain fall during summer (May to October). The red laterite soil, an indication of concentration of iron (ferric) oxides, which is poor in soluble minerals and rich in insoluble minerals, is dominant in the district.

The research methodology part provides a logical framework how to collect, process, and analyze the information gathered for this study. Major instruments used for data collection were questionnaire survey, focus group discussion, different tools of PRA, aerial photograph interpretation and satellite image (SPOT) analysis. Secondary data were collected from relevant government and nongovernmental organizations, books, and journals. Data collected were designed to address objectives and basic research questions outlined under section 1.3 and 1.4 respectively.

CHAPTER FOUR

DEMOGRAPHIC AND SOCIO-ECONOMIC PROFILE OF THE SURVEYED POPULATION

4.1. Population Structure

4.1.1. Age and Sex Structure

The household survey conducted at the three sites revealed that, of the total sample population, 43.0% were below the age of fifteen, 52.9 % were between the age of 15-64 and the remaining 4.1% above 64. This indicates that, as it is true for Ethiopia and some other developing countries especially in Sub-Sahara Africa, the population is predominantly young. This, in turn, indicates the existence of high fertility rate.

The existence of such a young population increases the dependency ratio. Accordingly, the dependency ratio, computed in terms of economically inactive age groups (below 15 and above 64) divided by economically active age groups (between 15-64) for the study sites is found to be very high, i.e. 89.1 per 100. This means that 100 workers have to support 89 other dependents. Put it in other way round, for every 100 producers there are 89 dependents.

However, it is common that in a traditional society like that of rural Ethiopia, a boy or a girl of 8 or 9 years old or more shares the responsibilities of his/her parents based on their respective sexes. It is also common to find boys or girls below the age of 18 that are actively engaged in different agricultural activities, apart from a multitude of household chores.

It is also important to consider the age structure of migrants. Accordingly, more than half (54.3%) of the surveyed migrants age is between 30 and 39. On the other hand, a little greater than 30 % falls between 40 and 49. Thus, 89.4% of the households age is between 20 and 49 years indicating that migration is age selective (Table 4.1).

Table 4. 1. Households Response to Age Category

Age category	Migrants		Local Population	
	No.	%	No.	%
20-29	5	4.8	2	1.9
30-39	57	54.3	37	35.2
40-49	32	30.5	37	35.2
>49	11	10.4	29	27.7
Total	105	100.0	105	100.0

Source: Field Survey, 2011

The sex composition of the sampled households reveal that of the total 1367 population, 52.4% are males while the remaining 47.6% are females. This gives a male-female ratio of 110.1:100. Put the other way, for every 110 males there are 100 females.

4.1.2. Marital Status and Family Size

Marital status is an important variable affecting fertility behavior since most of the births take place within marital union. So the change in the distribution of marital status has an important bearing on the size and structure of families and households. The survey at the three sites has revealed that 95.2% of the sampled respondents were married, 1.4% unmarried and the remaining 1.9 % and 1.4% were divorced and separated respectively (refer to Table 4.2).

Table 4. 2. Marital Status of Sampled Households

Marital status	No.	%
Married	200	95.2
Unmarried	3	1.4
Divorced	4	1.9
Separated	3	1.4
Total	210	100.0

Source: Field Survey, 2011

The average family size of the individual households in the study area as a whole is 6.2. However, it ranges widely from 2 to 12.

Table 4. 3. Family Size of the Respondent

No. of members	No.	%
<3	18	8.6
3 - 5	62	29.5
6 - 8	83	39.5
>8	47	22.4
Total	210	100.0

Source: Field Survey, 2011

As indicated in Table 4.3, the majority of the farm households have six to eight family members, accounting for 39.5 % of the total sample household. Households with less than three members constitute 8.6 % whereas farmers with eight and more members share 22.4 %. Some extremely large family sizes were observed in the survey with some of them having 10-12 family members.

The two household strata namely, local people and local migrants show distinct mean difference in family size patterns. The Gumuz, for example has an average of 7 household members whereas the migrants 6.0.

59

4.1.3. *Ethnicity and Religious Affiliation*

The Gumuz and Agaw are numerically the largest ethnic groups in the study area. These ethnic groups account for about 50.0% and 46.2 % of the total households respectively (refer to Table 4.4). The third position is held by the Amhara ethnic group, accounting for about 3.8%.

Information regarding religious affiliation of sample households reveals that 71.0 % are Orthodox Christians, 15.2% indigenous faith, 2.4 Muslims, 6.7 % Protestants and the remaining 4.8 % are adherents of the Catholic faith.

Table 4. 4. Households by Ethnic and Religious Affiliation

Ethnic Groups	No.	%	Religion	No.	%
Gumuz	105	50.0	Orthodox Christian	149	71.0
Agaw	97	46.2	Indigenous faith	32	15.2
Amhara	8	3.8	Protestant	14	6.7
Total	210	100.0	Muslim	5	2.4
			Catholic	10	4.8
			Total	210	100.0

Source: Field Survey, 2011

4.1.4. *Educational Status*

Table 4.4 shows the educational profile of surveyed farmers. The data presented in Table 4.5 reveals that only 63.3 % of the respondents cannot read and write. Those who can read and write constitute 19.5 percent. The corresponding shares of respondents who have received formal education comprise 17.1 %, i.e. primary and secondary education. It will also be noted from Table 4.5 that in regard to the attainment of education most respondents were not favored in terms of education.

Table 4. 5. Educational Status of Sampled Farm Households

Educational Status	No.	%
Cannot read and write	133	63.3
Can read and write	41	19.5
Primary education(1-8)	32	15.2
Secondary education(9-12)	4	1.9
Total	210	100.0

Source: Field Survey, 2011

4.2.   Landholding Size

The land holding size of the households ranges from 0.25 ha to 5.0 ha, 0.25 ha to 8 ha and 0.25 to 12 ha currently, ten and twenty years ago respectively. Table 4.6 shows that twenty years ago more than 58 % of the respondents have a holding size less than 2.5 hectares of land. Furthermore, 41.4 % of the households have holding size greater or equal to 2.5 ha. On the other hand, family holding size ten years ago reveals that the largest proportions (69.0 %) of sample households have holding size less than 2.5 ha and 31 % had a holding size greater than 2.5 ha.

The current land holding size of sample households indicate that 91.0 % possess holding size less than 2.5 ha whereas sample households with land holding size greater or equal to 2.5 ha constitute only 9.0 %. The over trend pertaining of land holding size shows decreasing trend. Attempt has been made to explore whether or not there is a variation in land holding size between the local Gumuz and the local migrant households. Consequently, the cross tabulation result reveals that better holding size is associated with the local Gumuz as depicted in the Table 4.6. Accordingly, 9.0 % of the surveyed Gumuz households have holding size grater or equal to 2.5 hectares of land as opposed to zero percent for the local people.

Table 4. 6. Land Holding Size over the Past 20 Years

Holding Size (ha)	20 years a go		10 years a go		current	
	No.	%	No.	%	No.	%
<2.5	123	58.6	145	69.0	191	91.0
≥ 2.5	87	41.4	65	31.0	19	9.0
Total	210	100.0	210	100.0	210	100.0
Household Strata	Holding Size (ha)					
	<2.5		≥ 2.5		Total	
	No.	%	No.	%	No.	%
Gumuz	86	41.0	19	9.0	105	50
Migrants	105	50.0	0	0.0	105	50

Source: Field Survey, 2011

The mean land holding size of sample households show a decline, i.e. it was 3.5 ha, 2.2 ha and 1.2 ha twenty years and ten years ago and at present respectively. The possible reasons for the decline could be population increase manifested through settlement expansion, appropriation of existing land holding to the young, and decline of shifting cultivation, which usually carried out in area of low population pressure. This result is in line with that of Mekuria (2008) who states that continual advance and expansion of settlement from highlanders resulted in relative scarcity of farmland, shortened fallow period, and more importantly the average size and plot number of the natives was reduced. The computed Mann-Whitney test reveals that there is significant statistical mean difference (P=0.000) between the Gumuz and migrants pertaining to mean landholding.

4.3.   Livestock Possession and Availability of Grazing Land

It is a common practice in Ethiopia to combine crop production and rearing of animals. The latter is conducted for various purposes including prestige, source of income, draught power, and sources of manure. In Metekel in general and the study area in particular rearing

of animals is as important as other agricultural activities. The survey result shows that the number of farm households involved in livestock rearing were large.

Table 4. 7. Distribution of Households by Livestock Types

No. of Livestock	Types of Livestock											
	Goats				Cattle				Sheep			
	2000s		1990s		2000s		1990s		2000s		1990s	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1-5	171	81.4	156	74.3	169	80.5	146	69.5	159	75.7	159	75.7
5+	3	1.4	25	11.9	3	1.4	19	9.1	0	0.0	6	2.9
Don't have	36	17.1	29	13.8	38	18.1	45	21.4	51	24.3	45	21.4
Total	210	100	210	100	210	100	210	100	210	100	210	100

Source: Field Survey, 2011

From Table 4.7 it is possible to note that goat and cattle rearing are more widely practiced than sheep. The majority of the households had one to five heads of livestock types under discussion, i.e. 81.4 and 74.3 % for goats, 80.5 and 69.5 % for cattle and 75.7 % for sheep for the periods 2000s and 1990s respectively. While farm households with more than 5 accounted for small proportion for all livestock types. Yet, significant proportions of households have no livestock in the study area. The average goat holding per farmer is 1.86 and 2.9 in 2000s and 1990s respectively. The corresponding value for cattle in the same period was 1.9 and 2.6 respectively. Likewise average sheep holding is 1.5 and 2.1 respectively. It is possible to note form Table 4.7 that average holding of livestock show a declining trend in the study district between 1990s and 2000s. The possible reasons could be trypanosomiasis and other animal diseases, decline in grazing land and, per capita land holding in the study area. Mekuria (2008:57) confirms this idea and states that "the absence of widespread cattle rearing habit of the Gumuz is attributed to the frequent outbreak of cattle disease caused by render pest."

The survey result and participatory field investigation have clearly indicated that there is shortage of grazing land. One of the reasons mentioned by farm households is that more and more land was brought under cultivation due to population pressure that in turn, triggered the need for additional agricultural land. In view of this, 61.4 % of farm households describe that grazing land is in short supply (Table 4.8). This was why Ethio-Italian Joint Project Formulation (2000) stated that degradation of rangeland is accelerating, particularly in the last few decades due to fast expansion of agricultural land triggered by demographic pressure.

Table 4. 8. Farmers Response to Grazing Land Availability

Availability of Grazing land	No.	Percent
Yes	81	38.6
No	129	61.4
Total	210	100.0

Source: Field Survey, 2011

4.4. Household Labour

Human labor is highly essential in subsistence and technologically backward agricultural activities. Especially in developing countries like Ethiopia, family labor predominates the labor share of agricultural activities. It is for this reason that in many studies family size has an important implication on yield (GebreGiorgis, 1989; Assefa, 1991). From this point of view, it is vital to refer to the structure of the working age population at the study sites.

The survey data reveal that the number of workers in a household ranges from one to eight. From Table 4.9, it is possible to infer that the majority of the households (54.8 %) have one to three workers. Households with three to five workers constitute 34.7% while the remaining 10.5 % account for five working age persons, or more.

64

Table 4. 9. Number of Working Age People in a Household

No.	Kutir Hulet		Jigda Selasie		Photo Manjere		Total	
	No	%	No	%	No	%	No.	%
1-3	29	41.4	42	60.0	44	62.9	115	54.8
3-5	31	44.3	22	31.4	20	28.5	73	34.7
≥ 5	10	14.3	6	8.6	6	8.6	22	10.5
Total	70	100.0	70	100.0	70	100.0	210	100.0

Source: Field Survey, 2011

There is a slight variation of average working age population by households at the three sites, the overall average being 3.4. Accordingly, in Kutir Hulet the average is 3.9. The corresponding value for Jigda Selasie and Photo Manjere is 3.2, indicating that farm households in Kutir Hulet have more working age population than Jigda Selasie and Photo Manjere. The computed Mann-Whitney test reveals that there is significant statistical mean difference (P=0.006) between the Gumuz and migrants pertaining to working age population.

4.5. Food Availability and Strategies

In countries like Ethiopia, much of the crop yield produced by smallholder farmers is used for subsistence purposes. In most cases the yield produced is consumed before the next agricultural produce is harvested. A discussion with a group of farmers revealed that when food shortage is serious, they are even forced to sell their livestock mainly goats. From this it is possible to note that farmers could face a high degree of food crop shortage. This condition compels the farmers to invest the cash income from charcoal and wood sell to purchase cereals from market. A discussion held with groups of farmers has revealed that the problem was more serious for local migrants. This is because the Gumuz can opt for other activities like charcoal and wood selling, and land leasing as the land and other resources are predominantly possessed by them. The situation prevailing in the region was best described by Mekuria (2008: 59) as follows:

The episode [periodic food shortage] resulted in the introduction of new institution unknown to the Gumuz; the land leasing institution. It was adapted by the Gumuz as a mechanism of copping with the new problematic condition. Formerly the indigenous (Gumuz) population used to supplement the agricultural activity with hunting, fishing, and honey collection. But these auxiliary activities are fading out with demographic pressure.

In order to overcome food production shortage migrant farmers pursue different strategies including borrowing in cash or in kind, selling livestock, working as daily laborer in and around the nearby towns, and any other job to make livelihood feasible.

4.6.   Land Clearing Practice

In many developing countries of the world, rural households are used to clear forests, wood lands, grasslands, and Shrub lands so as to get land for cultivation. Such encroachment to marginal land is more evident when there is high population pressure. An assessment has been made whether or not farm households have opened up of woodlands for cultivation for the last 20 years or so. In this regard, the majority of the Gumuz are used to opening up woodlands for cultivation and confirmed by 97.1 % of the respondents. Only very small proportion, i.e. 2.9 % have not extended (cleared) to woodlands for agricultural purpose. As opposed to this, none of the migrants has extended agricultural land to the woodlands (Table 4.10).

Table 4. 10. Farmers Response to Opening up of Woodlands for Cultivation

Response	Household strata			
	Local People		Local Migrants	
	No.	%	No.	%
Yes	102	97.1	0	0.0
No	3	2.9	105	100.0
Total	105	100.0	105	100.0

Source: Field Survey, 2011

With regard to land possession by the Gumuz, the common practice is that individualism is mixed with collective ownership. Thus, the migrants have no the right to extend to woodlands unless the land is leased to them by the local population under different arrangements (for details please see chapter 6).

4.7.   Conclusion

The study attempted to describe different demographic and socio-economic characteristics based on the survey. As elsewhere in Ethiopia the age structure of the surveyed population was young. This in turn indicates the existence of high fertility and occurrence of high dependency ratio. Average household size for the study district shows variation between the local people and migrants where the former has an average family size of 7 and the latter 6. Educational attainment of the surveyed population in general was low. The study further reveals that livestock possession of the surveyed population shows a declining trend between 1990s and 2000s. Similarly, average land holding size also shows the same trend between 1990s and 2000s partly due to mounting population in the area. Thus, land is becoming a scarce resource as well as other sources of income like livestock rearing, and possession is deteriorating in the district. As a result, heavy dependence on land resources seems to be an imminent condition practiced by small farm households in an effort to sustain them. As most farm households are not food secure, they are engaging in extractive economic activities like wood and charcoal selling and land leasing as risk management strategies.

CHAPTER FIVE

POPULATION DYNAMICS

Over 80 % of the world's population as well as 98 % of the world's population growth is currently occurring in developing countries (Newbold, 2010**).** The same source further reveals that, Africa, and particularly Sub-Saharan Africa, has growth rates in excess of 2.5 % and total fertility rates that exceed 5.00 (Newbold, 2010; Population reference Bureau, 2012).

5.1.   Population Size and Growth

Ethiopia has made three national population and housing surveys in 1984, 1994 and 2007. The population size of Mandura district was 18,017 in 1984, 22,593 in 1994, and 40,746 in 2007 (Figure 5.1). An attempt was made to estimate population size of the district prior to 1984. Assuming an exponential growth rate of 2.6 % per year between the two census periods of 1984 and 1994, the estimated population size for the district was about 8,925 in 1957, 10,708 in 1964, and 13,890 in 1974. This means, on average, 292 people were added to the district each year. Between 1957 and 2007, on average, 636 people were added each year, reaching 40,746 in 2007. Furthermore, taking the base population of 18,017 for 1984, on average, 458 persons were added each year to reach 22,593 in 1994. Based on the 1994 population, on average, 1,396 persons were added per year to reach 40,746 in 2007(Figure 5.1). The overall trend shows a continuing population increase in the district with an average population growth rate of 2.61 since 1975.

Crude density which refers to the number of people per unit area and is usually calculated by dividing the total population by its total area also reveals a considerable change throughout the study period. In view of this, the crude density which was 8.9 persons per square kilometer in 1957 has reached 40.5 persons per square kilometer in

2007 and supposed to reach 46.8 persons per square kilometer in 2017. This in turn indicates how through time population pressure on land is increasing in the district.
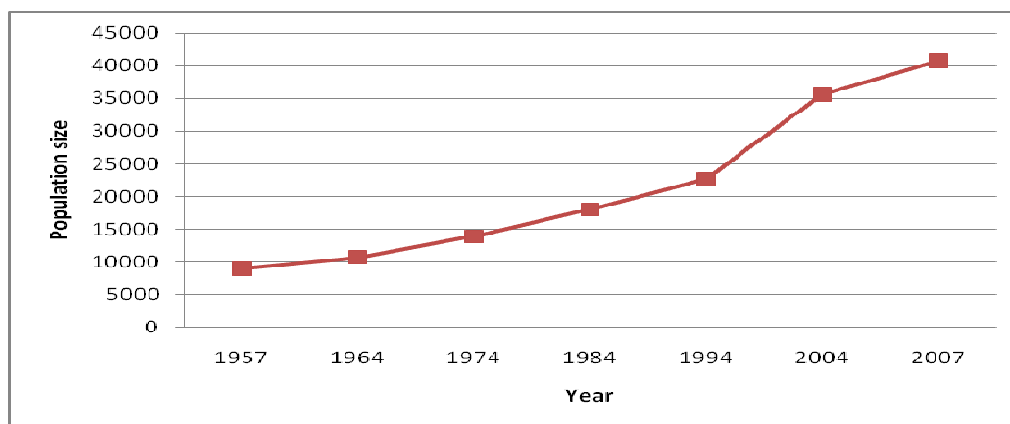
Figure 5. 1. Population Size of Mandura district, 1957-2007

The three census results reveal that population growth in the study district was high. Between 1957 and 1984, a period of 27 years, the population grew at 2.6 % per year. But this rate of growth rose considerably to 4.54 % between 1984 and 2007, a period of 23 years.

Table 5. 1. Inter-Censal Population Estimate of Mandura District, 1984-2007

Year	1984*	1985[5]	1986	1987	1988	1989	1990	1991	1992	1993	1994*	1995
Population size	18017	18475	18932	19390	19847	20305	20763	21220	21678	22135	22593	23989

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007*
Population size	25386	26782	28179	29575	30971	32368	33764	35161	36557	37953	39350	40746

* Source*: CSA, 1987; 1996 and 2008a*

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[5] *For other years population size was calculated using linear interpolation method* $P_t = P_0 + t/n (P_n - P_0)$

The majority of the population of Mandura district are rural residents. As a consequence, effort has been made to investigate population growth rate for rural parts of the district. Table 5.2 reveals that the population growth of the rural kebeles was extremely high, with average annual growth rate of 3.48 %. At this rate of increase, the population would double in 20 years. This is a short time for a district with considerably deteriorating natural resources and a population predominantly dependent upon subsistence agriculture.

The implication of this is that there will be increased demand for arable land, land for settlement expansion, forest for fuel and construction, reeds, and other natural resources. In a nutshell, more people in a short period means more pressure on land resources which in turn accelerates degradation and loss of pertinent resources. Furthermore, the district is supposed to cope with this fast and accelerated population increase which definitely is difficult with the current rapidly declining resources. As Embaye (2000) indicates population pressure is one of the most important factors that have accelerated the degradation of bamboo trees in Mandura district through expansion of agricultural land, settlements, need for fuel and construction materials. During focus group discussions it was learned that institutional weakness where there is little or no effort to manage and wisely utilize the natural environment by the local people, who currently have the upper hand over natural resources, is the most important factor in natural resources degradation. In the same way, development agents and experts also indicated that there is weak institutional setup and lack of coordination between the various actors in the district.

Table 5. 2. Population Growth in Rural Mandura between 1994 and 2007

Rural Kebeles	Population		Growth between 1994 and 2007	Rate of Growth (%)[6]	Population doubling period (after 2007)
	1994[a]	2007[b]			
Gumade	2428	3931	1503	3.71	19
Jegeda Selasie	1730	2843	1113	3.82	18
Manjare	850	1347	497	3.54	20
Kutir Hulet	2657	4008	1351	3.16	22
Deboh Giorges	1753	2840	1087	3.71	19
DahaAnzabuguna	1300	2003	703	3.33	21
Deha Nubeshe	1221	1929	708	3.52	20
Deha Maksegnit	2013	3197	1184	3.56	20
Bahus	523	746	223	2.73	25
Wodit	1255	1962	707	3.44	20
Ejenta	1008	1512	504	3.32	21
Gidem Dafeli	1713	2731	1018	3.59	19
Tuni Dadoshe	1472	2242	770	3.24	21
Dach Lumebiya	1222	1937	715	3.54	20
Total	21145	33228	12083	3.48	20

[a]Source: CSA, 1996
[b]Source: *CSA, 2008b*

Attempt has been made to project the rural population of the study area by taking the 2007 population and housing census result as a baseline. Assuming 3.48 % annual exponential growth rate to continue in the years to come, the population size of the rural population at ten year interval is shown in Table 5.3.

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[6]*The growth rates were calculated on the bases of the assumption of exponential growth: $P_t = e^{rn}$ Therefore, $r = 1/n \ln (p_t/P_0)$; the doubling period in years is given as $\ln 2/r$*

Table 5. 3. Projected Rural Population of Mandura District, 2007-2057

Year	Population size[7]	Rate of Growth in %
2007*	33228	3.48[2]
2017[2]	47069	
2027[2]	66675	
2037[2]	94448	
2047[2]	133790	
2057[2]	189519	

Source: CSA, 2008b and own calculation[2]

From Table 5.3 it is possible to note that the rural population would increase the years to come. Given the current age structure, decline in mortality and relatively high fertility, population increase for the future is unavoidable phenomena in the district. The rural young population (less than 15 years old) constitutes 50.01 % (CSA, 2008b). The same source further indicates that Metekel zone has recorded a total fertility rate of 5.09 which was one of the highest in the region (CSA, 2008b). Unless there is a sharp rise in death rates, population with high proportion of young will eventually experience fast population growth (Ehrlich and Ehrlich, 1990; Miller and Spoolman, 2010) emanating from high fertility. Mortality is declining but in-migration is still high. The facts stated above clearly show that future population rise of the district would be an inevitable scenario. Such increasing population means corresponding demand for resources on planet earth: air, water, and land environments (MEA, 2005). Hamandawana *et al*., (2005) observed deteriorating environmental trends in the form of deforestation, increased soil erosion, decline in grazing resources and extension of arable land into marginal areas due to population pressure in Zimbabwe. The impact that human population has resulted on natural environment at global level for the last fifty years has

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[7] *Population size was calculated on the bases of the assumption of exponential growth: $P_t = e^{rn}$*

been summarized by Panayotou (2000:1) as "the past fifty years have witnessed two simultaneous and accelerating trends: an explosive growth in population and a steep increase in resource depletion and environmental degradation". Without a doubt, such a condition has been the case in the study area where population has been dramatically increased whereas the natural environment has dwindled at an unprecedented rate.

5.2. Urbanization

Almost all population growth in the foreseeable future will occur in urban areas, mostly in developing countries (Pacione, 2009). At present, many developing countries are experiencing fast rates of urbanization, which is partly explained by population increase. Bilsborrow (1992) observed that the rapidity of urbanization in Africa is closely related to agricultural expansion and industrialization and has a profound effect on natural resources through increasing consumption demand. Indeed, urbanization has fundamentally changed and continues to change the human habitat (Véron, 2012).

Table 5. 4. Urban Population Growth in Mandura District (1994-2007)

Urban centers	Population			Growth between 1994 and 2007	Rate of Growth (%)[8]	Population doubling period (after 2007)
	1984[d]	1994[e]	2007[f]			
Genete Mariam	910	1448	4556	3646	7.00	9.9
Gelgel Beles	-	-	2962	-	-	-
Mandura	910	1448	7518	6608	9.2	7.5

[d]Source: CSA (1987)
[e]Source: CSA, (1996)
[f] Source: CSA (2008b)

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[8] *The growth rates were calculated on the bases of the assumption of exponential growth: $P_t = P_0 e^{rn}$*
Therefore, $r = 1/n \ln (p_t/P_0)$; the doubling period in years is given as $\ln 2/r$

Yu *et al*., (2010) also observed that during the past decades, land use/cover change has taken place around most Chinese cities at unprecedented rates due to economic growth, population, and changes in policies. Ethiopia is also experiencing a similar trend. One of the measures of urbanization is population size. Change in population size is the result of either natural increase or in-migration. As can be seen from Table 5.4 and Figure 5.2., the rate of population increase in the study district has been considerable. Mandura district encompasses Gelgel Beles, which is the administrative town of Metekel zone since 2000/2001.

Because of this both zonal and district government and non-governmental offices have been established at Gelgel Beles town. This eventually triggered the inflow of population to the town and considerably reduced the doubling time.
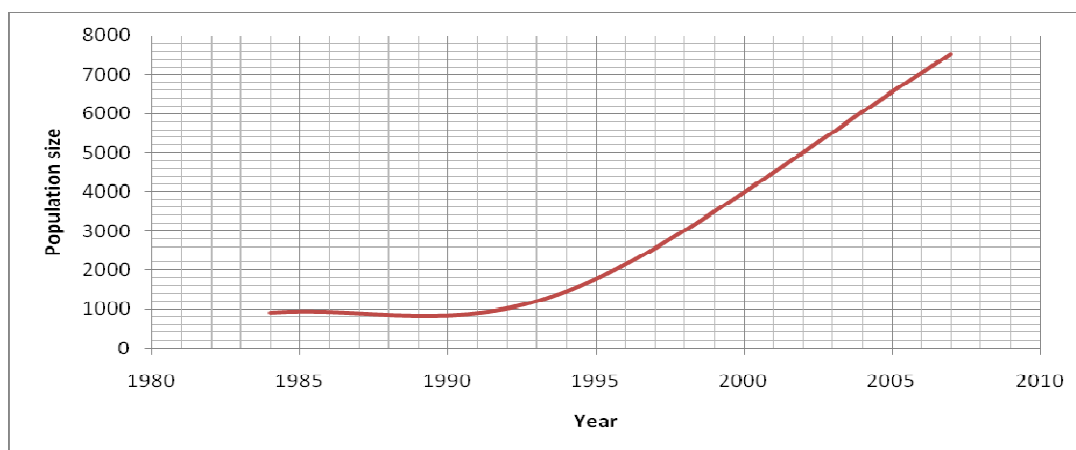
Figure 5. 2. Urban Population Increase, 1984-2007

This fast increasing population is resulting in growing need for forest and other natural resource products such as wood for fuel and construction. It is evident that forest products are widely used for different purposes in Gilgel Beles as well as Genete Mariam towns. Thus, the unprecedented urban population increase has resulted in resource loss and degradation emanating from corresponding increase in demand for natural resources.

74

Table 5. 5. Population Distribution by Type of Fuel Used for Cooking

Town/ District	No. of Respondents	Type of Fuel for cooking								
		Kerosene (1)	%	Charcoal (2)	%	Firewood (3)	%	Others (4)	%	(2+3) %
Genete Mariam	1686	15	0.9	587	34.8	897	53.2	187	11.1	88
Gelgel Beles	1816	97	5.3	831	45.8	867	47.7	21	1.2	93.5
Mandura	3502	112	3.2	1418	40.5	1764	50.4	208	5.9	90.9

Source: CSA, 2008b

It is clear from Table 5.5 that the principal source of wood for fuel in major towns of the study area is the natural forest. In view of this, in all the three geographical areas indicated above charcoal and wood utilization as source of fuel constitutes well above 85 %. The share of other alternative source of energy on the other hand is negligible (Table 5.5).

5.3.   Population Change as Perceived by Farmers

Households were asked to explore their perception on population increase in their respective kebeles. As depicted in the Table 5.6, population increase in the 1980s was slow. A momentous population increase began to take place since the 1990s. The respondents were asked why such an increase has occurred since the 1990s but not before.

Table 5. 6. Respondents Perception of Population Change in 1980s and 2000s

Rate of population increase	Year					
	1980s		1990s		Since 2000s	
	No.	%	No.	%	No.	%
Very high	2	1.0	21	10.0	88	41.9
high	29	13.8	111	52.9	122	58.1
low	93	44.3	51	24.3	0	0.0
no change	6	2.9	2	1.0	0	0.0
don't know	80	38.0	25	11.9	0	0.0
Total	210	100.0	210	100.0	210	100.0

Source: Field Survey, 2011

As indicated in Table 5.7, the causes for such a change were in-migration from the surrounding region (46.7%), natural increase (21.4 %) and both factors (31.9 %). Furthermore, according to the information obtained from residents, mortality has decreased due to immunization and the birth rate has been increasing due to improved maternal and child care as compared to the situation prior to the 1990s.

Table 5. 7. Households Response to Reasons for Population Increase

Reasons for Population increase	No. H.H.	%
In-migration	98	46.7
Excess of births over deaths(natural increase)	45	21.4
Due to In-migration and natural increase	67	31.9
Total	210	100.0

Source: Field Survey, 2011

5.4.   Reasons for Migration to the Lowlands

Movement of population from one geographical area to another is triggered by a number of push and pull factors at area of origin and destination respectively. These factors are broadly classified as natural (physical), social, economic and political (Witherick, 1990). Depending upon the situation in a particular area, these factors alone or in combination play a pivotal role in causing population movements. The factors that trigger population movements to the study area are summarized in Table 5.8.

Under the push factors listed, land degradation is one of the reasons that have activated many smallholders to migrate to the lowlands. As it was mentioned repeatedly, the highlands of Ethiopia have long been occupied by people which consequently resulted in land degradation, soil fertility decline, biodiversity loss and water point deterioration (Tegene, 2002; Bewket, 2003; Woldetsadik, 2003; Garedew *et al*., 2009; Amsalu, 2006; Tsegaye *et al*., 2010; Bantider, Hurni and Zeleke, 2011; Ayalewl, Kassahun and Woldetsadik, 2012; Bewket and Abebe, 2013). Likewise, the majority of the population of Ethiopia resides in the highlands. The distribution pattern is such that many people reside in a limited geographical area (Wolde-Mariam, 1992). High population and economic activities concentration in a limited geographical area coupled with other mediating factors like policies, tenure system have resulted in the gradual resources degradation to happen in the highlands of Ethiopia. Equally important is the way this population has grown for the last thirty or so years were significantly high, 3 % per year. This additional population is practicing agriculture and other economic activities on the existing land resource. Its sufficiency in the meantime deteriorated and forced many farmers to move to the lowlands. The proofs for this fact are huge government sponsored and spontaneous population relocations which were took place since the imperial period to the lowlands including the study area.

Table 5. 8. Factors Influencing the Movement of Households to the Study Area

No	Push Factors	No	Pull Factors
1	Land Degradation	1	Government
	Declining soil fertility		Resettlement
	Declining per capita holding		Absence of land use policy at regional level
2	Demography		Introduction of new development project
	Population increase	2	Land factor
	Population pressure		Land availability
	High fertility and declining mortality	3	Socio-Economic Factors
	Young age structure		Urbanization
3	Political Factors		Existence of all weather road
	Land redistribution		Institutional weakness at kebele level
4	Socio-Economic Factors		
	Growth of a family		
	Poverty		
	unemployment		

Source: Compiled from Focus Group Discussions and In-depth Interviews, 2011 and 2012

This is the reason that the Environmental Protection Authority (EPA, 1998: 42) summarizes the situation as:

> *Problems in the highlands push farmers to the marginal lands at lower altitudes. Here they try to practice their highland farming systems, resulting in enhanced environmental degradation.*

It is evident in many developing countries including Ethiopia that natural rate of increase is high. For example, Ethiopia's crude birth and death rates were 37 and 10 respectively per one thousand of the population in 2011. This gives 2.7 % rate of natural increase,

which is one of the highest in Africa as well as in the world (Population Reference Bureau, 2011). With this rate of growth the population would double itself in less than 26 years, which is a very short time period for a country that practices predominantly subsistence agriculture. This fast expanding population in rural parts of the country needs additional resource to subsist itself. This resource is available in the lowland parts of the country. Partly this is the reason why at present there is planned resettlement by the government as well as a continuous flow of people to the lowlands in their own initiatives. A study conducted in rural Tanzania also reveals the same situation where the recent trends in natural resources show diminishing of common property resources like land, forest, minerals, wildlife, and water resources due to population pressure and the various actions (Madulu, 2005).

The age structure of the population also affects future fertility behavior potentials of a certain area. As it was stated above, the age composition of the Ethiopian population in general and the study area in particular is young. This means that population will enter the child bearing age after sometime; hence, fertility will continue to be high over the years to come. Indeed, Hunter (2000) contends that propensity of migration varies by age, with young adults showing the highest likelihood of moving for different opportunities; especially those moving to rural areas increase pressure on the existing natural resource stocks including forest, land and water in an effort to satisfy their different needs.

The current government of Ethiopia has carried out land redistribution in Amhara regional state in 1996. As a result, large number of farm households has moved to the lowlands, including the study area, in search of arable and grazing land. A little greater than 96 % (101 out of 105 respondents) of the surveyed migrant farm households are from Amhara regional state. Discussions with migrant respondents reveal that farm land shortage, soil fertility and per capita landholding decline were mentioned as principal reasons for change of usual place of residence. As Rahmato (2009) rightly put it the land size currently possessed by many cereal producers in the highlands at country level is

not sufficient. He further noted that "… an average family would, under normal circumstances, require between 2.5 to 3.5 hectares of good quality land to produce enough food to feed itself for one harvest year" (Rahmato, 2009:306-07). But most farmers in the nearby regional state have not that much land size which consequently put them on risk of food insecurity. The same source further reveals that more than 87 % of farmers in Amhara, Tigrai, SNNP and Oromiya posses land holding size of 2 hectare or less (Rahmato, 2009). The above discussions clearly indicate that there is critical shortage of land in the nearby region which partly forces farmers to move to the lowlands.

During the field survey selected migrant respondents also indicated that one of the principal reasons for change of place of residence is attributed to growth of family size. With this condition household heads are unable to reallocate land to young family members who need the resource desperately. Some of them are forced to migrate to the lowlands in search of farm land as well other off farm opportunities. According to Gebreselassie (2006) smallholders in the highlands have reached to the point where they cannot reallocate their already meager and fragmented land to the growing labor within their family. The largest proportion, 85.9 % of rural households have a holding size less or equal to two hectares (Rahmato, 2009). Moreover, Bewket (2011) also contends that the land redistribution carried out in 1996 in Amhara region has resulted in land fragmentation. Legass (2010) shares this idea and argues that population increase and lack of potential agricultural land brought about land fragmentation in Gerado, Wello. As Rahmato (2009) rightly put it the land size currently possessed by many cereal producers in the highlands at country level is not sufficient. He further notes that "… an average family would, under normal circumstances, require between 2.5 to 3.5 hectares of good quality land to produce enough food to feed itself for one harvest year" (Rahmato, 2009:306-07). But land size among smallholders in many parts of the country is far smaller than two hectare. As coping strategy those who have no land would migrate to the lowlands. It is also evident at international level that scarcity of land

resources has led to waves of outmigration to hitherto unoccupied lands (Sherbinin, 2006).

In a subsistence agriculture where the utilization of modern agricultural inputs is little or none existent, prevalence of poverty among farm households, emanating from food insecurity is becoming an inescapable phenomenon. Thus, households devise all possible ways to escape from being trapped in the problem and end up in a crisis. One of these could be, to migrate where there exists ample resources and opportunities. This is partly the explanation behind why they opt for migration. Unemployment in rural parts of Ethiopia is closely associated with availability of land. Land is in short supply in many parts of rural Ethiopia for different reasons including tenure insecurity and ever increasing population pressure (Rahmato, 2009).

Government policies, land and socio-economic factors are identified as important pull factors. The study area was one of the settlement projects identified by the government in the 1980s following severe drought and famine in the country. Of the total 600,000 people identified for resettlement, over 82, 000 of them were moved to Metekel zone (Yntiso, 2002). Thus, the resettlement program of the government has increased demographic pressure in the study area. The situation not only increased population pressure but also displaced the local population which adversely impacted the environment. In the same way, Ethiopia has no any explicit land use policy. So does BenshangulGumuz Regional State. Land is utilized in a haphazard way. Due to lack of such a regulatory framework on the use of land, many migrants and local population have been flowing and invading hitherto unoccupied areas, clear forests, woodlands, Shrub lands for agriculture in the region in general and the study district in particular. Compared to other areas, the lowlands have ample arable land though the size of arable land is diminishing from time to time following increased pressure from highland migrants. Such availability coupled with other factors can be possible pull factor that attract many people. Aderie (2002) observed that the land redistribution in Amhara regional state in 1996 has implications of movement of the people out of their place of

residence in search of other opportunities. Migration is set in motion in the study area like what has been stated by Carr (2009) and Amacher *et al*., (1998) not only population pressure, unemployment and land scarcity at area of origin (push forces) but also low population pressure, of undeveloped land like forest land with insecure right with the existing tenure is important attractor of migrants (pull forces) to a frontier.

Socioeconomic factors in terms of urbanization, existence of all weather road and institutional weakness at kebele level have also encouraged many highlanders to intrude into the lowlands. New urban centers have been emerging following the new regionalization setup by the federal government. Opportunities to engage in different activities attracted many people to the area. It is observed that rapid urbanization has significantly triggered land use/cover changes (Dewan and Yamaguchi, 2009; Yu *et al*., 2010). Similarly, existence of all-weather road makes the lowland to be accessible by many land seekers. In Brazil and other tropical countries, the existence of road network access has intensified as one of the causes for land use/cover dynamics (Lambin *et al*., 2003). Kebeles are not strong enough to discharge their duties. There are no any kinds of rules and regulations to prohibit migrants to settle in any of the kebeles and practice different activities. The overall condition is, therefore, easy flow to the district, occupy land and practice different agricultural activities after different arrangements like in the form of share cropping and or cash with the local population.

The above discussions clearly indicate that different factors in combination or and at times in isolation have been playing a pivotal role in activating migration to the study area.

5.5.   Conclusion

Population in many countries of sub-Saharan Africa is growing very fast. Similarly, the population of the study district is also growing at alarming rate. Between 1957 and 2006/07, a period of 49 years, the population has increased more than fourfold. As it is

true elsewhere in rural Ethiopia the rate at which the rural population increase was spectacular. It is true that such fast increasing population demand additional land for agriculture which surely is becoming scarce. Reasons for such accelerated rate of growth were attributed to migration from the surrounding region, decline in mortality rate and increase in fertility rates in the district. Moreover, following the 1991 change in government, Benshangu-Gumuz was designated as one of the nine regional states in Ethiopia. New urban centers start to emerge following the new organizational setup. These new urban centers in turn start to attract population for different opportunities from the nearby rural and distant areas. Various push and pull factors have played an important role in triggering such mobility to happen. Among others, land degradation in the highlands, natural increase, migration, government policies have been the most important factors in the population dynamics of the study area.

CHAPTER SIX

FARMING SYSTEM AND LAND USE/COVER DYNAMICS SINCE 1957

6.1.   The Farming System

The farming system in the study sites is characterized by sedentary mixed farming with crop production as the main and livestock rearing as auxiliary practices. While the local migrants farmers follow the oxen-based farming the Gumz ethnic group relies on shifting hoe cultivation. The farmers still employ their age old indigenous technology for crop production and animal husbandry. Annual crops are mainly cultivated for meeting household subsistence needs. Whatever surplus is produced in the form of cash crops or animals is mainly meant to cover the simple domestic necessities of the family and pay land taxes.

The farming system remains highly dependent on simple hand equipment: the traditional wooden plough, called "maresha", which is drawn by a pair of oxen, is the tool used in the process of agricultural production by migrant. The Gumuz widely use hoe and mainly cultivate crops for direct consumption including cereals (finger millet, sorghum, maize), pulses, root crops (yam, sweet potato) and horticultural crops (okra, pumpkin, pepper, cabbage, etc.). The main cash crops are, apart from ginger (grown on river banks), cotton, sesame, and nigger seed. They also harvest seeds, leaves, roots, barks of wild plants. Ginger which was once dominant root crop in Mandura district is rarely found due to deterioration of water points in the district. Furthermore, the Gumuz own livestock, mainly small ruminants and poultry, which are raised for meat, cash income and social and religious ceremonies. In the past, Gumz are said to have been great cattle herders, but they were discouraged by recurrent disease (mainly trypanosomiasis) and theft (mainly by highlanders who took advantage of the free grazing system practiced by the Gumz). Gumz complement agriculture and livestock raising with hunting, fishing, craft, and trade (Ethio-Italian Joint Project Formulation, 2000; Awas *et al*., 2010).

However, shifting cultivation which is usually associated with low population pressure is currently fading away due to population increase (Awas *et al*., 2010). Since 1995 the local population has been practicing share-cropping arrangements with highlanders in exchange for crops or cash. Discussions with experts indicate that the share cropping arrangement has resulted in destruction of long existed tress, woodlands, and grasslands as the migrants need space for ox plough.

6.1.1. *Rainfall Distribution and Crop production*

Discussion was held with group of farmers to see their perception of rainfall distribution through seasonality analysis. The farmers ranked, June, July, August, and September as the months of highest rainfall and October and April are ranked as fifth and sixth highest rainfall months. March and November are the months with low rainfall. Finally, the months of December, January and February are indicated as the least in rainfall amount. Furthermore, farm households reported that rainfall distribution trend has changed since the last few years. Accordingly, it starts late and ends early as opposed to what has been observed during the normal time. They ascertained the situation for example in 2011 rain started in May but normally it should have been in March or the latest by April which in turn results shortened growing season.

A wide variety of crops are cultivated in the study sites. The dominant crops in terms of areal coverage are cereals that include millet, sorghum, maize, and Eragrostis teff whereas sesame, groundnut and nigger seed are oil crops cultivated. Haricot bean is the other crop widely cultivated by smallholders. Mango, papaya, cabbage, banana, lemon, potato, pepper, pumpkin, onion, and climbing beans also grow and intercropped around the homestead. The 2011 crop cultivation in the district for major crops and cropping season shows that cereal production predominate the cropping pattern in the study district. The share of other crops is small as compared to cereals (Table 6.1).

As it can be observed in Table 6.1 the types of crops cultivated for 2011 shows that a little more than 38 % of the cultivated land was constituted by sorghum and millet as these two crops are the most staple crops, indicating that these crops are by far the most widely cultivated cereal crops in the study area. The next important cereal crops were maize and Eragrostis teff. Sesame was one of the most outstanding, i.e. in terms of source of cash and widely cultivated oil crops, which constituted 79.5 % of the cultivated land by all oil crops. This was so because Sesame is one of the most important cash generating oil crops in the country. The corresponding share for groundnut and nigger seed was 17.5 % and 3 % respectively.

Farmers were asked to explore whether or not there was yield decrease for the last 20 years or so. The majority of farm households (78.1 %) stated that yield was decreased while small proportion stated as yield was increased (2.9%) and no change (19.0%) respectively.

Table 6. 1. Major Crops and Cropping Pattern in Mandura District, 2011

Category	Crop Type	Cultivated Land in Hectare	%
Cereals	Sorghum	10084	38.7
	Millet	10048.4	38.5
	Maize	5037	19.3
	Eragrostis teff	914	3.5
	Total	26083.4	100.0
Oil Seeds	Sesame	3725.25	79.5
	Groundnut	822	17.5
	Nigger seed	140.5	3.0
	Total	4687.75	100.0
Pulse	Haricot Bean	271	-

Source: Mandura District Agriculture and Rural Development Office, 2012

Discussions with groups of farmers have revealed that at times rainy season may start earlier and stays for shorter time or may start late and stay for prolonged times. This variability affects the short maturing crops such as maize and sorghum which are highly susceptible to heavy rainfall and prolonged dry season. As it is true elsewhere in the world, partly climate change is affecting agriculture in the study area.

6.1.2. Cropping Calendar

The farmers were asked to draw the calendar for each crop type under normal climatic condition and the result is shown in Table 6.2. According to the calendar the ploughing period varies from one crop type to another. If we start with one of the dominant cereals viz. maize, field preparation and ploughing start in April and May respectively. Sowing is usually done in May. The entire activities of weeding, i.e. hoeing, ploughing between rows of the young crops, clearing by machete and weeding by hand are conducted from June to July. Green harvesting starts in the month of August whereas the dry harvesting ends between the months of November and December.

The other crop widely cultivated by respondents is sorghum. Field preparation (ploughing) is done in the second week of May while sowing is accomplished at the end of the same month (May). The month of July and August are devoted to soil banding and weeding, respectively. Harvesting is carried out in December.

From mid May to mid June it is field preparation (ploughing) period for finger millet followed by sowing at the end of June and middle of July. From middle of July to August it is a season of weeding. Harvesting and threshing is accomplished from December to the end of February.

From May to July it is field preparation (ploughing) period for Eragrostis tef followed by sowing at the end of July. From September to October it is a season of weeding. Harvesting and threshing is accomplished from December to January.

As far as haricot bean is concerned, field preparation (ploughing) starts in July and lasts till mid August. This is followed by sowing and weeding in August and September respectively. Harvesting and threshing is accomplished from November to December.

Table 6. 2. Cropping Calendar of Major Crops in the Study District

Months / Crop Types	J	F	M	A	M	J	J	A	S	O	N	D
Millet	H	H			P	P/S	S/W	W			H	H
Sorghum	H				P/S			W			H	H
Maize				P	P/S	S/W	W		G		H	H
Eragrostis tef	H				P	P	P/S		W	W		H
Haricot Bean							P	P/S	W		H	H
Nigger seed							P	P/W	W		H	H
Sesame						P/S	S	W		H	H	H

P = Ploughing; S = Sowing; G = Green harvesting; W = Weeding (hoeing); H= harvesting

With regard to oil seeds sesame is one of the crops cultivated by respondents. Pertaining to cropping calendar, field preparation (ploughing) period is in June. Weeding is accomplished in the month of August whereas harvesting and threshing from October to December. Finally, for Nigger seed field preparation (ploughing) period is in June. The month of July is the season of sowing. Weeding is carried out in the month of July followed by harvesting and threshing from November to December.

Discussions with groups of farmers have revealed that the short maturing crops such as maize and sorghum are highly susceptible to heavy rainfall and prolonged dry season. As can be seen from Table 6.2 farmers are busy with different farming activities from May to January.

6.1.3. Farmland Utilization

One of the reasons for land use/cover change is the way land is utilized by farmers. An attempt has been made to assess land utilization among the surveyed population at present and twenty years ago. Shifting cultivation was one of the most important types of agricultural practice twenty years ago and this has been supported by 39 % of the surveyed households. Forty one percent of the respondents have favored the other category may be indicating that a mix of the listed forms of land utilization may be used. Respondents who stated that they were using their land once in a year constituted 15.7 %. Land was not used always twenty years ago (accounted only 2.9 %) indicating land was not a scarce resource (Figure 6.1).
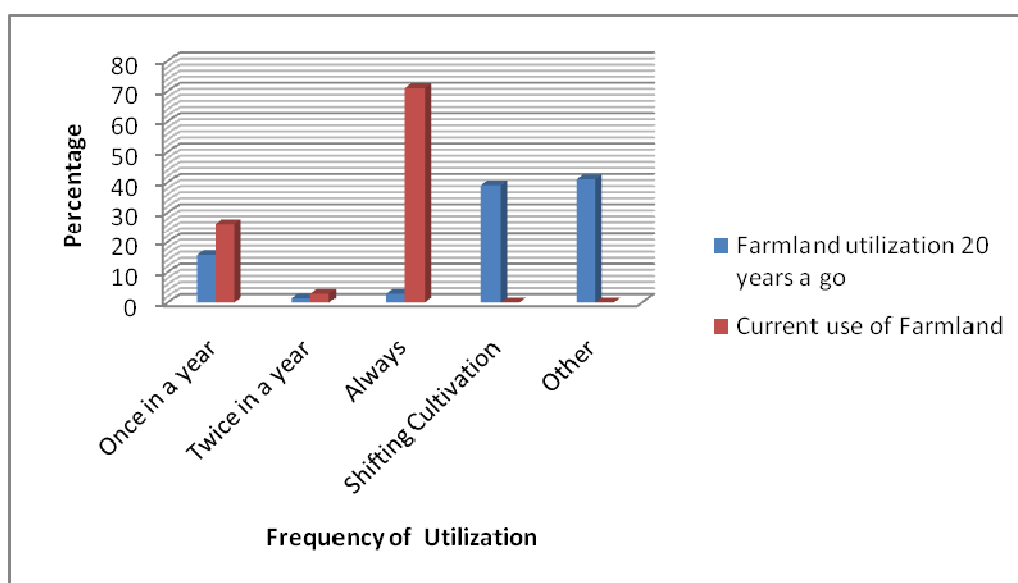
Figure 6. 1. Distribution on Farmland Utilization

With regard to the current land utilization practices, most respondents (71.0 %) affirmed that they are using their farmland always indicating presence of land shortage. Yet, those who use their land once in a year constitute the second largest response, 26.2 percent. Those who are utilizing their land twice in the year are very small (only 2.9%) and attributed the reason to absence of irrigation or small rainfall in the district (Figure

6.1). As Mekuria (2008) noted the Gumuz were forced to utilize fallow fields without proper vegetative substitution.

6.1.4. Land Availability and Strategies to Cope with Land Scarcity

The population of the study area is predominantly (89.0%) engaged in agriculture. Thus, land is an important asset to practice different agricultural activities. Farm households were asked to respond whether or not land in the study area is a scare resource. To this end, the majority of respondents feel that land is a scarce resource, confirmed by 92.9 % of surveyed respondents. Small proportion, (3.8%) of respondents, feel that land is an abundant resource. Yet, there is difference between the Gumuz and the migrants on their view on land availability. The computed cross tabulation within household strata reveals that the entire migrants (100%) feel that land is a scarce resource whereas the corresponding value for the Gumuz is 85.7 Percent.

During focus group discussions, respondents have confirmed that many of the migrants from the surrounding region have no land to plough. Instead they get land in the form of rent from the local Gumuz population. The procedure could be to pay back in cash or in-kind based on the agreement reached. As it is stated by the migrants the Gumuz used to deny them by breaching the deal reached. Consequently, they transfer the land to another person. In the process, the migrants suffer from this situation which as a result affects their livelihood and very existence. The migrants further stated that there is no strong local institution to keep an eye on and solve the problem. Respondents were further asked to give their views on the possible reason(s) for land scarcity. They feel that population increase is the most important factor, reaffirmed by 99.5%. The migrants from the surrounding region are continuously flooding into the area assuming that there is ample agricultural land. This has resulted in the use of large tracts of land for agriculture and widespread clearing of forest for fuel, house construction, and charcoal as alternative source of income. On the other hand, respondents who assume that land has fallen in few hands constitute 72.0 percent. The equivalent share for diminishing of

fertile land was supported by 39.0 percent (Table 6.3). Soil fertility decline is a serious problem in Jigda Selasie kebele than the other two. It is a one of the kebeles adjacent to the Amhara regional state. That was why Mekuria (2008) asserts that because of short fallow period, agricultural production has decreased and this in turn caused many of the Gumuz bordering the highlanders to suffer from periodic food shortages.

Farmers have long established indigenous knowledge to solve problems related to agriculture including land scarcity. In view of this fact, household respondents were asked to give their practice of how to overcome land scarcity. To this effect, 98.3 % farm households favor engaging on off farm activities whereas opting for ploughing steep slope was claimed by 39.4 percent. Furthermore, clearing more woodland as a strategy of alleviating land scarcity is supported by 32.0 % of the respondents. During focus group discussions it was stated that some farmers who have no land are engaged in off farm activities like daily laborer in the nearby towns (Table 6.3).

Table 6.3. Response to Reasons for Scarcity of Land and Solving Land Scarcity

Reasons for land scarcity	No.	%
Population increase	199	99.5
Proportion of fertile land is diminishing	78	39.0
Land has fallen in fewer hands	144	72.0
Total	421	210.5 [9]
Strategies of Solving Land Scarcity		
Clearing more woodlands	56	32.0
Plough steep slopes	69	39.4
Look for off-farm employment	172	98.3
Total	297	169.7

Source: Field Survey, 2011

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[9] *Total over 100 % is due to multiple responses*

Expansion of agricultural land to hitherto unoccupied and marginal lands like woodlands, Shrub lands and grasslands with scattered trees is evident from aerial photographs and image (SPOT) analysis of this study as well as table 4.10. The result of this study is in line with the findings of (Zelinsky, 1966; Carr, 2009; Newbold, 2010) which state that most of the developing world falls within the second stage of the mobility transition (the early transitional society) characterized by increased population, that in turn, encourages people to colonize new areas for agriculture (also called frontier ward migration) into more remote and hitherto unused and unoccupied parts of the country.

6.1.5. *Soil Productivity*

In an area where renewable natural resources degradation exists land productivity decline is inevitable. Farm households were asked to state whether or not there was productivity decline over the last 23 years. About, 53.4 % of the respondents stated that there has been productivity decline whereas the remaining 46.6 % stated non existence of the phenomena. As Table 6.4 indicates the problem is considerably high in Jigda Selasie kebele. It is one of the kebeles that is found neighboring Amhara regional state hence many migrants use it as stepping point to other areas.

Table 6. 4. Farmers Response to Soil Productivity Decline

Soil productivity decline	Name of kebele						Total	
	Kutir Hulet		Jigda Selasie		Photo Manjere			
	No.	%	No.	%	No.	%	No.	%
Yes	26	37.1	60	85.7	26	37.1	112	53.4
No	44	62.9	10	14.3	44	62.9	98	46.6
Total	70	100.0	70	100.0	70	100.0	210	100.0

Source: Field Survey, 2011

The response between the Gumuz and the migrant to soil productivity decline is also different. The problem is well felt by migrants accounting for 68.6% as opposed to 38.1

% by the Gumuz. The obvious reason for this is that land at present is occupied by the local population.

Table 6. 5. Cross-Tabulation of Soil Productivity Decline by Household Strata

Land productivity decline	Local population		Local Migrants		Total	
	No.	%	No.	%	No.	%
Yes	40	38.1	72	68.6	112	53.4
No	65	61.9	33	31.4	98	46.6
Total	105	100.0	105	100.0	210	100.0
	X^2=19.59		P=0.000			

Source: Field Survey, 2011

The corresponding value for those who stated that there is no soil productivity decline constitute only 61.9.2 % and 31.4% by the Gumuz and migrants respectively (Table 6.5). The difference with regard to perception of land productivity decline between the two groups could be the migrants have more exposure on sedentary agriculture than the Gumuz who used to practice shifting cultivation. The calculated chi-square (Table 6.5) validates that the association between the Gumuz and the migrants pertaining to perception on soil productivity decline for the last 20 or so years is statistically significant (P= 0.000).

Productivity decline of soil is attributed to different reasons. About 96.4 % respondents were associated with loss of nutrients. The red laterite tropical soil of the area is susceptible to erosion once the vegetation cover is removed. Absence or little practice of fallow on the other hand contributed its share on soil productivity decline, supported by a little greater than 85 percent. The remaining 66.1% were associated with aging of the land (Table 6.6). That was why Yntiso (2003) affirms that the subtropical soils of Metekel contain limited organic nutrients. Moreover, the soils are vulnerable to erosion. The abandonment of the fallow practice and the consequent loss of vegetation cover will be damaging to the fragile ecology. Studies so far made convincingly indicate that short fallow period, aging of land and nutrient depletion are widely observed in different parts

of Ethiopia (see Zeleke and Hurni, 2001; Tegene, 2002; Bewket, 2003; Amsalu, 2006; Garedew *et al*., 2009; Teferra, 2009; Tsegaye *et al*., 2010; Ayalewl, Kassahun and Woldetsadik, 2012; Bewket and Abebe, 2013).

Table 6. 6. Reasons for Soil Productivity Decline

Reasons for land productivity decline	No.	%
Loss of nutrients	108	96.4
Little or no use of fallow	96	85.7
Aging of the land	74	66.1
Total	278	248.2

Source: Field Survey, 2011

6.1.6. Methods of Improving Soil Fertility

Farmers practice different strategies to improve the fertility of the Soil. The methods involve modern and traditional techniques including applying commercial fertilizer, manuring, crop rotation, and fallowing.

Table 6. 7. Soil Fertility Management Methods

Methods	No.	%
Use manure	83	39.5
Commercial fertilizer	10	4.8
Rotate crops	117	55.7
	210	100.0

Sources: Field Survey, 2011

Table 6.7 shows that 39.5 % of the respondents use manuring to improve fertility of the soil and the majority (55.7 %) rotate crops to maintain fertility of the soil. The remaining 4.8 % use commercial fertilizer to improve fertility of the soil. Thus, traditional methods are still more frequently used by most of the respondents. High and constantly increasing price

keep away many traditional and subsistence farmers from using modern inputs, as it is clearly shown in Tables 6.7 and 6.8.

Commercial fertilizer utilization in the district is not only small but also fluctuates in amount. Likewise, improved seed utilization reveals the same situation. Discussion with development agents and local experts reveal that only few indigenous Gumuz farmers are involving as model farmers to get extra assistance from them. Possible reasons stated by them were raising price of modern inputs and low credit facilities which repeal them from being involving. Involvement of migrant farmers is also low for similar reasons (Table 6.8).

Table 6. 8. Modern Fertilizer and Improved seed Utilization, 2008-2011/12

Type of Fertilizer (Kg)	Year			
	2008/09	2009/10	2010/11	2011/12
DAP	884	223	484	423
UREA	284	187	510	393
Total	1168	410	994	816
Type of seed (Kg)				
Maize	7100	2300	8600	Not available
Sesame	3900	3200	11700	Not available
Groundnut	700	1600	6800	Not available
Haricot Bean	900	1600	5300	Not available
Total	12600	8700	32400	

Source: Mandura District Agriculture and Rural Development Office, 2012

Similarly, the utilization of chemical fertilizer by smallholders was constrained by high and increasing market prices, lack of credit services and risks associated with rainfall failure in the central highlands of Ethiopia (Amsalu, 2006).

6.1.7. Crop Rotation Patterns and Fallowing Practices

In order to restore soil fertility, farmers use crop rotation as an important strategy. In the study sites the number of farmers practicing this method was found to be 55.7 % (Table 6.7).

The most frequently used rotational sequence is Millet, Sorghum and Maize and followed by Sesame (Figure 6.2). Discussions held with groups of farmers indicate that they do not usually cultivate maize on the same plot unless the sorghum fields are manured. Farmers know from experience that if they sow maize consecutively with sorghum the amount of maize yield they obtain will considerably decrease. By contrast, they rent the land for migrants so that the land would be exhaustively ploughed, thereby uprooting the roots of the sorghum residue thus the main cause of yield decline will be eradicated.

The number of farmers using fallowing as a method of improving soil fertility is small, accounting for 12.9 % of the total respondents. The basic reason for low fallowing practice, according to the respondents is that the land size they have and the family they possess is not well-matched. In some instances they allocate land to the young son(s) which consequently diminish farm size of the household.

This, in turn, means population increase and consequent shortage of land is apparent in the study area. Farmers with large holding size, however, can manage to fallow their land. Taking the twenty seven farmers who practice fallowing, 77.8 % fallow their land for only one year while the remaining 22 .2 % for two years. The response for the two strata is the same in that more than 85 % of respondents did not practice fallowing to restore fertility of soil. Studies also indicate that with increasing population size land becomes a scarce resource this in turn resulted in reduced farm size and make it difficult to practice fallowing to restore soil fertility (Aderie, 2002; Woldetsadik, 2003; Amsalu, 2006;. Emiru, Gebrekidan and Tibebe, 2012).

Figure 6 2.The Routine Crop Rotation Practice of the local Gumuz Population

6.1.8. Rate of Advice by the Government

In the questionnaire survey, a question regarding the availability and frequency of advice and services by the government on soil and water management, crop production, animal health and input delivery was administered.

Table 6. 9. Farmers Responses by Rate of Advice by the Government

Frequency of Advice	No.	%
Every six month	11	5.3
Every three month	40	19.0
Every month	40	19.0
Every week	119	56.7
Total	210	100.0

Source: Field Survey, 2011

As indicated in Table 6.9 a little more than 56 % of the respondents stated that they were visited by development agents every week, whereas 19.0 % agreed that experts from different levels of Agricultural Office visited them in every one and three month. The remaining respondents stating visits every sixth month constituted 5.3%. The attention by

97

the authorities as well as development agents in this regard is good. The prevalence of advice is still much better for contact-farmers who practice the extension packages. These are model farmers selected by the development agent (if they are willing) and get a close follow-up while practicing the different extension packages. Despite expansion of extension and development works in the country in general and the study area in particular (Kassa, 2008), field observations, discussion with farm households, and experts reveal that changes observed on agricultural practices, lifestyles, environmental protection and management practices are still found at the lowest stages of development. This, in turn, is an indication of the low performance of the extension and development program in the district. Development agents mostly come with already decided agenda by the government, a top down approach, and thereby to be implemented by farm households. Past experiences convincingly testify that rural residents are less likely to accept and put into practice. Consequently, extension and development endeavors intended to change the life of farmers will not bring any change. Farmers were not involved in the decision making process, i.e. the voices of the farmers are missing. In reality, farmers should have been made to voice their lived experiences. To improve the situation therefore from planning to the stage of implementation, monitoring and evaluation, the active participation of the users is an extremely a desirable processes.

6.2.   Land Use/cover Types and Changes Since 1957

The major land use/cover types identified hereunder are based on the description given in Table 6.10 below. As a result eight major land use/cover types including forests, woodland, shrub land, grassland with scattered trees, reverine trees, bare land, farmland and, settlement have been identified.

Table 6. 10. Land Use/Cover Type and their Respective Definition

Land use/cover type	Description
Farm Land	Areas used for rain fed and irrigated cultivation, including fallow plots, cultivated land mixed with some bushes, and trees but dominated by farmland.
Natural forest	Areas covered by trees forming closed or nearly closed canopies (70-100%); predominant species are Bamboo *Arundinaria alpina*
Wood Lands	Land covered by an open stand of trees taller than 5m and up to 20m height and a canopy more than 20%.
Bush and Shrub land	Land covered by an open stand of trees/or-scattered shrubs 2 to 5m tall and canopy cover of more than 20% as well as short shrubs and thorny bushes with little useful woods found along rugged micro-relief.
Grassland with scattered trees	Areas dominated by permanent grass cover mixed with scattered trees along ridges steep slopes and plain areas used for grazing; usually individual as well as communal
Bare Land	Areas that have little or no vegetation cover, mainly with gullies and exposed rocks. (Barren eroded lands mostly on top of mountains, open areas near homesteads).
Riverine trees	Trees and shrubs along the stream/river courses
Settlement	Areas occupied by urban and rural residential houses and other buildings

Table 6.11 below depicts the area coverage, spatial distribution, gains, and losses of the different land use/cover types in Mandura district.

6.2.1. *Forests*

As elsewhere in Ethiopia, the forest cover of the study area shows a gradual decrease during the study periods (1957-2006/07). Forest cover decreased from 5.17 % in 1957 to 2.59 % in 1982. There was no forest left in the district in 2006/07. In terms of land area

the district lost 2,602 ha of forest cover between 1957 and 1982 and 2,598 ha of forest cover between 1982 and 2006 (Table 6.11 and Figures 6.3, 6.4 and 6.5).

Table **6. 11. Land Use/Cover Changes in Mandura District between 1957 and 2006**

Land use/cover classes	Land use/cover Changes						Area changes of Land use/cover between the study years; gain(+) or loss (-)		
	1957		1982		2006		1957-1982	1982-2006	1957-2006
	ha	%	ha	%	ha	%	ha	ha	ha
Forests	5200	5.17	2598	2.59	0	0	-2602	-2598	-5200
Woodlands	17700	17.61	15712	15.63	232	0.23	-11988	-15480	-17468
Shrub lands	41000	40.80	33649	33.48	24100	23.98	-7051	-9549	-16900
Grassland with scattered trees	10500	10.45	5858	5.83	45	0.04	-4642	-5813	-10455
Bare land	11900	11.84	5466	5.44	3520	3.50	-6434	-1946	-8380
Riverine trees	1800	1.79	2502	2.49	6882	6.85	+702	+4380	+5082
Farmland	12200	12.14	34534	34.36	64800	64.48	+22334	+30266	+52600
Settlement	200	0.20	181	0.18	921	0.92	-19	+740	+721
Total	100500	100	100500	100	100500	100			

Source: Aerial Photographs of 1957, 1982 and SPOT _5 Image 2006/07
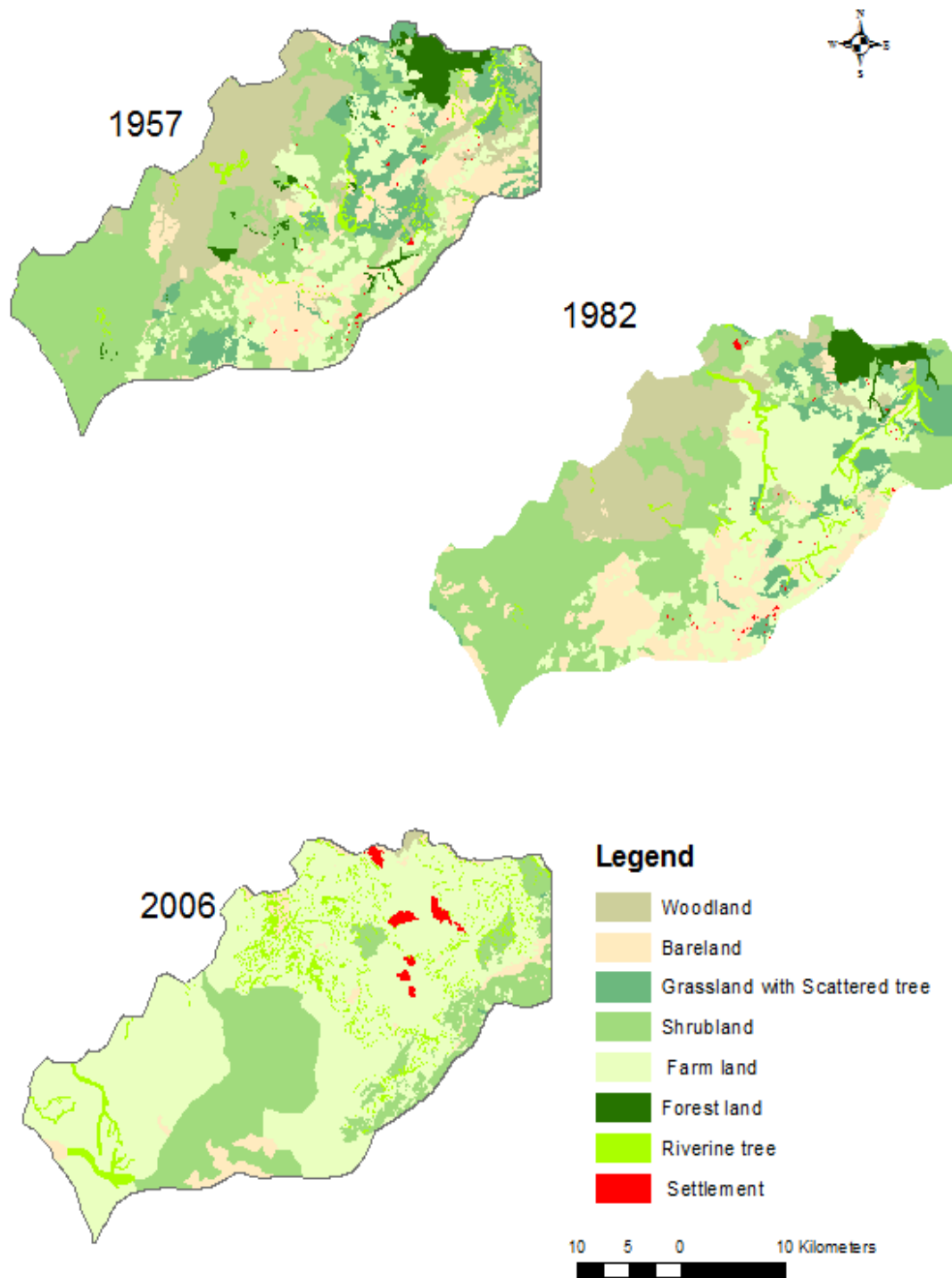
Figure 6 3. Land Use/Cover Types in Mandura District in 1957, 1982 and 2006

Box 1

Bamboo forest: Importance and Degradation

Ethiopia has about one million ha of high- and lowland bamboos (Study on sustainable bamboo management cited in Embaye, 2000). This represents 67 % of Africa's and 7% of world's bamboo resources (Embaye, 2000). The bamboo forests in Ethiopia can be classified as highland and lowland depending upon where it grows. However, lowland bamboo forest (Oxytenanthera abyssinica) are predominates in terms of area coverage. The lowland bamboo, which is the main concern of this study, is mainly found in BenshangulGumuz regional state, specifically in Assosa, Kamash and Metekel Zones. Bamboo trees are one of the fastest growing tree species in Ethiopia (Embaye, 2000). "Bamboo flowers towards the end of its lifetime (14 to 50 years in some species) and then dies soon after. For this reason bamboo flowering is considered as a "disease" by Ethiopians who live in the bamboo growing areas" (Embaye, 2000:519). They provide a variety of advantages to the rural residents. Smallholders extensively depend upon bamboo trees for multiple purposes, including tukul (hut) construction, fencing, the production of furniture, containers for water transport and storage, baskets, agricultural tools, beehives, household utensils, and various artifacts.

Despite its wide ranging significance, currently bamboo forests are declining at an unprecedented rate. Bamboo forest deterioration in Mandura district was summarized by Embaye (2006:6) as follows: Most of the bamboo in Mandura district flowered and eventually died about a decade ago. Four spots of a quarter of a hectare each were fenced and protected from fire in order to observe the performance difference of natural bamboo forest regeneration in protected and unprotected conditions. Now, after a decade, bamboo can only be found in the protected Spots and has totally disappeared from the rest of the area.

This partly explains how the area under the forests in the district has decreased and eventually disappeared due to human interference. The principal factors that have caused the deterioration of bamboo forests in the area include the conversion of bamboo forests to farmland and unsustainable cutting for income generation, house construction, and fuel. During field investigation, one of the residents states that "twenty years ago it was possible to harvest bamboo trees for different purposes from around the homesteads but now we are forced to travel long distances outside of our kebele, where at times we may not succeed in finding a bamboo tree."

Source: Personal observation and discussion with development gents and key informants at Kuter Hulet and Photo-Manjere Kebeles, May 2011

6.2.2. *Woodlands and Shrub lands*

In terms of area, woodland is one of the largest land use/cover types in the study district. The proportion of woodland cover at different periods also shows change. In 1957 it constitutes 17.61 % and further decreased to 15.63 % 1982. The change was dramatic in 2006 where the proportion dropped to a mere 0.23 %.Woodland loss in the district totaled 11,988 ha between 1957 and 1982 and 15,480 ha between 1982 and 2006. In other words, a total of 27,468 ha of woodland has been converted to different land use/cover type(s) in the span of less than 50 years (Table 6.11 and Figures 6.3, 6.4 and 6.5).

Shrub lands were the largest in terms of area in 1957, constituting a little more than 40 % of the total area in the district. The proportion decreased to 33.5% between 1957 and 1982, the largest changes in the land use/cover category under consideration. The proportion further dropped 24 % in 2006. Thus, a total of 16,900 ha of Shrub lands have been converted to different land use/cover types over a period of 49 years (Table 6.11 and Figures 6.3, 6.4 and 6.5).
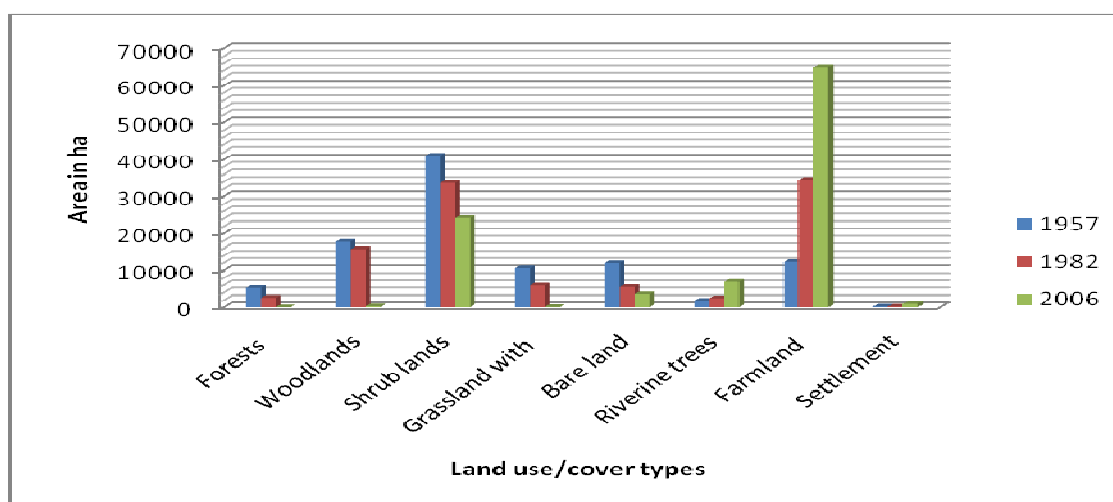
Figure 6. 4. Major Land Use/Cover Types and their Change in Mandura District, 1957, 1982 and 2006/07

103

6.2.3. Grasslands with Scattered Trees and Bare land

Like land use/cover categories mentioned above, grassland with scattered trees follow similar pattern of decrease. This land use/cover type gradually decreased from 10.45 % in 1957 to 5.83 % in 1982 to 0.04 % in 2006. Overall, 10,455 ha of grassland with scattered trees have been converted into different land use/cover types between 1957 and 2006 (Table 6.11 and Figures 6.3, 6.4 and 6.5).

Bare lands have also been transformed into other land use types. Their proportion decreased from 11.84 % in 1957 to 5.44 % in 1982 and to 3.50 % 2006. The conversion totaled 8,380 ha (Table 6.11 and Figures 6.3, 6.4 and 6.5).

6.2.4. Riverine Trees

In the study district, it is common to see trees growing along river banks. In fact, most tall trees in the district are growing along the banks of rivers and streams. The information generated from land use/cover maps for different years reveals that this class of land cover constitutes 1.79 %, 2.49 % and 6.85% of the total area in 1957, 1982 and 2006 respectively. The trend shows a gain of 5,082 ha of land between 1957 and 2006 (Table 6.11 and Figures 6.3, 6.4 and 6.5).

6.2.5. Farmland and Settlement

As can be seen from table 6.15 above, farmland expansion was huge and it is the largest land use type that gained the largest proportion of land from other land use/cover types. In 1957, farmlands constituted 12.14 % of the total land area in the district but the proportion increased dramatically to 34.36 % in 1982 and to 64.5% in 2006. Between 1957 and 2006, a total of 52,600 ha of land have been converted to farmland. Of the total 58,403 of land that underwent conversion, farmland constituted 90. 1%, riverine trees 8.7 % and settlements 1.2% (Table 6.11 and Figures 6.3, 6.4 and 6.5). That was why

Lambin *et al., (*2003*)* stated that in Africa large scale forest conversion for cropland expansion by smallholders dominates (Figure 6.5).

Figure 6. 5. Shows an Area which once covered with Thick Bamboo and other Trees but now Converted to Farmland

Though a small increase, settlements have expanded between the study periods. The proportion of land under settlements constituted 0.20 %, 0.18 % and 0.92 % in 1957, 1982, and 2006, respectively. A total of 721 ha of land have been converted to settlements between 1957 and 2006 (Table 6.11 and Figures 6.3, 6.4 and 6.5).
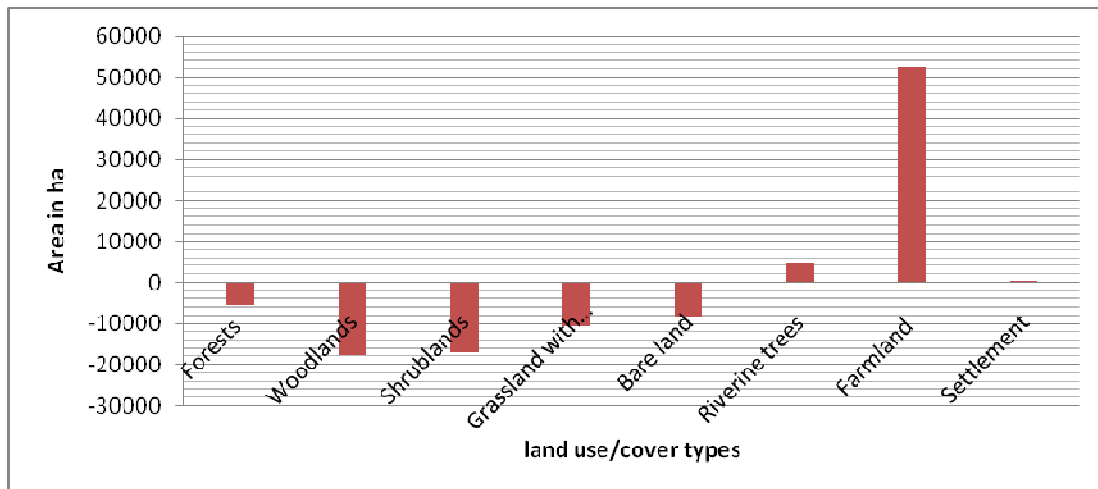
Figure 6. 6. Area Change of Major Land Use/Cover Types, 1957-2006

6.3.   Change in Cultivated Land

Attempts were made to assess the current land use in the study district. To this end, the District Agricultural and Rural Development Office has been consulted. As elsewhere in Ethiopia, the majority of rural residents of the district derive their livelihoods from agriculture. As a result, agriculture, mainly crop cultivation, predominate the land use.

As can be seen from Table 6.12 and Figure 6.6, the land that has been brought under cultivation is significantly high. It is also evident that the yield increase each year was obtained at the expense of bringing more land under cultivation.   In subsistence agriculture, where the use of modern agricultural input is little or none existent, yield increases are achieved by bringing more land under cultivation. Subsistence agriculture is inherently ineffective and, therefore, large areas of land are needed to meet the needs of rural households (Worku, 2007). As previous studies indicate, much of the agricultural expansion targets marginal and ecologically fragile environments such as forests, woodlands, wetlands, and steep slopes (Aredo, 1990; Mamo, 1995; Sishaw, 1998; Abute, 2002; Yntiso, 2003). Such expansion may eventually result in irreversible environmental damages.

Table 6. 12. District Level Land under Cultivation and Amount of Yield (2005-2011)

Year	Cultivated Land (hectare)	% change	Yield Obtained(Kg)
2005	10636	-	11060400
2006	12460	14.7	22883400
2007	14156	12.9	26947900
2008	17340	18.4	30291400
2009	18556	6.6	35294300
2010	23195	20	22815400
2011	31147	25.5	73197800

Source: Mandura District Agriculture and Rural Development Office, 2012

Based on data obtained from the same office, it is apparent from Table 6.12 that on average 2,930 ha of land has been brought under cultivation each year between 2005 and 2011. The same table also reveals that the percentage change of cultivated land shows a remarkable increase each year over the study period.

Pearson's correlation coefficient was calculated to investigate whether or not there is an association between cultivated land and population size increase and the result (r=0.971, P=.000) shows that there is a very strong positive association between the two. The implication is that as population size increases there is a corresponding increase in cultivated land and vice versa. The finding of this study is in line with that of Mather and Needle (2000) which state that there is a general trend of forest cover decrease in areas of fast population growth and countries with fast and accelerating agricultural yield greater than population growth appeared to experience shirking size of forest cover.
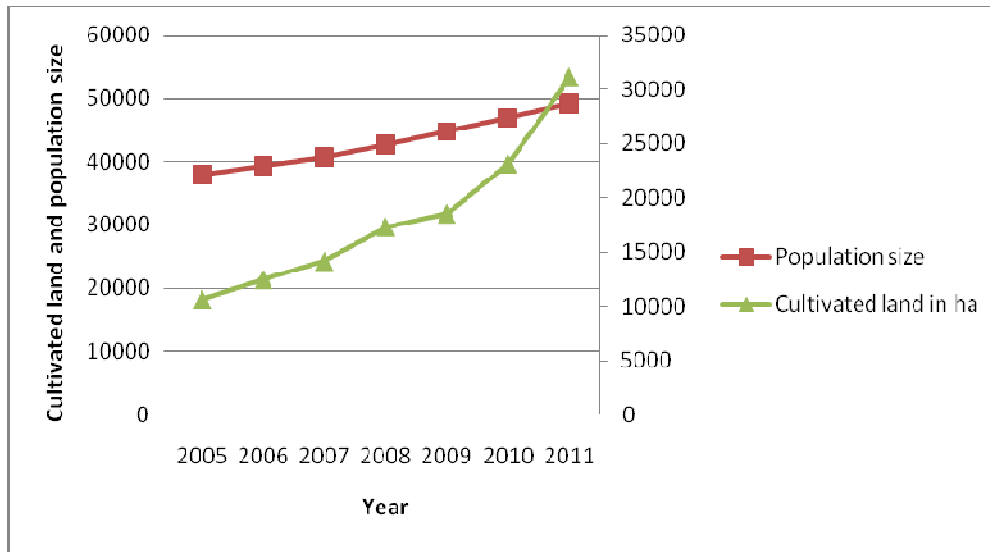
Figure 6. 7. Cultivated Land and Population Increase in Mandura District, 2005-2011

6.4.   Drivers of Land Use/Cover Dynamics

Drivers of land use/cover changes are broadly categorized into two as proximate (direct) and underlying (indirect or root) causes. Proximate variables are context and region specific while the root causes on the other hand are the result of complex political, economic and social conditions occurring at a distance. Infrastructural and agricultural expansion, wood extraction and other factors such as soil quality as proximate causes whereas demographic and economic, Policy and Institutional, and cultural factors as underlying factors (Figure 6.11).

6.4.1. Proximate Causes

The existence of all-weather road since the 1980s makes the lowlands accessible by many land seekers especially from the highland parts of the country. This in turn has correspondingly increased human settlement expansion at the expense of other land use/cover types as evidenced from aerial photograph and satellite image analysis. Infrastructural expansion has further been intensified by the introduction of the Ethio-

Italian project called the Tana Beles by expanding feeder roads in the project area and beyond.

The aerial photograph and image analysis of the study area further reveals that of the total 58,403 ha of land that underwent conversion, farmland constituted 90. 1% indicating that agricultural expansion is by far the most important proximate cause for land use/cover change in the study area. As it was repeatedly mentioned in this document land is becoming a scarce resource, thus, subsistence farmers in an attempt to generate their livelihoods keep on expanding agricultural activities to hitherto unoccupied areas. This is so because other alternative sources of livelihoods are fading out in the study district. Similar trends are observed in Ethiopia as well as at global levels (see Geist and Lambin, 2002; Bewket and Abebe, 2013).

The regional state in general and the study area in particular has decided to sedentarize shifting cultivators through villagization program so as to provide them with the necessary social services and modern agricultural inputs and in the meantime shifting cultivators adopt plough agriculture(Yntiso, 2003). The process involves site identification and redistribution of land. As it was stated under section 3.3., the process of villagization was not carefully planned in the study area. Study by Tafesse (1995) and Scott (1998) indicate that villagization, unless, properly planned with the involvement of the users would result in environmental deterioration. During focus group discussions it was mentioned that for some farmers distance to farm plots has increased. This in turn has a significant repercussion on agricultural yield, access to important resources (water points, fire wood) and investment on land resources. It is common to observe in the study area that village construction was under way since 2010. As a result, cutting of trees for construction, reeds for thatching and utilization of other remaining scarce natural resources have been escalating (Figure 6.7). Moreover, the land distribution has not been in effect until 2012.

Figure 6. 8. Villagization, Typical Thatched-Roof House under Construction, 2011

In many developing countries of the world wood is an important source of fuel and construction. For example, wood cutting for fuel in developing countries has increased at alarming rate. Case in point is rate of consumption exceeds rate of sustainable supply by 70 % in the Sudan, by 150 % in Ethiopia, and by 200 % in Niger (Hunter, 2000) due to population increase. Most income-generation activities by smallholders in the study area are geared towards satisfying daily needs (to supplement food gaps) including wood extraction for charcoal and fuel. As a result, the natural forest is nonexistent at present, while woodlands, Shrub lands, and grasses have dramatically dwindled throughout the study period. In relation to this Mckee (2007) affirms that charcoal and fuel wood production is on the rise everywhere in the country [Ethiopia] to satisfy the growing demand of ever increasing population.

The subtropical soils of Metekel are characterized by low organic content and highly susceptible for erosion. Given the current vegetation destruction and scarcity of land that makes short fallowing to prevail, land use/cover dynamics would be an imminent phenomenon in the years to come in the study area. Finally, it is important to note that the proximate causes trigger land use/cover dynamics synergetically.

6.4.2.   *Underlying Driving Forces*

Demographic Change

Human population is on rise in many developing countries of the world including Ethiopia. As a consequence of this observable fact the natural environment is under continual destruction and threat in many developing countries as documented in many research works (See Rosero-Bixby and Palloni, 1998; Drechsel, kunze and Vries, 2001; Woldetsadik, 2003; Amsalu, 2006; Mcneill, 2006; Long, *et al.*, 2007; Brink and Eva, 2009; Garedew *et al.*, 2009; Teferra, 2009; Tsegaye *et al.*, 2010; Ayalewl, Kassahun and Woldetsadik, 2012; Bewket and Abebe, 2013).

An unprecedented population increase each year both in rural and urban areas is one of the reasons for land use/cover dynamics in the study district. The population of the study area has increased more than fourfold between 1957 and 2006/07. Fast increasing population in rural areas means additional need for agricultural land, and other natural resources for various purposes will equally get bigger and bigger. This is confirmed in the study area that the size of cultivated land which was 10, 636 ha in 2005 has increased to 31, 147 ha in 2011. This, in turn, means on average 3418.5 ha of land has been brought to cultivation each year. This has partly been triggered by fast population increase in the district. Decrease and eventual disappearance of forest cover and expansion of farm land in the study district can serve as verification of encroachment of small farm households to marginal lands (Figure 6.8). Population increase in Mandura district was the outcome of planned and unplanned resettlement, in-migration from the surrounding areas as well as high fertility and declining mortality. Since the 1984 until today population inflow to the district is spectacular. Almost all population growth in the foreseeable future will occur in urban areas, mostly in developing countries (Pacione, 2009). This is true in the study area as well where urban population increases was considerably high. As a consequence, the need for natural resources will equally

increase. The net result of all these is alarming rate of land use/cover changes (for details see section 6.3).

Figure 6. 9 Cultivated Steep Slope with very little Remnant Vegetation cover

Change in Land Tenure, Institutional Setup and Decision Making Processes

Considerable socioeconomic changes have been taking place in the district since the 1957. Under the indigenous land tenure system, the Gumuz had full rights to access common resources like land, forest, grazing land, and water resources. But this has changed significantly over time. A historical study by Mekuria (2008) indicates that communal land tenure system of the local population has changed since the 1960s following the coming of migrants from the highland region. As a matter of fact, prior to the coming of many migrants to Metekel lowlands, the Gumuz practiced shifting cultivation as an important agricultural activity. The process involved clearing and burning of land, usually called slash and burn, and then cultivating crops for two to three years. After the fertility of the soil has been exhausted, farmers moved to a new plot of land and repeated similar routines. Yntiso (2003) states that the Gumuz used to fallow their land for several years, i.e. often 5-7 years to restore soil fertility. After the 1984 massive government sponsored resettlement programs and self-initiated spontaneous resettlement, the land use and tenure system started

to change because of land scarcity. In addition, shifting cultivation practice has virtually ended since the 1990s (Yntiso, 2003). Indeed, during field survey farmers as well as agricultural experts explained that there is not enough land to practice shifting cultivation. The net result of all these changes were wearing down of customary laws where the Gumuz started to lease their holding to the migrants in cash or payment in kind. As a result, the Gumuz began to clear as much land they can locate, for the purpose of leasing it to migrants, without the knowledge of traditional leaders who were previously responsible for the administration and management of land. Consequently, communal grazing lands, forests, and other common resources have significantly deteriorated. Study by Madulu (2005) in rural Tanzania indicates that traditionally, land was distributed and utilized according to customary inheritance rules and procedures; but rapid increase of human population was consequently accompanied by a significant departure from these traditional practices, hence, abandoning the indigenous knowledge that was used to determine land use and land management system over time. Indeed, in the study district, a similar state of affairs is occurring.

Furthermore, institutional changes in the area have also resulted in the dynamics of economic activities that led to the practice of selling charcoal and wood by the local population in order to supplement their livelihoods (Figures 6.9 and 6.10). Charcoal and wood selling has never been practiced before by the local population.

Figure 6. 10. The Gumuz Women along the Way to Chagni from Gilgel-Beles selling charcoal

This risk management strategy, in turn, has profound effects on land use/cover changes that have taken place in the study area. Today, it is not uncommon to observe charcoal traders of the local population along the Chagni- Gilgel-Beles road. (Figure 6.10).

Figure 6. 11. Gumuz Woman in Gelgel-Beles Town Selling Fuel Wood

Cultural Factors

Decision making process at the level of the kebele regarding natural resources management is uncoordinated among different actors. Discussions were conducted with development agents, the Gumuz, and migrants. Development agents state that the local Gumuz are not willing to participate in natural resources management practice. The migrants also strongly hold the Gumuz accountable for the deterioration of the natural resources, particularly forests and woodlands. On the other hand, the Gumuz put the blame solely on the migrants for pushing them to engage in extractive economic activities and the abandonment of shifting cultivation, hunting, fishing, and honey collection in the district. Whatever the case may be, natural resources management demands coordinated effort from all actors, which is not the case in the study area. The Gumuz totally ignore development agents advice on proper management and utilization of natural resources. As a result, the Gumuz, as decision makers of the kebele, keep on adversely altering land use/covers in the district.

It is worth to cite the explanation of Madulu (2005:45) in relation to institutional weakness, fading out of customary practices, and population increase in rural Tanzania:

> *... local communities are capable of established institutional and legal frameworks that could facilitate sustainable use and management of common property resources. The traditional legal and institutional frameworks were very effective in the past, but have largely been affected by population pressure and lack of political will and support. As a result, many of the traditional resources management systems have been rendered ineffective, hence, are non-functiona*l.

Indeed, in the study district, habitual resource use and management practices have been disrupted, institutions that maintain natural resources for long have been collapsed due to population increase, and more importantly there is little political will to curb the problem at different government jurisdiction levels (Figure 6.11).
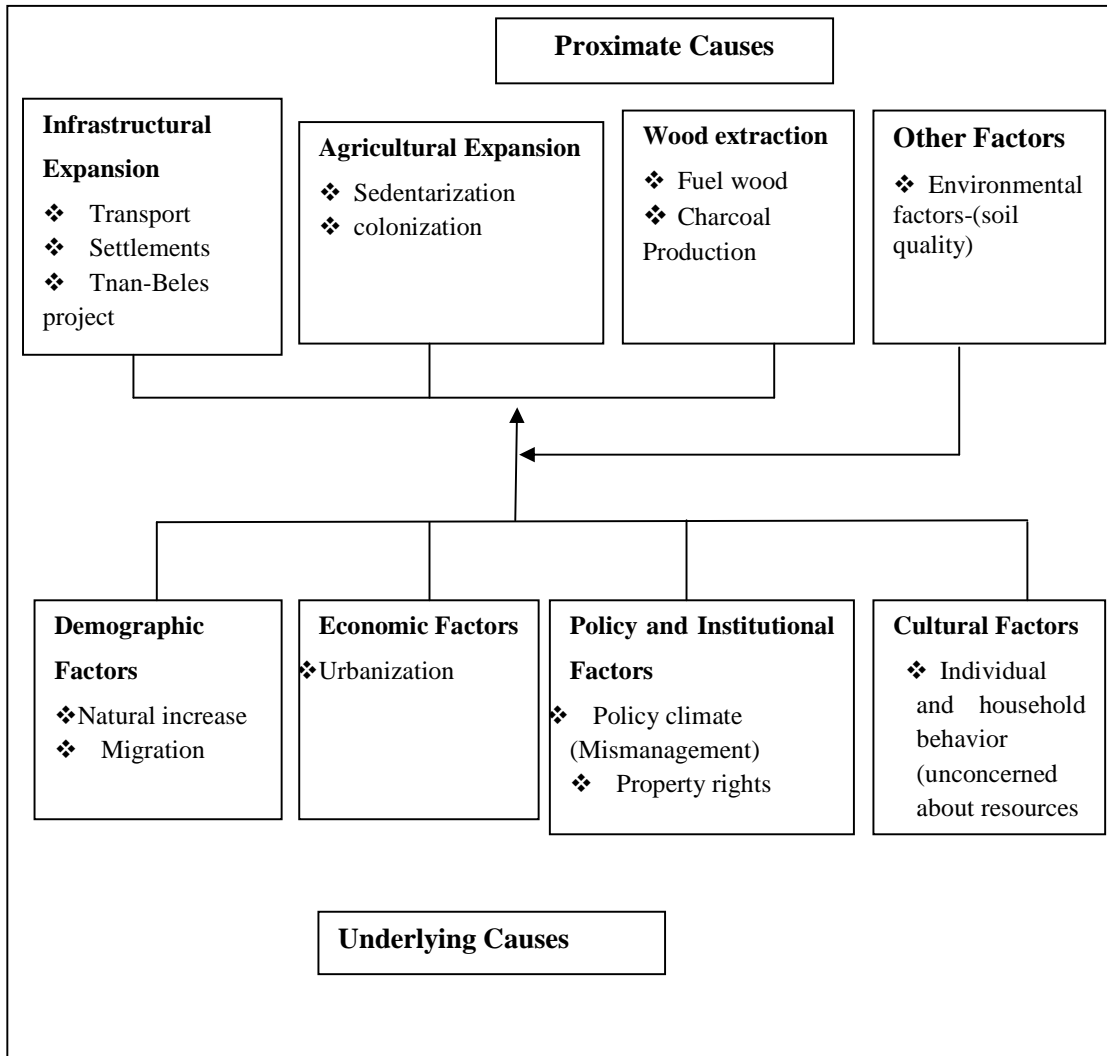
Figure 6. 12 Proximate and Underlying causes of land Use/Cover Changes, Mandura District (Own Construction)

Unconsulted Decision Making: Field Observation

Forest and woodland clearing is a day today activity in many rural parts of Ethiopia. During field verification it is common to hear in the woodlands/Shrub lands people cutting trees for fuel, charcoal, construction and other extractive purposes. While a focus group discussion was conducted in one of the kebeles, i.e. Kuter Hulet a group of individuals (migrants), were moving around in search of land for agriculture and/ or to cut trees. The development agent explained the situation as this is a routine exercise in the district that they do not even make any kind of consultation with decision makers of the kebele as well as other responsible bodies. At spot the development agent has warned the same individuals not to invade land or cut trees.

The other observation in the same kebele, i.e. Kuter Hulet was destruction of protected woodland. There was protected woodland for regeneration in the kebele. However, few weeks ago without permission and knowledge of the chairperson of the Kebele or other concerned agents it was totally cleared for cultivation. The deforestation activity was taken by nongovernmental organization (NGO) work for women's development in the district for the purpose of crop cultivation. According to the responsible person of the NGO, that particular area was selected by the Gumuz women and the process was done without consulting district as well as local level professionals and administrators.

This, in turn, means decision making process at kebele level is unplanned and uncoordinated. Furthermore, it implies that institutions intended to rightly administer the kebele are not properly functioning. The overall effect, therefore, is unprecedented land use/cover changes in the district, are partly attributed to such kinds of decision making processes.

Source: Personal observation and discussion with development and NGO agents at Kuter Hulet Kebele, May 2011

6.5. Effects of Policy Changes on Land/Cover and Population Dynamics

6.5.1. *National and Regional Policy Frameworks*

This section tries to appraise past and existing policies in relation to their effect on land use/cover and population dynamics in Ethiopia. Specifically, land tenure, population, environment and other related policies and strategies and their effects under the three

regimes will be explored. To obtain the intended information, policy documents at various levels and time periods were evaluated.

In many countries of the world, land is source of power and politics. Misguided or uncoordinated sectorial policies could be one of the major causes of land degradation (Lambin and Geist, 2006). Policies are not established on political and economic vacuum. Instead, they are the result of struggle between competing actors seeking to influence policy formulation (Bryant, 1992). The context in Ethiopia is not exceptional to these realities on the ground.

Different policies, strategies and programs have been launched in Ethiopia so as to sustain the natural environment including land, forest, water, soil, population, energy, wild life, and other biophysical resources. The intension of all these policies and strategies were to balance the natural environmental service with ever increasing need of the growing population. For varied reasons policies in place may or may not meet the intended objectives. It has been reported that Ethiopia has formulated and established the Environmental Policy of Ethiopian (EPE) and Environmental Protection Authority (EPA) in 1997, respectively. Nevertheless, there are significant gaps between policy and practice and limited stakeholders participation (McKee, 2007). Especially, natural resources related policies and programs need the active involvement of all stakeholders at different levels. But such practices are low in many developing countries of the world including Ethiopia. Most policies and strategies were initiated in a top-down manner by the government or policy makers (Scott, 1998; Madulu, 2005; Bekele, 2008; Kassa, 2008; Rahmato, 2008b). The knowledge of management practice and use of resources by ordinary population was underestimated by policy makers which consequently affect the natural resources in the long term. Tsighe (1995) reported that smallholders should have been informed and actively involved in rural development programs to share their deep knowledge about their problems, needs, and environment. Against this background Madulu (2005) observed that involving local communities in the planning and management of common property resources is of prime importance, and could trigger

sustainable conservation and development at the grassroots level. So far there has not been clearly stipulated land use policy in Ethiopia as well as in the study area.

In early years of the imperial regime, nothing was stated in the Constitution (1931) pertaining to natural resource use, conservation and management. Then after, in the revised imperial Constitution of the 1955, issue of natural resource has been explicitly stated. Accordingly, all natural resources were put under state realm (Bekele, 2008). In the same way, the revised economic development strategy emphasized expansion of agricultural products both for domestic consumption and export purpose. To materialize these objectives, natural resources (forest and land) were generously distributed to individuals so that they can change into agricultural land (Bekele, 2008). The first wide-ranging laws on forest use and management were launched in 1965 but did not come with that detail regulations (until 1968) to enforce the laws. This, in turn, has created forest cover deterioration in the country. As Bekele (2008:339) rightly put it "the period was probably one of the most distressing phases of forestry management". The same source further reveals that due to absence and delay of laws and issuance of detail regulation, the forest cover of the county estimated six million ha in 1937 has reduced to three million ha in the early 1960s.

The downfall of the imperial regime in 1974 has brought about change in resource conservation, use and management following the 1975 land policy change. One cannot deny the commitment the Dergue regime had in regard to resource development (Bekele, 2008). The Dergue had an ambitious plan of delimiting, rehabilitating degraded land through area closure, soil and water conservation of thousands of hectare of land to conserve, manage and utilize for different purposes (Bekele, 2008). Like its predecessors, all these development and conservation efforts were top-down approaches to problem solving where the involvement of the community was minimal (Scott, 1998; Bewket, 2003; Amsalu, 2006; Bekele, 2008). Consequently, most efforts pertaining to resources conservation and management were destructed by the community during the

1991 regime change (Bewket, 2003; Amsalu, 2006; Bekele, 2008; Kassa, 2008; Rahmato, 2008b; Biazin and Sterk, 2013).

The post-May 1991 land policy of the government has also similar shortcomings. During the early years of the current government there was no clearly stated power and duties between the federal and local regional states pertaining to resources administration, use and management. Absence of such explicit responsibilities in the meantime resulted in devastating destruction of resources in the country. That was why Bekele (2008) affirmed that the shift from unitary to federal state in 1991 had created a power vacuum during which time destruction of resources took place on a large scale. Mckee (2007) also reiterates that there are no institutions intended to deal with environmental issues at district level in Ethiopia. One of the government's core policies launched in the mid 1990s was ADLI (Agricultural Development Led Industrialization). The main objective of this policy was to increase agricultural productivity of the smallholders and thereby serve as stepping-stone to industrialization. The original ADLI document does not incorporate environmental issues. Thus, absence of clear environmental concern in the main government document eventually resulted in devastating environmental destruction (Amsalu, 2006; Mckee, 2007).

The limited involvement of the regional government in natural resources management is also summarized in the Benishangul- Gumuz region's food security strategy document as follows:

> *The involvement of government organizations in enhancing the management of natural resources is low. The ecology is generally fragile and vulnerable to various disasters. The overall effect of this is reduction of agricultural production thereby increasing vulnerability and worsening the food security situation of the people. Therefore, all development interventions should duly consider the management of natural resources (Benishangul-Gumuz region, 2004:27).*

Up until now there is no well organized and strong institutional setup even to implement existing policies and strategies of different kinds initiated by the regional and federal governments. The situation prevailing in the area was summarized as follows by the Ethio-Italian joint project formulation: Problems are compounded by the low capacity of regional institutions for planning and implementing development activities. For instance, data and information concerning natural resources situation and socio-economic status of the population that could be used to assess the potential for development, to define strategies, to prepare funding proposals and to implement meaningful development activities, are scarce (Ethio-Italian joint project formulation, 2000:27).Similarly, Awas *et al.*, (2010) reported that to date, no designated conservation area exists in Benishangul- Gumuz Regional State.

The above discussions partly confirm that policies, strategies and programs so far developed during different periods were their own contribution for the destruction of natural resources and there is little or no effort to enhance sustainable resource use and management in the region in general and the study area in particular.

6.5.2. *Effects of Policy in Mandura District*

Aerial photographs (1957 and 1982) as well as satellite image (SPOT-5 image) of 2006/07 analysis reveal that there was a significant land use/cover dynamics in the study district. Likewise, household survey results show that population dynamics was high throughout the study periods. The discussions above also clearly indicate that policies and strategies during different regimes have contributed for land use/cover and population dynamics.

A series of discussions were held with group of elders as well as experts in the study district on changes that were observed for the last 20 or so years. They were asked to rate land use/cover and population dynamics during the three regimes. Accordingly, they first explained that there was a significant difference in the three regimes, i.e., the Imperial, the military and the current governments pertaining to land use/cover and population dynamics.

They replied that degree of change both in land use/cover and population was low during the imperial period. Following the 1984 countrywide famine and drought, the government launched a resettlement program through which the demography of the study area was changed significantly. They further reiterated that natural vegetation cutting was escalated to construct houses for new settlers. The clearance of vegetation was indiscriminate and wider in scale which consequently lowers the vegetation cover of the area. Available sources indicate that a total of 82,000 people have resettled in Metekel lowlands (See Alula, 1988; Yntiso, 2002). Moreover, self initiated spontaneous migration was also high from the surrounding Amhara region during the same period. Participants also mentioned the launching of the Tana-Beles project, which was sponsored by the Italian government in March 1986, contributed its share for degradation of natural resources in the area. Whatever the cases may be, a noticeable population increase has gradually prevailed in the region in general and the study area in particular leading to increasing pressure to mount upon the existing natural resources. It is evident from the above testimonies that government resettlement policy has brought about population and land use/cover dynamics in the area, particularly since the mid 1980s.

The study district is located adjacent to the Amhara regional state where the agricultural land is degraded and fragmented. Moreover, Amhara regional state has experienced land redistribution in 1996 (Teklu, 2005). The land already under cultivation was distributed which further accentuated land fragmentation (Aderie, 2002). Moreover, Bewket (2011:60) reported that "the ability of the land to support ever growing populations had been compromised by land fragmentation due to government-sponsored redistribution and the traditional practice of passing land on to one's male children." The land redistribution process by the government has partly forced many farm households to move to Metekel lowlands in search of arable land and other opportunities. That was why Aderie (2002) reported that it [the land redistribution], has implication of movement of the people out of their place of residence and increases holding insecurities among subsistence farmers. This, in turn, has a profound implication on land investment, resource use and management. During focus group discussions, migrants from Amhara regional state reported the same

reason (shortage of farm land) for their migration. Specific to Kuter Hulet kebele, participants in the focus group discussion added that migration to the kebele was high and steadily increasing from time to time during the current government. Participants in the discussions further pointed out farm size decrease, soil fertility decline, and family size increase as most important causes for their migration.

Experts in the focus group discussion stated that the regional government has a plan to redistribute rural lands to the local population, i.e. five to seven hectares, to help them practice shifting cultivation. The scheme has also entitled migrants to have up to three hectare of rural lands. However, the proposed scheme has not been put in to effect until 2012.

Administration and coordination positions are predominantly occupied by the local Gumuz population. Nevertheless, the contribution of the Gumuz to conservation and wise management of natural resources is not as encouraging as it should be. What was repeatedly said during the discussion with farm households and development agents was that the Gumuz keep on cutting and destructing the natural environment taking advantage of their position and never accept advice from government (development) agents. Thus, migrants as well as experts put their finger of blame on the local population. Decision on utilization of natural resources is made spontaneously. This is part of the reason that conservation units as well as management of natural resource is either too little or nonexistent in the district. From field observation it was also evident that still tree cutting and grass harvesting is escalating in unsustainable way due to the current villagization program.

From the foregoing discussions, it can be concluded that natural environment was beginning to feel destruction during military regime and considerably reached its peak during the current government. Under the current situation commitment in the part of the regional government to reduce the problem is low. Even currently there is no plan put in place to reverse the situation.

6.6. Economic Activities: Change, Decline and Consequence

As elsewhere in rural Ethiopia, agriculture is the mainstay of the economy in the district. Specifically, shifting cultivation was the most important economic undertaking some years back. Likewise, hunting, fishing, honey and fruit gathering were ancillary activities for the local population. The Gumuz has no limit on land possession to practice agriculture. Labor is an essential component of the farming system. It is a common practice in subsistence agriculture that much of the work is done manually. Thus, there is a serious shortage of labor at peak seasons. In order to solve labor shortages, different strategies are used by farm households. Mutual aid and family labor are the most popular ways of overcoming agricultural labor shortage. According to Mekuria (2008) the size of labor that an individual could receive largely depends on the quality and quantity of the non marketed agricultural products refreshment that he/she could provide to those who come to work. This, in turn, depends upon the resource, wealth, social sanctions and disapproval in the community.

Dynamics of economic activities have started to happen since the 1960s and currently reached its peak. The situation was triggered by inflow of highlanders to the area whereby the Gumuze rent their land under different arrangements. During focus group discussions, it was mentioned that the Gumuz rented their land not only for migrants in the district but also to non settlers in the immediate districts of Amhara region which they described it as "*mofer zemet*" or "*mofer zelel.*" This is tantamount to say that farmers in Amhara regional state (immediate neighboring districts) made an arrangement to cultivate the land and in return to give the renters crop or cash as per the accord made. Farm households further explain that this kind of arrangement has created a serious problem on migrants because the Gumuz prefer to lease their land to the former. The preference to lease land to the non settlers is due to the capability of paying more than the migrants in cash as well as in kind and probably to reduce risk of land ownership title. This state of affairs according to Mekuria (2008) has introduced a new institution to the Gumuz. Following this relation, the Gumuz started to learn plough agriculture. But this is constrained by serious shortage of

124

farm oxen, which are one of the basic inputs in many traditional Ethiopian farming systems. Occurrence of trypanosomiasis and other animal diseases are one of the limiting factors for sustainable supply of farm oxen in the study area. Apart from this, during field survey and focus group discussions, it was mentioned that there are some Gumuz model farmers. Model farmers are selected by the development agent (if they are willing) and get a close follow-up while practicing the different extension packages so that they became successful in their endeavor and serve as a model to disseminate the know-how to the area.

Like shifting cultivation, hunting and gathering which were ones the most important economic activities in the district have shown a decline. Consequently, land use/cover as well as population dynamics in the district appeared to happen in a higher scale. In view of this, Mekuria (2008:59-60) states that:

> *The expansion of human settlements minimized the forestland. Hunting grounds were turned into farmlands. This brought scarcity in the availability of wild foods to gather and disappearance of game animals to hunt. Harvest for fishing also declined due to the interference in the waters of the area and reduction in the flow of streams and rivers. Consequently, members of the society had to travel so many kilometers away from their localities for the purpose of hunting, gathering and fishing.*

The above discussions evidently indicate that traditional economic activities practiced by the local people have gradually worn-out following land use/cover and population dynamics mediated by policy and institutional factor. Furthermore, policies enacted by the government have directly or indirectly contributed for the modification and weakening of long existed and environmentally friendly economic activities in the study area.

In sum, demographic and non-demographic factors in isolation or combination have impacted land use/cover dynamics in the study district. Figure 6.12 demonstrates the link between land use/cover dynamics with other demographic and none demographic factors. It further relates causes of land use/cover dynamics (indicated by one way

relationship) and others that impact and impacted by land use/cover dynamics(indicated by two way relationships). Figure 6.12 shows that how population dynamics mediated by government policies, strategies and programs, technologies and institutional setups in the meantime leads to land use/cover dynamics to occur in the study district. Assessments made under this study evidently show that ongoing changes in population dynamics and land use/cover in this region is vital given the fact that more development endeavors (for example, hydropower generation, irrigation, and mechanized agriculture) are being undertaken by the government.
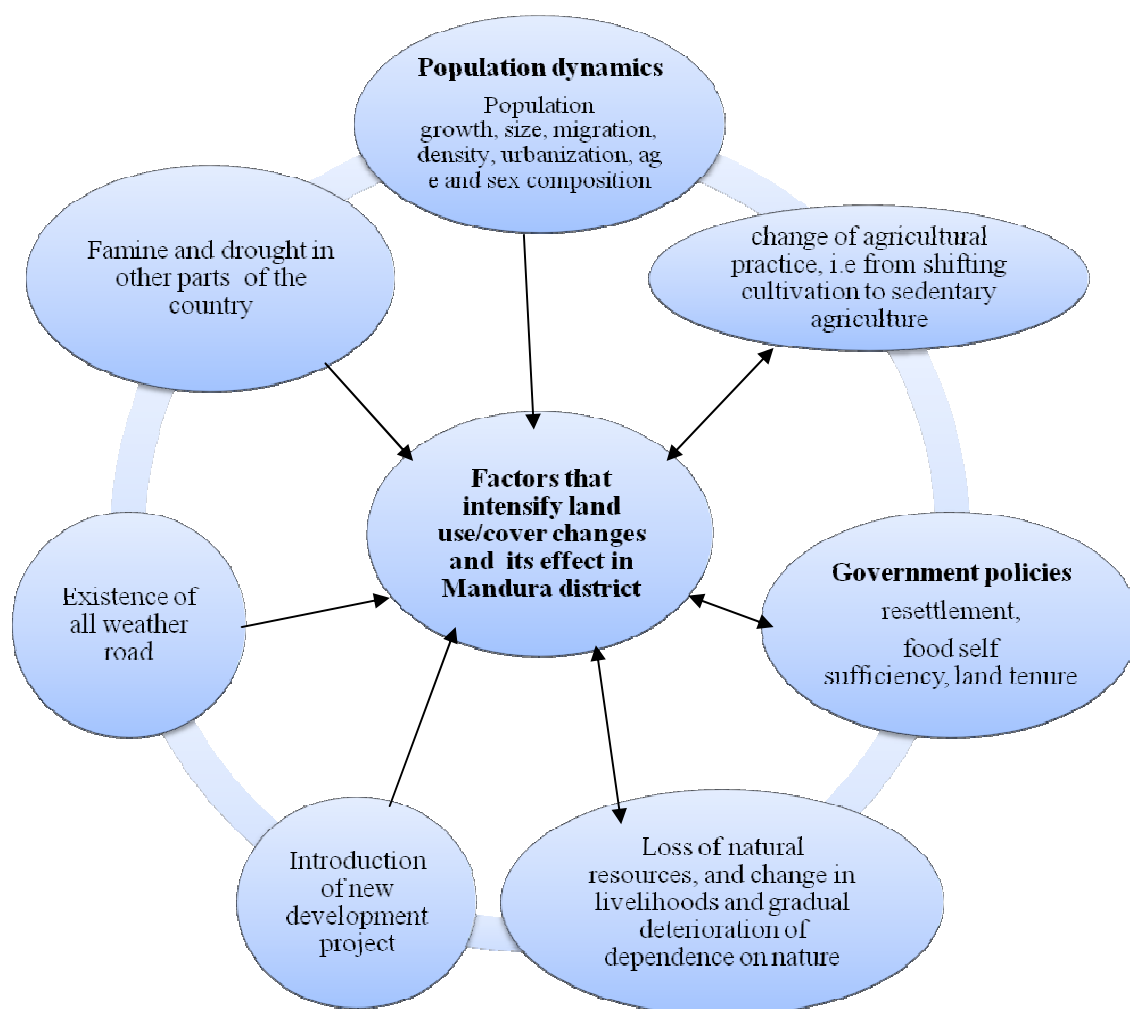
Figure 6. 13. Factors that Cause Land Use/Cover Change and their Effects

To maintain and improve existing natural resources and development endeavors currently taking place in the region, sustainable resources utilization and management is an indispensible and timely action to be taken by the regional government. As can be learnt from this study, partly the source of the problem of resource degradation associated with population dynamics is emanating from the problems occurring outside the regional state.

For instance, drought and famine, land redistribution and land tenure insecurity have forced many smallholders to migrate to the lowlands in search of arable and grazing land. Possible problems should be anticipated from the outset before the same and equivalent problems happen.

6.7.   Conclusion

The farming system is dominated by subsistence agriculture intended for personal consumption. There is a distinct difference between the Gumuz and migrants pertaining to farming practices. While the former are shifting cultivators, the latter carry out ox plough farming. But there is a general trend that shifting cultivation and other supporting activities like hunting, gathering, honey collection, and fishing are fading out following mounting population in the region. Furthermore, land is becoming scarce resource. As many empirical studies show, with increasing population farm households start to migrate and practice intensification as risk management strategies (Boserup, 1965; Drechsel, kunze and Vries, 2001; Otsuka, 2001; Carr, Suter and Barbieri, 2005; Demont *et al*., 2007; Sherbinin *et al*., 2007). But this situation is not prevailing in the district. Likewise, modern agricultural input utilization is either too small or fluctuating year to year. Instead extensification of agriculture is the most widely practiced agricultural undertaking in the district. Clearing woodlands, Shrub lands, and grasses for agriculture is a frequent practice in the district. As a result, soil fertility decline is one of emerging and upcoming problems in the district.

Land use/cover dynamics in the district occurred in unprecedented rate. Most of these conversions to farmlands are partly indicating how human population increase is mediated by other factors like government policies, institutional weakness, and customary land tenure.

CHAPTER SEVEN

**FARMERS PERCEPTION ON TRENDS AND DRIVERS OF LAND
USE/COVER CHANGES**

7.1.   Introduction

Agriculture in Ethiopia is mainly reliant upon natural resource stocks. This important economic sector is under threat emanating mainly from environmental degradation. To this end, smallholders knowledge of the environment has significant importance for appropriate interventions. This is so because it is smallholders that utilize and manage the environment. To make natural environmental management effective and sustainable, exploring the knowledge and perceptions of the people is indispensable. It is based on this logic that farmers understanding of their environment is treated in a separate section below.

7.2.   Farmers Perception on Land Use/cover Changes

Subsistence farmers in many parts of the developing world have kept on changing the natural environment in an effort to subsist themselves. Basically this change is closely associated with the changing situations prevailing in the area under discussion or at national and global levels. Anthropogenic influences on the natural environment can be expressed in terms of gradual conversion or complete change of the natural environment. In the study area too, complete change as well as conversion of the natural vegetation has been evident since the 1980s and before (Yntiso, 2003; Abute; 2004; Mekuria, 2008).

Figure 7.1 depicts farmers views on the proportion of land under bamboo tree cover has been in a good condition in the 1980s. In this regard, about 57 % of the respondents replied favoring bamboo cover was high. The same source further reveals that 76.7 % of

respondents reported that bamboo tree cover has decreased since the 1990s. In the same way in the 2000s bamboo cover has significantly declined where 93.3 % of respondents have ascertained the situation (Figure 7.1). By the time this study was conducted in 2011, many areas which were once covered by bamboo trees were devoid of this vegetation. The study by Embaye (2006) also indicates that bamboo trees are found in the protected spots and have totally disappeared from the rest of the area. According to the same author, the major drivers were conversion to agricultural land, unsustainable cut for sale which eventually put the bamboo forest spectacular deterioration in the district.
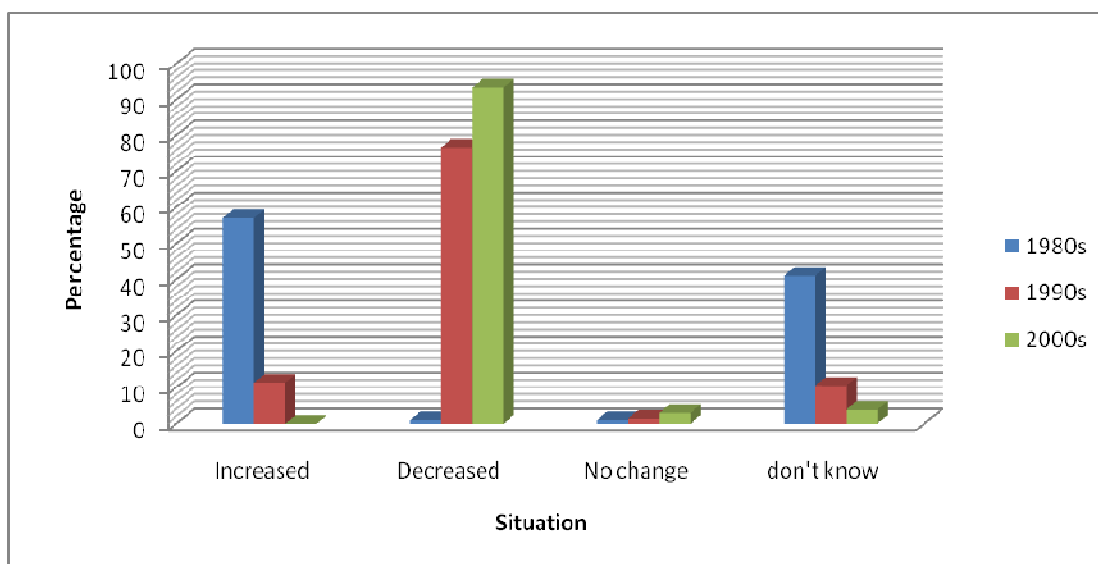
Figure 7. 1. Farmers View on Bamboo Use/Cover Change, 1980s-2000s

Contrary to this, the proportion of cultivated land devoted for cultivation was small during the 1980s and increased since the 1990s. Partly the explanation is there was land redistribution in the nearby region which forced significant proportion of farmers to move to the study area. More than 92.4 % of the respondents reaffirm that the proportion of cultivated land at present is significantly high (Figure 7.2).

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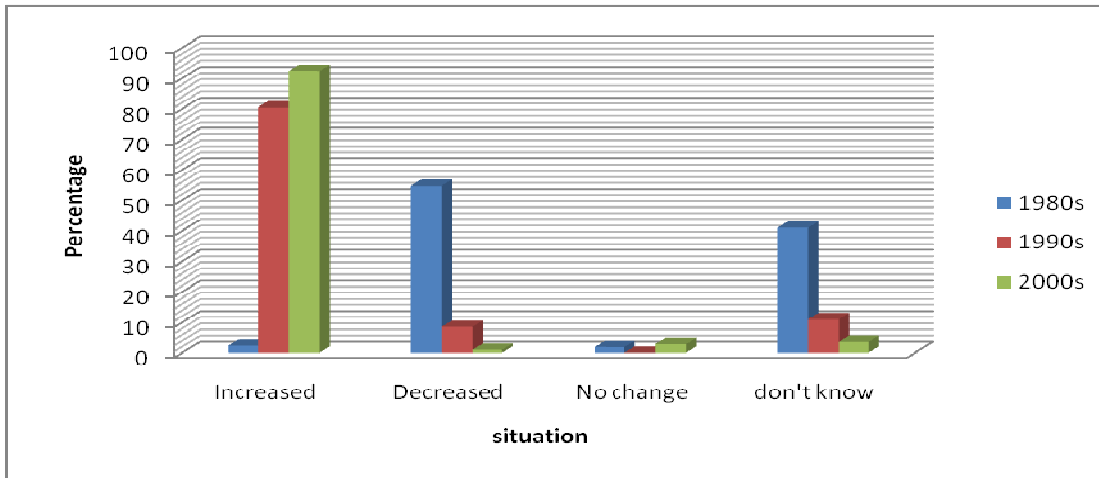
Figure 7. 2. Farmers View on Cultivated Land Use/Cover Change, 1980s-2000s

Grazing land that was once abundant in the 1980s and before, has significantly dwindled since the 1990s. More than 77 % and 96.7 % of respondents have supported this decrease for 1990s and 2000s, respectively. The corresponding proportion for 1980s is more than 54 % indicating a better availability of grazing land which latter involves downward spiral (Figure 7.3).
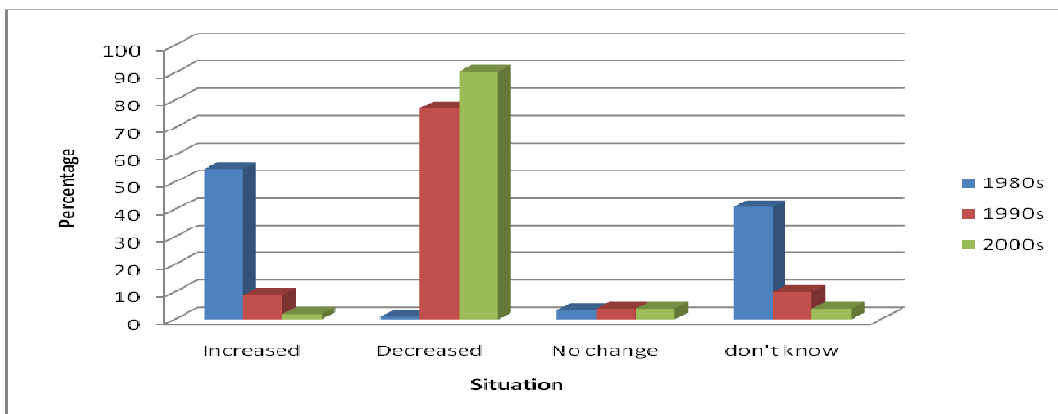
Figure 7. 3. Farmers View on Grazing Land Use/Cover Change, 1980s-2000s

Like elsewhere in Ethiopia, grasses have versatile importance to the rural population: they are used for thatching of houses, granaries or outbuildings. Like other land use and cover, about 55.2% of the respondents report that grasses have also been in good

condition during the 1980s. The situation has changed since the 1990s where deterioration is significantly high. As it is indicated in Figure 7.4, 85.2 % and 91.9 % of respondents confirm that grasses deteriorated seriously in the study district in the 1990s and 2000s. During focus group discussions, the farmers described the difficulty they have faced to get grasses for purposes mentioned above. Furthermore, they expressed that to get quality grass, they were forced to travel up to 30-40 km.
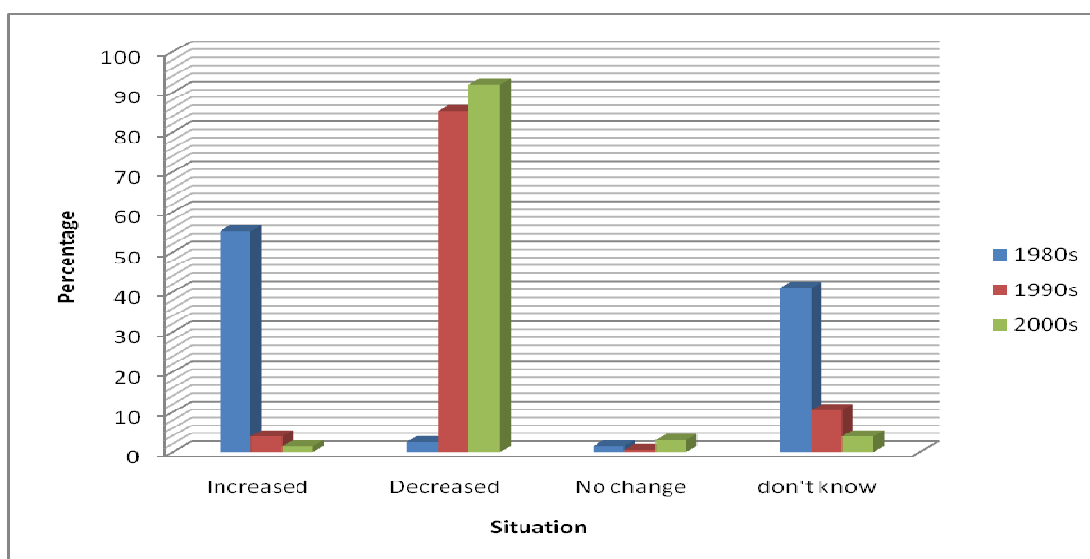
Figure 7. 4. Farmers View on Grassland Use/Cover Change, 1980s-2000s

In the study district settlement expansion follows a similar trend like population increase and agricultural expansion. Accordingly, settlements were small during the 1980s as reported by 57.6 % of the respondents. It tended to increase since the 1990s and reached its climax in 2000s as perceived by rural residents, which is confirmed by 82.9 % and 92.4 % of their responses respectively (Figure 7.5).
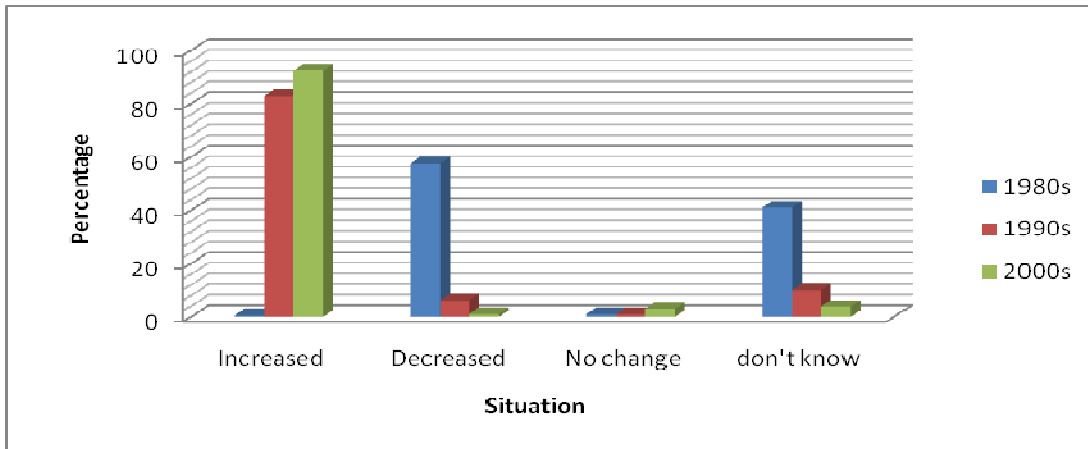
Figure 7. 5. Farmers View on Settlement Use/Cover Change, 1980s-2000s

Significant proportion of the study area was covered with lowland bamboo. These important vegetation cover and other land covers have been widely cleared creating negative impacts on the size and diversity of wildlife resources of the area.
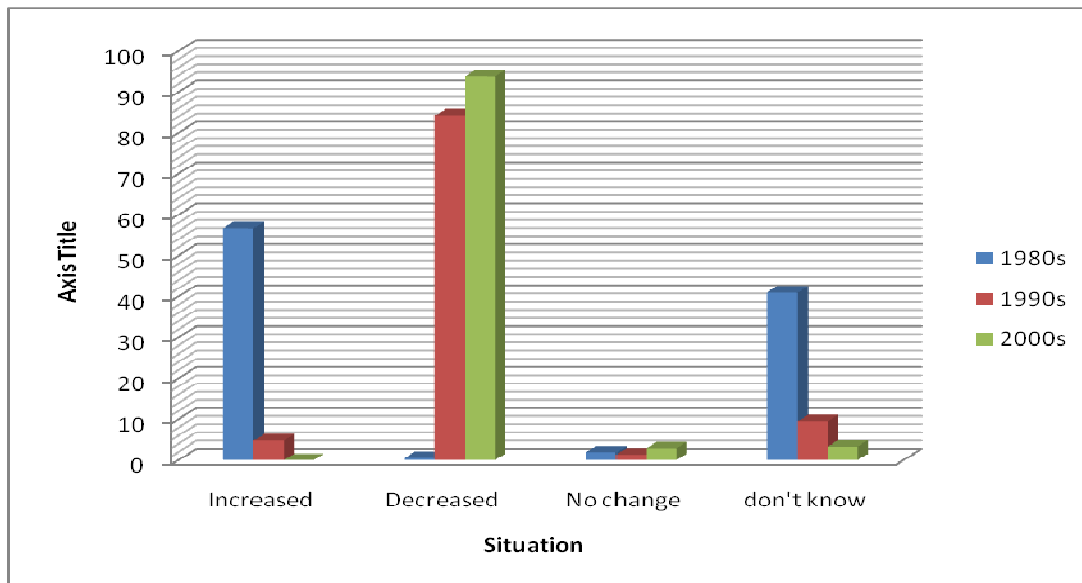
Figure 7. 6. Farmers View on Wildlife Availability, 1980s-2000s

In response to this during the survey, more than 56 % of farm households confirmed that wildlife was commonly available during the 1980s. But the situation has changed since the 1990s where there exists a significant decrease of wildlife and other resources as perceived

by respondents (Figure 7.6). As Yntiso (2004:104) described "the deforestation process contributed to the tragic disappearance of wild animals and edible wild plants". Teferra (2009) also reiterates the same finding that absence of strong institutions since the downfall of the military government in 1991 seems to have contributed to the current destruction and the dwindling interest in environmental protection by subsistence farmers in Angar Gutin, Eastern Wallaga.

7.3.   Land Use/cover Changes and Associated Problems

Land use/cover change in the study area was high as perceived by farm households. To this effect, respondents were asked to reason out possible causes of land use/cover changes. Accordingly, 100 % of respondents associate land use/cover changes with population increase in the area whereas the share of deforestation on the other hand, is 96.7 percent. Likewise expansion of agricultural land accounts 94.3 percent. The corresponding share of the introduction of development projects is 34.3 % (Table 7.1). The overall assessment is that population increase triggers deforestation and expansion of agricultural activities which eventually result in land use/cover changes. The principal reason for population increase was flow of population from the nearby regions in search of land for cultivation and other related agricultural activities. This migration of people is triggered by drought and famine, demographic pressure, land re-distribution and shortage of arable land in the area of origin. This, in turn, has increased rural population size in the area of destination. Consequently, this has created land shortage for shifting cultivators (the Gumuz) and pressure and deterioration of the natural environment. During field investigation, one of the residents in Photo-Manjere states that "twenty years ago it was possible to harvest bamboo trees for different purposes from around the homesteads but now we are forced to travel long distances outside of our kebele, where at times we may not succeed in finding a bamboo tree." This assertion clearly indicates that residents are well aware of natural environment change.

During focus group discussions, participants have mentioned that small urban centers have been flourishing, and as a result demand for natural resources as source of fuel and construction has also simultaneously increased.

Table 7. 1. Farmers View on Causes of Land Use/Cover Changes

Causes of land use/cover changes	No.	%
Population increase	210	100.0
Expansion of agricultural land	198	94.3
Introduction of development projects	72	34.3
Deforestation	203	96.7
Total	683	325.2

Source: Field Survey, 2011

This in turn has attracted many migrants from the nearby region. Specifically, the local population widely cut trees and prepares charcoal/fire wood for sale for urban residents, which was not formerly the practice. To derive their livelihoods they keep on clearing natural vegetation and grab as much land as they can, and the vicious circle of the problems continues. Consequently, this has resulted in natural resources depletion and change of livelihoods of the local population which formerly used to be friendly with the environment (Figure 7.7).
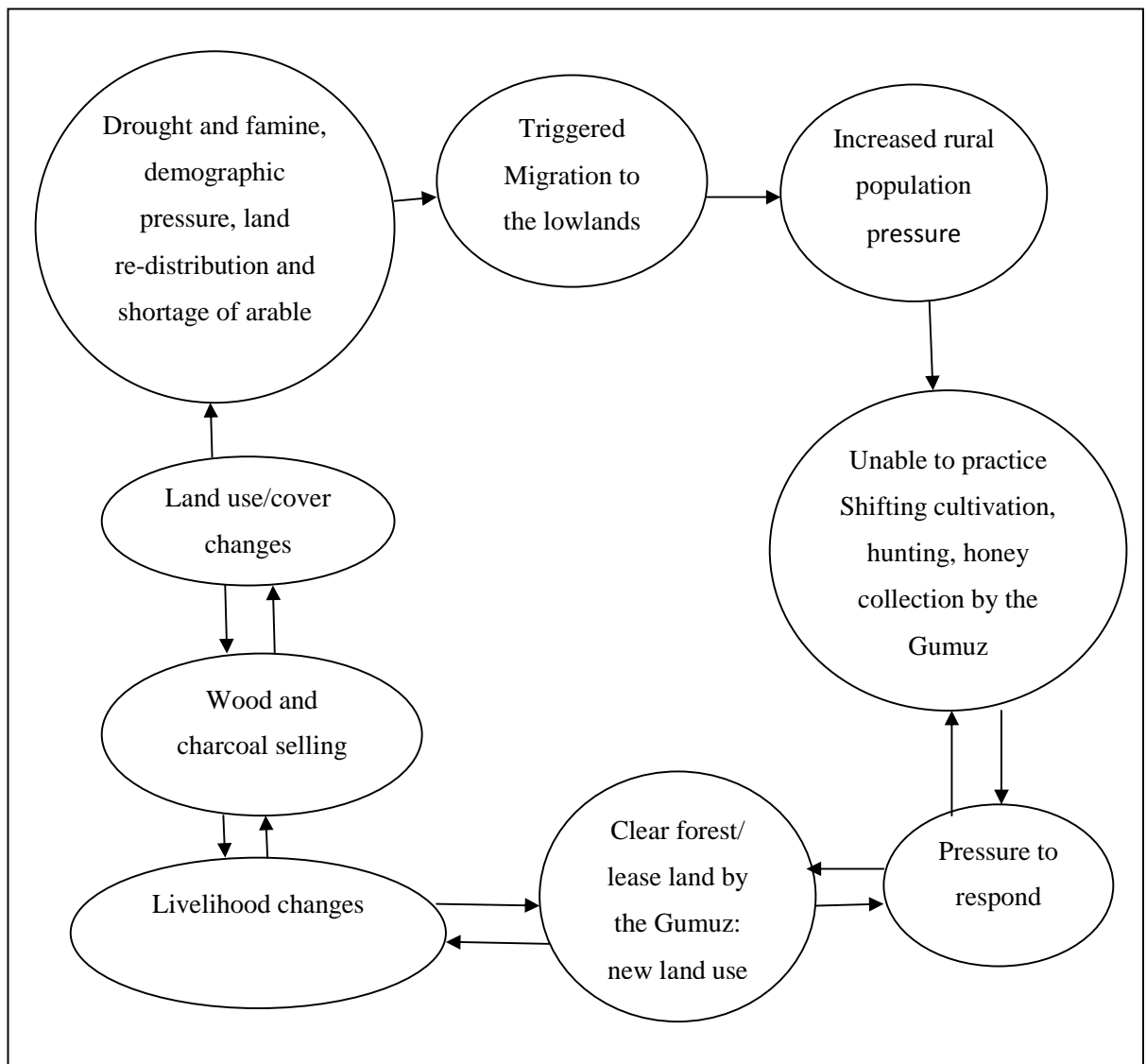
Figure 7. 7. Causative factors and processes for migration, livelihood and land use/ land cover changes

7.4. Resource Management Practices

Many rural residents in developing countries are under the mercy of nature for the simple reason that most livelihoods in one way or another are derived from natures warehouse. In view of this fact, the wise utilization as well as conservation of natural resources is an indispensable activity to be practiced by rural dwellers. Failure to do this will have

profound consequences as can be evidenced from recurrent drought and famine in Ethiopia. As many research results show, the frequent drought and famine in highland Ethiopia is attributed to indiscriminate natural resource destruction which consequently resulted in deterioration of the natural environment (Zeleke and Hurni, 2001; Tegene, 2002; Bewket, 2003; Amsalu, 2006; Garedew *et al*., 2009; Tsegaye *et al*., 2010). In view of this, an attempt has been made to investigate whether or not farm household are practicing resource conservation/ management and forwarded their view as depicted in the Table 7.2 below.

Table 7. 2. Resources Management Practice of Households

Did you make an effort to manage resources?	Gumuz		Migrant		Total	
	No.	%	No.	%	No.	%
Yes	27	25.7	59	56.2	86	41.0
No	78	74.3	46	43.8	124	59.0
Total	105	100.0	105	100.0	210	100.0
	X^2=20.165		P=0.000			

Source: Field Survey, 2011

Accordingly, the majority of farm households, i.e. 59.0 % did not make any effort to manage natural resources like forest, woodlands, soils etc. The remaining, 41 % on the other hand are making an effort to manage resources. The survey result further reveals that there is variation between the Gumuz and migrants in managing natural resources. The cross tabulation result reveals that 74% of the local population did not take part any resource management practice. The corresponding share for local migrants is 43.8%. As opposed to this, the proportion of local population who took part in resource conservation is 27.7% compared to the local migrants 56.2 % (Table 7.2). Development agents also share the views expressed by households. They state that the local population is not willing to manage resources rather they keep on cutting natural vegetation for source of income. Furthermore, there is absence of coordination between development agents and kebele administrators. The calculated chi-square (Table 7.2) confirms that the association between

the Gumuz and the migrants pertaining to resource management practice is statistically significant (P= 0.0000).

Respondents were asked to reason out why resources management is low in the district. A little greater than 95 % believe that lack of ownership feeling as a cause for not managing natural recourses.

Table 7. 3. Farmers Response for not Managing Natural Resources

Reasons for not making an effort to manage resources	No.	%
My subsistence income does not allow me	83	66.9
Fear of further land redistribution	81	65.3
Lack of ownership feeling	118	95.2
Total	282	227.4

Source: Field survey, 2011

Some 66.9 % on the other hand associate that it is subsistence low income that limits them to effectively manage natural resources. The remaining, a little greater than 65 %, connect failure to manage natural resources with fear of land redistribution for the future (Table 7.3). This is in agreement with the findings of Teferra (2009) where absence of tenure security, fear of further land redistribution, absence of alternative employment opportunities has triggered resource destruction in Angar Gutin area of Eastern Wallaga.

7.4.1. Major Environmental Problems

The discussion above clearly shows that environmental problem is imminent in the study area. In the light of this, an attempt is made to identify the major environmental problems in the study area. Consequently, 99.5 % identified deforestation as one of the major environmental problems whereas 98.1 % believe deterioration of water points as the other environmental problem. More than 94 % of the respondents confirm that soil erosion is one of the other environmental problems in the study district. The remaining 88.6 % identified

inadequate rainfall as major environmental problem (Figure 7.8). The resources identified as major environmental problems are renewable natural resources. If one is affected, it has an effect on the other. In the same way other natural resources like soil, wildlife etc are also affected.
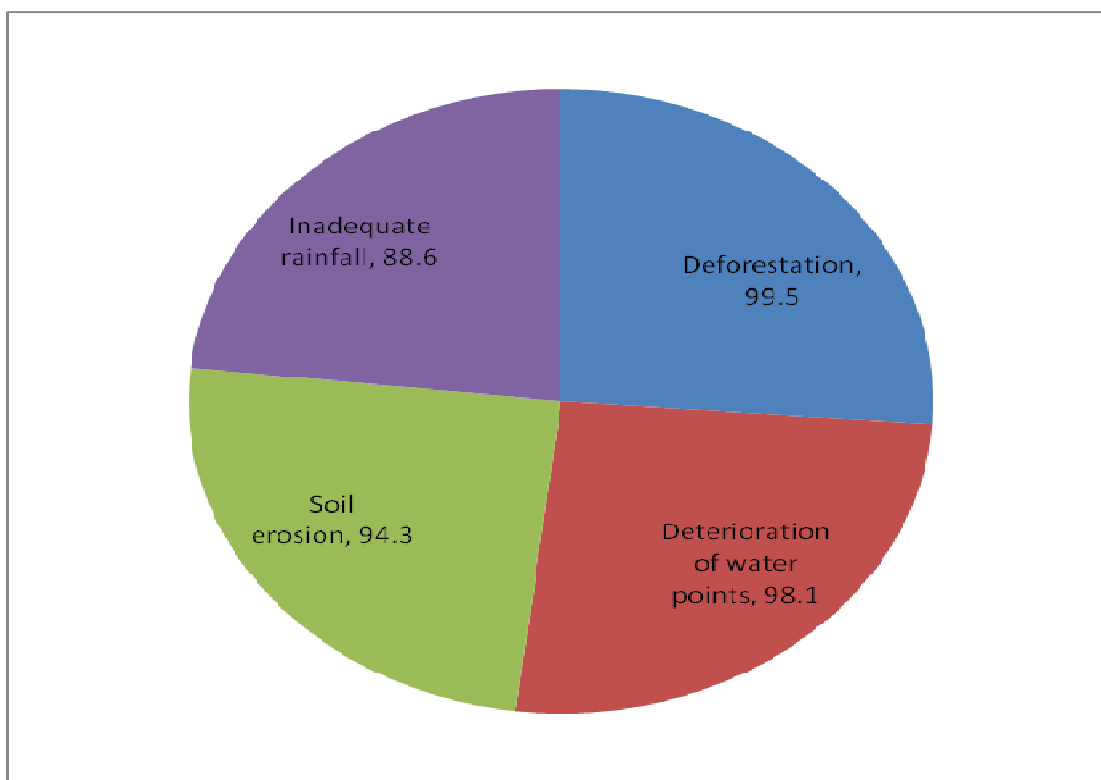
Figure 7. 8. Major Environmental Problems as Perceived by Respondents (Multiple Responses)

7.4.2. *Determinants of Land Resource Management Practices*

Resource management practices are influenced by a number of factors. Economic, social, political and cultural factors play a prominent role in the process of resource management practices. Especially, in countries like Ethiopia where there is heavy direct dependence on natural resources, critical assessment of factors that affect resource management is an indispensable issue. In view of this fact, attempt has been made to identify factors that affect resource management practices by farm households. In this regard, the study

identified household strata, labor size, household size and current land size as important correlates of resource management practices among the surveyed farm households. To this end, a chi-square test was run so as to see the existence of association between the dependent (effort to manage resources) and independent variables. As can be seen from Table 7.6 all the factors selected have associations and are statistically significant (P value less than 0.05).

Table 7. 4.Correlates of Resources Management Practices

Characteristics of a household	Effort to Manage Resources				Total		X^2	P-Value
	Yes		No					
	No.	%	No.	%	No.	%		
Household Strata								
Gumuz	27	25.7	78	74.3	105	1.000		
Migrants	59	56.2	46	43.8	105	100.0	20.16	0.000
Labor Size								
≤ 3.44	56	48.7	59	51.3	115	100.0		
> 3.44	30	31.6	65	68.4	95	100.0	6.303	0.018
Household Size								
<3	7	3.3	11	5.2	18	8.6		
3 – 5	32	15.2	30	14.3	62	29.5		
6 – 8	38	18.1	45	21.4	43	39.5	12.98	0.005
>8	9	4.3	38	18.1	47	22.4		
Current Land Size								
<2.5	84	44.0	107	56.0	191	100.0		
≥ 2.5	2	10.5	17	89.5	19	100.0	7.99	0.010

Household Strata versus Resource Management Practices

Two strata of households, the Gumuz and Migrants, have been surveyed for further analysis. The study result reveals that the resource management practice between the dependent variable and household strata show existence of association. The computed chi-square confirms that there is statistically significant association (P= 0.000) between the dependent and explanatory variables.

During focus group discussions farm households as well as development agents state that the Gumuz are destructing natural resources to get income. For instance, cutting trees for fuel is an everyday activity by the local population. Furthermore, it was indicated that there is no concerted effort by local administration to halt the problem.

Labor Size and Household Size versus Resource Management Practices

In developing countries like Ethiopia, labor force size in a family plays a crucial role. It is also true that family labor predominates the labor share of agricultural activities. It does the same purpose in an effort by households to manage natural resources. To this end, attempt has been made to see whether or not there exists statistical significant difference when it is above and below or equal to the mean of labor size. The computed chi square test shows that there is significant relationship between the two (P= 0.018). This, in turn, means those households with large human resource have the capability to engage in resource conservation which needs concerted effort by family members. The finding of this study is in line with DFID, 2002 and Degefa (2005).

Size of a family is one of the most important demographic variables that have profound direct effect on household's effort to manage natural resources. The computed chi-square test confirms as there is statistically significant association (P= 0.005) between household size and effort to manage natural resources.

Current Land Holding Size versus Resource Management Practices

Especially for rural population land is the most important resource to carry out different activities as well as to derive livelihoods. To this end, effort has been made to see whether or not current land size holding has an effect on resource management practices. The computed chi-square test confirms as there is statistically significant association (P= 0.010) between current land holding size and effort to manage natural resources. A cut point of 2.5 ha was taken on the assumption that "under normal circumstances, an average family would require between 2.5 to 3.5 ha of good quality land to produce enough food to feed itself for one harvest year" (Rahmato, 2009:306-7).

7.5. Conclusion

This chapter has presented the analysis and discussion of farm households perception on land use/cover and population dynamics, and major environmental problems prevailing in the district. The survey results indicate that key natural resources like bamboo forest, grazing land, grasses, and wildlife have significantly declined in the study district. Correspondingly, cultivated land and settlements have increased at the expense of forest cover, woodlands, Shrub lands, and grasslands. The survey result is in line with the analysis of aerial Photographs and satellite image analysis made under chapter six. Moreover, respondents identified factors like population increase, expansion of agricultural land, introduction of development projects, and consequently deforestation as causes for land use/cover dynamics. There is a marked difference between the Gumuz and migrants views on status of natural resources and effort to manage major natural resources. In this regard, migrants are well aware of the destruction of natural resources as well as make greater effort to manage natural resources than the Gumuz. The explanation behind this difference is migrants have past experience and exposure to resources destruction and its consequences than their counter part.

Currently there is a wider natural resources management effort and practice in Ethiopia. Contrary to this, the study identifies the existence of little or no effort and management practice of major natural resources. Especially this is true among the local Gumuz population who have the upper hand in resources as well as administrative possessions. They are widely engaged in extractive economic activities that are adversely affecting the natural environment.

CHAPTER EIGHT

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

8.1. Introduction

It is evident that Ethiopia is one of the countries of Africa that is experiencing significant population growth as well as land use/cover dynamics. Land use/cover induced degradation of natural resources is a major challenge to the country's development. Several studies have been conducted to understand the reciprocal effects of population growth and natural resource degradation. However, most of these studies were limited to the highlands and hence the dynamics in the lowlands of the country is not yet well understood.

The objective of this study was to assess how demographic and non demographic factors impacted land use/cover in Mandura district of the western lowlands of the country. In view of this, the study attempted to monitor population dynamics (growth, size, migration and urbanization more than others), land use/cover dynamics since 1957 and effects of policy changes on land use/cover and livelihoods changes in the study district. The study also intends to generate data on past and current land use/cover dynamics, smallholders perceptions and response on population and land use/cover dynamics and identify proximate (direct) and underlying (indirect or root causes) of land use/cover dynamics in the study area. The summary of the key findings of the study is presented as follows.

8.2.   Summary of Key Findings

The results and key findings of the study are summarized and presented according to the specific objectives set out in the study in an effort to address the issues raised by the research questions.

8.2.1.   *Population Dynamics since 1950s*

As elsewhere in Ethiopia, the population of Mandura district is increasing throughout the study period. The population has increased by more than fourfold between 1957 and 2007. The computed exponential population growth rate of the district reveals that for a period of twenty seven years (1957-1984), it has grown by 2.6% and substantially rose to 4.54 % between 1984 and 2007, a period of 23 years. High growth rate between 1984 and 2007 partly attributed to mass resettlement program of the government. Critical shortages of arable land, repeated famine and drought, poverty, and resource degradation in the highlands of Ethiopia have forced many farmers to move to the lowlands. Since the 1984, the influx of people to the district has been spectacular. With 3.48 % annual population increase, the rural part of the study area experienced fast population growth which raised the demand for additional arable land, fuel, food, construction materials and land for settlement. This has been achieved by clearing forested areas and bringing more land under cultivation. Smallholders, in an effort to fulfill their needs, are currently utilizing resources more rapidly than their replacement. Hence, the environment is degrading at an alarming rate in the district. Urbanization and consequent population in-flow to the district has also amplified the demographic pressure. It is evident from the CSA (1987, 1996 and 2008b) data that the rate of urbanization for the district was high.

Migration to the district was also high due to massive government-sponsored and self-initiated resettlement, land redistribution in the nearby regional state, and establishment of Gilgel Beles as administrative town of Metekel. Moreover, the Ethio-Italian project, called Tana-Beles project, and opening up of access roads since the 1980s have attracted

many people and once again increased the population pressure. The survey result further indicates that most migrants (89.4%) are young adults between the age of 20 and 49 years. This population group desperately needs land for themselves as well as other young family members for different purposes.

8.2.2. *Farming System, Land Use/cover Dynamics and the Driving Forces*

The farming system in the study area remains highly dependent on simple hand equipment. The information about crop production reveals that the dominant crops in terms of area coverage are cereals and oil crops. Shifting cultivation was once the dominant agriculture largely practiced by the local population. However, since the middle of the 1980s it has been fading away due to population pressure. At present land is a scarce resource due to mounting population increase. This has resulted in a fallow period to be shortened. The ever increasing price of modern agricultural inputs such as improved seed and commercial fertilizer partly discouraged intensive agriculture. The fact that 97.1 %, i.e. 102 out of 105 respondents of the Gumuz have opened up virgin plots for cultivation for the last 20 years or so, indicates that colonization of new areas is an ongoing process in the area. Smallholders have aged long experience of maintaining soil fertility. The study reveals that farm households use crop rotation as a major strategy to maintain soil fertility instead of using manure. The low utilization of animal dung is attributed to high prevalence of livestock diseases in the area.

Land use/cover changes have occurred at an unprecedented rate nearly for the past half a century. The total land use/cover conversions, which totals 58,403 ha of land, the share that goes to farm land constitutes 90.1% (52,600 ha), reverine trees 8.7 % (5,082 ha), and settlements 1.2 % (721 ha). Thus, conversion to farmland has increased in an extraordinary rate in the district while forest land has significantly decreased by 5.17 % and 2.59 % in 1957 and 1982, respectively. In 2006, forest cover was non-existent in the district. Similarly, land use/cover transition was high for woodlands, shrub lands, and grassland with scattered trees in the study period. Between 1957 and 2006, woodlands,

shrub lands, and grassland with scattered trees have lost a total of 44, 823 ha of land. This trend is likely to continue for the years to come, especially given the continuing inflow of population from the nearby regions and absence of any coordinated resource management practices at different administrative levels.

Indigenous institutions, which sustain natural resources for centuries, have collapsed thereby triggered adverse land use/cover changes in the district. These institutions have gradually lost their decision making power and thus become unable to efficiently coordinate the management of natural resources to reverse the situation. Likewise, the traditional land tenure system which maintains resources for centuries have buckled following population inflow to the district, and common natural resources are not protected by indigenous institutions, i.e. elders as it was the case previously. The Gumuz have become unwilling to participate in natural resources management practices and put aside the advice of development agents related to natural resources management and utilization.

8.2.3. *Environmental Consequences of Land Use/cover Changes*

Mandura district is facing environmental problems due to unprecedented land use/cover changes. Gebreyohannis *et al*, (2013) reported that forest cover change is a principal contributor to biodiversity loss, depletion of soil carbon, impairment of water resources, climate change, soil degradation, and even cultural shifts. Indeed, the study district has experienced huge forest, woodlands, and Shrub lands losses. Besides, it has faced land productivity decline, wild animals loss and loss of other renewable natural resources. Accordingly, land productivity, particularly soil fertility, is on decline as it was ascertained by more than 50% of the interviewed farmers. Likewise, wild animals which once abundant and used as important source of meat are disappearing fast in the district. Moreover, shifting cultivation, fishing, fruit and honey collection by the Gumuz has been weakened following land use/cover dynamics. Water points have deteriorated in the district as evidenced by 25.8 % of responses and 98.1% of cases.

The rich biodiversity resources of the region are under threat due to deforestation, especially plants that have diverse uses and importance, like sources of food, medicine, recreation, are diminishing from time to time. Asfaw and Tadesse (2001:50) observed that "wild edibles are reserve foods that fill the food gap of poor members of society." Formerly the Gumuz widely depend on fruits, leaves, roots and barks for multifaceted purposes including complementing main food sources. Currently, with deteriorating natural vegetation availability and access to these resources is on the verge of collapse. As it was stated in the region's food security strategy document, resource degradation is identified as one of the most important factors that trigger food insecurity in the region. In view of this situation, it is apparent that the Gumuz are pushed to engage in destructive economic activities and their traditional practices of using natural resources for various purposes are disrupted.

8.2.4. *Farmers Perception on Trends and Drivers of Land Use /cover and Population Dynamics*

Respondents have identified varied factors that caused the degradation of natural resources in their area. Accordingly, population pressure, expansion of agricultural land, introduction of development projects, and deforestation were identified as the most important causes of environmental change and degradation.

The study further identified time and rate of natural resources decline during different regimes. It was since the 1990s, i.e. during the current regime that decline of the natural environment accentuated and reached its peak. In this regard, the finding of this study is in line with Bekele (2008) who has stated that the shift from unitary to federal state in 1991 had created a power vacuum during which time destruction of natural resources took place on a large scale. Furthermore, absence of clearly stated responsibility between the federal and regional governments pertaining to utilization and management of natural resources has been one of the reasons for environmental destruction in the region.

With regard to land resources management practice, the study found out that there is a marked difference between the migrant and the local population in that the latter make little effort to manage natural resources. It happens so when traditional economic activities gradually wear down that they opted for extractive economic activities which have an adverse effect on the natural environment. The study further reveals that the current livelihood options in the district are extremely small.

8.2.5. *Policy Changes and their Effects on Land Use/cover and Population Dynamics*

Policies ratified during the three regimes have contributed their part in shaping land use/cover and population dynamics. The three regimes are characterized by absence of clear policy frameworks, limited involvement of the community, underestimating age-long knowledge and experience of the community, which has resulted in land use/cover dynamics and eventual resources degradation. However, the magnitudes of land use/cover and population dynamics vary during the three regimes.

One of the policies that has created land use/cover and population dynamics in Ethiopia in general and the study area in particular was the resettlement program carried out during the military regime (Dergue) in 1984. The Military government has devised this policy as one of the ways out from famine and drought that strikes the country in the same year.

The government after 1991 has also prepared and effected different policies. Early years of the current government have been characterized by absence of clear responsibilities between the federal and regional governments pertaining to natural resources conservation, management and use. The BGNRS has come late, i.e. after 19 years with the February 2010 proclamation of rural land administration and use. Even then, until the end of 2012 the policy was not materialized. Thus, the proclamation is too late to protect the disappearance of forest cover and the shirking size of woodlands, Shrub lands and grasses. The management at kebele level could not stop or reduce conversion of

much of the forest land, woodlands, Shrub lands and grassland to crop land. This is a good indicator of institutional weakness in rural Ethiopia.

As elsewhere in Ethiopia, the land policy of the government has contributed to environmental destruction and enhanced sense of tenure insecurity. Intentions have been there by the regional government to reverse the alarming environmental deterioration. A case in point is the preparation of the Rural Land Administration and Use proclamation, Proclamation No. 85/2010 to create sense of security among rural residents. The proclamation is intended to issue land certificate to smallholder farmers, but was not put into effect until the end of 2012.

The top-down policy formulation and implementation strategy of the government is responsible for the frequent failures of policies and strategies which used to be rejected by the community, i.e. implementers.

8.2.6. Responses of Farm Households to Population and Land Use/cover Changes

The results of this study show that Mandura district has faced momentous natural resources and demographic dynamics since the 1980s. Following escalating population size and natural resources degradation, livelihoods of the local population has changed. Moreover, as customary practices of the local population altered, the friendly relationship between the natural environment and the people started to change.

The first response of the local population was to move away from their original settlement being pushed aside by settlers and the native traditional agricultural systems and natural resources management practices were altered. As most areas were colonized and options to move to other areas were almost impossible, the Gumuz started to engage in leasing land, charcoal extraction, and wood selling as coping strategies which in turn adversely affect the natural environment. Charcoal and wood selling has never been practiced before by the local people. The second response was to lease the land to farmers

outside of the district. At times they snatch the land from migrants who reside in the kebele and give it to farmers who came from the immediate region. The reason the local population prefers to lease their lands for farmers from immediate region is that the payment they get from these farmers either in kind or cash is far better than the migrants and probably to reduce risk of land ownership title. This situation has encouraged the ingenious population to grab as much land as they can which in turn accentuated the destruction of the remaining natural resources. This growing state of affair has also created resentment between the migrant and local population. Formerly common natural resources like forest, water points, and grazing land were under the administration and close supervision of the elderly. Following growing population pressure in the area, traditional resource administration and management came to an end whereby these common resources were possessed and over utilized by individuals. This, in turn, partly has contributed its share for natural resources destruction in the district.

8.3.   Conclusions

The following concluding remarks may be drawn from the major findings discussed above. In a subsistence economy where dependence on natural resources is high, quantifying and properly understanding land use/cover and population dynamics have a profound significance and implication for proper use and management of natural resources. As this study indicates, natural resources degradation by demographic dynamics and other non demographic factors is widely observed in the study area which in turn is an indication of the widening of the problem to every physiographic region of the country. Population will increase in the future exerting a profound pressure on the remaining natural resources given the current high birth rates, declining death rate, in migration, and low level of educational achievement in the district. Level of fertility is inversely related to educational attainment. In view of this fact, it can be concluded that fertility will not drop significantly in the near future given the low level of educational achievement of the rural inhabitants in the district.

Equally important is the migration process which the district is currently experiencing and the responses of farm households. One of the objectives stated in the national population policy of Ethiopia was to 'preserve the environment' though this objective is too far to attain soon in the study area given the current fast population inflow to the district triggered by different factors at a distance and in the district. The current increasing population size does not result in out migration as a risk management strategy as hypothesized by Boserup. Likewise, this study does not support the Boserupian hypothesis that contends population increase (size) will motivate farm households to practice intensification through modern agricultural inputs or diversify livelihoods. Instead, land leasing and share cropping arrangement mainly by the Gumuz as risk management strategy is practiced which as a result adversely affects the natural environment. Thus, there was no any robust intensification and livelihood diversification that change the life of smallholders in the district as hypostasized by Boserup. But, experience in other parts of the country indicates that if government agents show the scientific way of resources conservation, management and income diversification, the farmers can adopt and change their life in the mean time (for details see Nyssen, Simegn and Taha, 2009).

As elsewhere in Ethiopia, forests more than any other land use/cover types, have been destroyed in the district while woodlands, shrub lands and grasses are degrading fast without any kind of replacement. This dynamics will continue to prevail in Mandura district given the current rapid population increase, institutional weakness, tenure insecurity, and haphazard decision making process. Thus, this study does not support the argument of Robert Malthus which describes a linear outlook that assumes direct, causal linear relationship between population and environment, and thus, simplifies the population environment interaction. Rather the argument of proximate determinists seem applicable in the study area where high population increase aggravates resource loss in conjunction with other factors like level of technology, consumption, institutions, poverty and policies. Indeed, mounting population size mediated by other factors like institutional weakness, weakness of customary practices and policies (tenure insecurity), has resulted in unprecedented land use/cover dynamics to happen in Mandura district. It is

also important to note the argument of Bilsborrow who states that high population growth combined with barriers to land reform and agricultural inputs will severely limit the process and efficiency of agricultural intensification for the foreseeable future (Marquette, 1997); given the inflexible land tenure policy of the government of Ethiopia, and the low level and fluctuating modern input supply and utilization in the district.

Most of the problems prevailing in the district are partly the outcome of past and present rural development policies and strategies of the different regimes. Tsighe (1995:90) argues that "the various rural development programs that were introduced at one time or another were socially inappropriate and did little to free the peasantry from their depressed conditions." Indeed, similar conditions are apparent in the study area where most rural residents currently pursue destitute and backward lifestyles that adversely impact the natural environment. Almost all rural development policies and strategies intended to bring change were put in place in a top-down approach without the involvement of the beneficiaries. This reinforces the observation of Tsighe (1995:90)   that they [the rural development policy of Ethiopia in particular] had little or no impact on the welfare of poor peasants and failed to achieve the objective of eradicating rural poverty. Indeed, subsistence farmers were not consulted what their priority was. That is why most of the rural development endeavors couldn't bring remarkable change on the life of the rural residents. This state of affairs would definitely be the case for the future so long as decisions are made at a higher level without involvement of the beneficiaries and understanding the local realities. A case in point is the current villagization process in the region which has been decided based upon a rapid rural appraisal report. Successive governments including the current regime have apparently excluded the rural mass in prioritizing and deciding on their own problems. Thus, most rural policies and strategies are designed and implemented only to serve the political machinery than the rural poor. This condition will continue to prevail in the study area, too, leaving the rural population backward, destitute and food insecure.

As elsewhere in Ethiopia, most rural institutions are weak and are not properly functioning as they are anticipated. If institutions are not functioning properly, i.e. in terms of

153

determining who has access to which resources, or land tenure arrangements are highly inequitable, it is likely that there will be a higher degree of resource degradation than in cases where common property regimes are respected and households have sufficient land to pursue their livelihood strategies (Sherbinin, 2006). Indeed, institutions are not properly functioning, likewise the traditional land tenure system which contributed to maintain resources for centuries have collapsed following population inflow to the district, and common natural resources are not protected by indigenous institutions, i.e. elders as it was the case previously. Consequently, resource degradation would remain the problem in the study area up until the aforementioned challenges are appropriately addressed. It is also important to note that farm households' perception to all these changes is negative, i.e. unprecedented natural resources destruction.

Furthermore, the analyses presented in this study clearly indicated that population and land use/cover dynamics and associated factors that affect their interaction could be better understood if diverse research instruments are employed so as to capture as many varied causes and consequences as possible.

8.4. Recommendations

Based on the findings of the study, the following recommendations are forwarded to enhance sustainable management of resources in the face of increasing population.

1. Land use/cover dynamics in the study area as well as the nearby regions is the results of smallholders struggle to sustain themselves. Combating this problem, therefore, calls for joint strategies both from the sender, i.e. Amhara regional state and the recipient, i.e. Benshangul-Gumuz regional state. The taskforce, which is composed of experts from both regions outline a kind of measure(s) to be taken to reduce existing and future natural resources related degradation. Moreover, outmigration from the nearby region would likely continue in the years to come through chain migration by smallholders. Thus, district level authorities should design strategies like planned population

relocation, alternative sources of livelihoods to effectively handle the influx of new migrants. Moreover, strengthening institutional setup at kebele level as well as reinitiating customary practices is crucial.

2. The current situation pertaining to natural resource management and use is extremely weak. Resources management inherently demands the involvement and genuine commitment of all actors. This, in turn, demands for awareness creation, education, collaboration among different government and nongovernmental institutions working around natural resources. This, in turn, demands the formulation of broad land use guiding principle so as to decrease the pressure on the remaining common natural resources. In conjunction with these, devising alternative sources of livelihoods for rural residents is extremely desirable action to be taken by concerned district officials as it partly relief the pressure on the remaining natural resources. Moreover, agricultural intensification through provision of modern input should also be adopted so as to hinder further encroachment to marginal lands and pressure on other natural resources. The other way of reducing pressure on the remaining natural resources is devising alternative energy source and new rural technologies that save energy and increase efficiency and reduce the volume of wood lots used for fuel.

3. Adequate attention needs to be given to the livestock sector. This can be achieved by reducing the loss of livestock through expanding veterinary service in the study area. The sector further expands the pace of obtaining other sources of food which, in turn, reduce the opportunity of land use/cover conversions for crop cultivation.

4. Most strategies and action plans implemented in the district follow a top down approach. Such approach should be replaced by the active involvement of the community at large in all phases of identifying, planning, implementing, evaluating, and monitoring processes.

5. The district has ample water resources. However, irrigation agriculture has not been practiced in Mandura district. Other alternatives namely, producing lean season crops and packages ensuring food security should be devised. This includes gradual expansion of irrigation scheme on the traditional farms of the households to enable them to produce enough food to carry over the entire consumption year. As a result, the conflict between land use/cover conversions and farmland expansion will be minimized.

6. The interaction between land use/cover and population dynamics which is complex in nature demands corresponding utilization of diverse instruments like remote sensing, questionnaire survey, focus group discussions, and in depth interview so as to capture as many factors and effects as possible.

Finally, possible areas of research may include physical drivers of land use/cover change, soil erosion and sediment yield which is not included in this study and villagization which is an ongoing activity in the region. As a final point the result of this study should be taken as indicative rather than conclusive.

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157

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158

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160

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LIST OF ANNEXES

ANNEX 1. HOUSEHOLD QUESTIONNAIRE

Kebele name/Village Name_____

Name of the person who filled the questionnaire: _____

Date on which the questionnaire was filled: _____/_____/2003 **E.C.**

HOUSEHOLD QUESTIONNAIRE FOR LAND USE AND LAND COVER CHANGE STUDY

BASIC HOUSEHOLD INFORMATION (Fill appropriate information or tick by putting ("√")

1. Occupation: _____

2. Age: _____

3. Sex: 1. Male_____   2. Female_____

4. Marital Status: 1. Married_____   2. Unmarried_____ 3. Divorced _____

        4. Separated_____   5. Other (specify)_____

5. Total family size by age group and gender:

Age group	Male	Female	Total
0-14			
15-64			
65+			

6. Religion: 1. Orthodox Christian_____ 2. Indigenous faith _____ 3. Muslim _____

    4. protestant _____ 5. Other (Specify) _____

7. To what Ethnic group do you belong? 1. Gumuz____ 2. Agaw_____ 3. Amhara_____

    4. Oromo_____   5. Shinasha_____ 6. Other (specify)_____

8. Educational status: 1. Can't read and write____ 2. Can read and write____ 3. Primary

(1-8)____   4. Secondary (9-12) ____   5. Tertiary (12+)_____

9. Status in the kebele: 1. Migrant_____   2. Non-Migrant_____

175

10. If you answered "Migrant" to question No. 9: how long have you been here? _____

11. If you answered "Migrant" to question No. 9 where did you live before? _____

Population Dynamics over time (years in E.C.)

12	How do you perceive population growth in the area between 1980s and now	**Since 2000s**	**1990s**	**1980s**
		1. very high 2. high 3. low 4. no change 5. don't know	1. very high 2. high 3. low 4. no change 5. don't know	1. very high 2. high 3. low 4. no change 5. don't know
13	If your answer is "very high or high" which factor is most important for the increase?	1. in-migration 2. Excess of births over deaths (natural increase) 3. Due to In-migration and natural increase	1. in-migration 2. Excess of births over deaths (natural increase) 3. Due to In-migration and natural increase	1. in-migration 2. Excess of births over deaths (natural increase) 3. Due to In-migration and natural increase

Land use/cover change

14. How do you perceive the change in the following land use/cover in the last 20 years or between 1980 and now? (years in E.C.).

1. Increased   2. Decreased   3. No change   4. Don't know

Land use/cover types	2000s	1990s	1980s	Comment, if any
Bamboo and thicket				
Cultivated land				
Grazing land				
grassland				
settlement				
wildlife				
Other, specify_____				

15. If you perceive an increase in land use/cover change in the last **twenty years**, what factor or factors do you think might have caused it? (You may give multiple answers)

        1. Population increase

        2. Expansion of agricultural land

        3. Introduction of new development projects

      4. Deforestation

        5. Other, specify _____

16. List the problems you are personally faced with due to increases in land use/cover change. List them in order of importance).

_____

_____

Land holding and property ownership

17. Total land holding in hectare. 1. Now _____ 2. 10 years ago_____ 3. 20 years ago ___

18. Is it common to have more children in order to obtain more land?

    1. Yes   2.No   3. Don't know

19. How often did you use your farmland 20 years ago?

1. Once in a year   3. Always

2. Twice a year   4. Shifting cultivation   5. Other, Specify____

20. How do you use your farm land currently?

      1. Once in a year   3. Always

      2. Twice a year   4. Other, Specify_____

21. Do you think that land is becoming scarce in your kebele?

   1. Yes, it is becoming scarce _____ 2. No, it is abundant _____ 3. No Change_____

22. If your answer for question 21 is yes, why is land become scarce (You may give multiple answers)?

      1. Because of population increase

      2. Because the proportion of fertile land is diminishing

      3. Land has fallen in fewer hands

      4. Land has been converted to non-agricultural uses

      5. Land has been given to developers

      6. Other, Specify_____

23. How do you rate your crop production from your plot(s) over the last 20 years?

      1. Increasing   2. Decreasing   3. No change

24. What is the estimate (in quintals) of your household production of crops for the years below (years in E.C.)

Crops	Since 2000s	1990 s	1980 s
Maize			
Sorghum			
Millet			
Sesame			
List all the crops produced			

25. Do you practice fallow method to recover the fertility of your plot of land?

 1. Yes _____   2. No _____

26. If your answer is 'Yes", how long (in years) does it rest before being used again? _

Use of inputs

27. Could you tell us whether you used the following modern agricultural inputs in the years mentioned below? (Years in E.C.)   Use code: 1=Yes

        2. =No

Use of inputs	Since 2000	1990s	1980s	Comment(if any)
Fertilizer				
Improved seed				
Insecticides				
Other, specify				

Extension of agricultural plots into forest fields

28. Have you opened up woodlands for cultivation since 1980s? 1. Yes __ 2. No.___

29. If the answer is "Yes" continue to answer questions 29.1 if the answer is "No" go to question

29.1. Extension of agricultural plots in virgin woodland in 2000 s (E.C)		No. of plots
	Number of plots extended	

 Perception of Land Sufficiency in the kebele

30. Is there enough land for everybody in the kebele?   1. Yes___   2. No_____

31. If the answer is "no" how did you solve the problem? (or how do you solve land shortage)?

       1. Clear more wood lands_____

       2. Plough steep slopes_____

       3. Look for off-farm employment_____

       4. Other, specify_____

Breeding of animals

32. How many animals did you own in the years indicated below? (years in E.C.)

Animal	1. since 2000	2. 1990 s	3. 1980 s
Goats			
Cattle			
Sheep			

33. Is there enough grazing land in the kebele?   1. Yes   2. No

34. If your answer is "No", how do you feed your herds?_____

      _____

Environmental Issues

35. Say YES (1) or NO (2) if the following are major environmental problems in the area? (Multiple answers are possible)

1. Deforestation_____   3. soil erosion_____

2. Deterioration of water points_____   4. Inadequate rainfall_____

5. Other, specify_____

36. If deforestation is one of your answers for No. 35, what might have caused this problem?

       1. An increasing demand for firewood_____

       2. Expansion of agricultural land_____

       3. Cutting of trees for construction_____

       4. Cutting of trees to generate income_____

       5. Other, specify_____

Resource Management (forest, soil, water etc)

37. Did you make an effort to manage resources (Forest/Woodlands, Soil etc)?

1. Yes_____   2. No_____

38. If your answer for question no 37 is No, why? (Multiple answers is possible)

      1. My subsistence income does not allow me

      2. Fear of further land redistribution

      3. Lack of ownership feeling

      4. Other, Specify_____

39. Do you think that the productivity of your land has decreased for the last 23 years?

 1. Yes   2. No

40. If your answer for question number 40 is yes, what is /are the main reasons (multiple answers is possible)

      1. Aging of the land   3. Loss of nutrients

      2. Little or no use of fallow   4. Other specify_____

41. How do you improve the fertility of your land?

      1. Use manure

      2. Add commercial fertilizer

      3. Rotate crops

      4. Other, Specify_____

42. How often do you receive government advice on natural resources conservation and management?

      1. Every six month

      2. Every three month

      3. Every month

      4. Every week

      5. Other, Specify_____

ANNEX 2. CHECKLIST FOR FOCUS GROUP DISCUSSION AND IN-DEPTH INTERVIEW

Elderly

1. How do you see the population changes since the 1950s?
2. What effect does this result on the ecology, population?
3. What are the major land use and land cover types some 20 years ago?
4. Is there land use and land cover change in the kebele?
5. Would you explain the extent of the change?
6. Which resources are more affected due to land use and land cover change?
7. In your opinion what   are the factors /reasons for these significant changes?
8. How did you rate population change in the kebele?
9. Why many people are coming to this area?
10. From the three regimes, when did population grow fast? Why?
11. What were the most important economic activities 20 years ago?
12. Explain the current economic activities in the kebele?
13. What effects they bear on you (if any)?
14. How did you rate quality of extension and development work services in the PA?

Experts

1. How do you rate population dynamics in the PA (for the last 20 years or so)?
2. What effect(s) did population dynamics impose on the PA?
3. How do you rate the extent of   land use/cover change in the PA
4. Would you please explain the pattern of change in land use/cover in the PA?
5. Which factors did you expect play a prominent role?
6. How do you explain the livelihood changes occurred in the PA?
7. In which one of the three regimes that land use/cover change was high? Why?
8. Would you list down the major extension and development works in the woreda?

ANNEX 3. STATISTICAL OUTPUTS

Mann-Whitney Test on Mean Land holding between the Gumuz and Migrants

Test Statistics[a]			
	Land holding ten years a go	Land holding Twenty Years a go	Current land holding in hectare
Mann-Whitney U	2415.000	1890.000	4515.000
Wilcoxon W	7980.000	7455.000	10080.000
Z	-8.786	-9.643	-4.555
Asymp. Sig. (2-tailed)	.000	.000	.000
a. Grouping Variable: Household strata			

Mann-Whitney Test on Mean Working Age population between the Gumuz and Migrants

	Working age population of hh
Mann-Whitney U	4430.500
Wilcoxon W	9995.500
Z	-2.760
Asymp. Sig. (2-tailed)	.006
a. Grouping Variable: household strata	

Correlation Results between Population size and Land under cultivation, 2005-2011

		Popsize	Landsiz
Popsize	Pearson Correlation	1	.971[**]
	Sig. (2-tailed)		.000
	N	7	7
Landsiz	Pearson Correlation	.971[**]	1
	Sig. (2-tailed)	.000	
	N	7	7
**. Correlation is significant at the 0.01 level (2-tailed).			

Cross tabulation -Chi-Square Tests Result on Resources Management Practices Between the Gumuz and Migrants

Did you make an effort to manage resources	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	20.165[a]	1	.000		
Continuity Correction[b]	18.924	1	.000		
Likelihood Ratio	20.550	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	20.069	1	.000		
N of Valid Cases[b]	210				
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 43.00.					
b. Computed only for a 2x2 table					

Cross tabulation -Chi-Square Tests Result on Land Productivity Decline Between the Gumuz and Migrants

Do you think that the productivity of your land has decreased for the last 23 years?	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	19.592[a]	1	.000		
Continuity Correction[b]	18.386	1	.000		
Likelihood Ratio	19.915	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	19.499	1	.000		
N of Valid Cases[b]	210				
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 49.00.					
b. Computed only for a 2x2 table					