

ADDIS ABABA UNIVERSITY
COLLEGE OF DEVELOPMENT STUDIES
CENTER FOR ENVIRONMENTAL DEVELOPMENT

THE NEXUS BETWEEN POPULATION PRESSURE AND ENVIRONMENT: THE CASE OF DEGEM WOREDA IN OROMIA REGION NORTH SHOWA ZONE

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A THESIS SUBMITTED TO THE COLLAGE OF DEVELOPMENTS STUDIES OF ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF MASTER OF ARTS IN ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

JUNE, 2022
ADDIS ABABA, ETHIOPIA

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DECLARATION

I **Abera Nigussie**, declare that this thesis is my original work and has never been presented to any university or any other Institutions for the award of a degree or any other award. I have made it independently with the close advice and guidance of my advisor; and that all sources of materials used for the study have been duly acknowledged.

Abera Nigussie Tolossa

Signed_____

Date_____

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This is to certify that the thesis presented by Abera Nigussie entitled on the nexus between population pressure and environment a: the case of Degem woreda Oromia region North Showa Zone and submitted in partial fulfillment of the requirement for the degree of master of science complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

Signed by the Examining committee:

External examiner_____Signature_____Date_____

Internal examiner_____Signature_____Date_____

Advisor_____Signature_____Date_____

_____

Chair of Department or Graduate Program Coordinator

ACKNOWLEDGEMENTS

At the outset, I would love to thank God for giving me patience, health, dedication and endurance to start and of course to finish what I dared as one of my life goals. Obviously, this thesis would not have been possible without the guidance and the help of several individuals who in one way or another contributed and extended their valuable assistance in the preparation and completion of this study.

My warmest gratitude and appreciation go to my advisor Engidawork Aseffa (PhD) who devoted his precious time to comment on the research proposal starting from the very commencement up to the final report. Successful accomplishment of this research would have been very difficult without his generous time devotion from the early design of the questionnaire to the final write up of the thesis by adding valuable, constrictive and ever teaching comments and thus I am indebted to him for his kind and tireless effort that enabled me to finalize this thesis.

I extend my profound gratitude to my friends Tarekegn Zegeye and Yeron Demeke for their financial as well as material supports in one way or other ways; really your support contributes a lot for my success indeed.

Finally, I would like to express my deepest appreciation to my beloved Feyise Derese, my mom Zewiditu Buli and my daughters Sena and Melala Abera for their moral encouragement and support in accomplishing this study.

ACRONYMS

BOLEP	Bureau of Land and Environmental Protection
CSA	Central Statistical Agency
DAs	Development Agents
EPA	Environmental Protection Authority
FAO	Food and Agricultural Organization
GFRA	Global Forest Resource Assessment
HHH	Household Heads
UNCED	United Nations Conference on Environment and Development
UNFPA	United Nations Fund for Population Activities
UN	United Nation
GIS	Geography and information system
PHCC.	Primary Health care corporation
IUD	Intrauterine Devices
TFR .	Total fertility rate
JICA.	Japan international corporation agency
MOFED.	Ministry of Finance economic development
HPCC .	Population and house sensus commission
EEA	Ethiopia Economic Association

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Abstract

The purpose of this study is to assess the nexus between population pressure and environment: the case of Degem woreda in Oromia Regional State, North Showa Zone. In order to meet the objectives of the study, a descriptive survey design was employed. The data used in this study was collected from 300 sample household heads of the three Kebeles of Degem Woreda. The researcher used quantitative research approach supplemented by the qualitative one in order to assess the nexus between population pressure and environment. To realize this, a quantitative descriptive case study has been employed; questionnaires were the main data gathering instruments while interview, observation and document analysis were employed to enrich the data gathered through questionnaires. The questionnaires were piloted and checked for their validity and reliability. The data obtained through the questionnaires were analyzed using descriptive statistics. The information obtained through open-ended questionnaires and the interview was qualitatively analyzed to supplement the quantitative data. As a result, the findings indicated that there was a relationship between population pressure and environment in search for agricultural land, which resulted in land degradation and deforestation. The results also indicated that there was significant association with responses to the impacts of population pressure on agricultural land in terms of age, family size, literacy status and contact with Development Agents. The findings of the study also showed that 75.5 percent and 70.25 percent of the sample population perceived population pressure as a cause for agricultural land degradation and forest resource depletion, respectively. On the basis of the study findings, it is recommended that advocacy of family planning and environmental conservation should be strengthened. On the other hand, raising farmers' awareness and promoting understanding of the essential linkage between population and environment should be encouraged.

Keywords: Development, Environment, Nexus, Population pressure

CHAPTER ONE

1. Introduction

Ethiopia is one of the countries with high fertility, rapidly growing and largely young population. At the same time, it is among countries with weak and poorly focused population policy. In light of this, this study intended to assess the causation between demographic factors and environmental development in Ethiopia.

The rapid population growth and economic development in country are degrading the environment through the uncontrolled expansion of deforestation and expansion and intensification of agriculture, and the destruction of natural habitats. One of the major causes of environmental degradation in Ethiopia could be attributed to rapid growth of population, which is adversely affecting the natural resources and environment (Gebrestadik, 2016).

The demographic change of population has been seen all over the world in general and Ethiopia in particular. According to Weber & Sciubba (2018), somewhere around 1990, it was turning point in Europe against limiting population growth. By the turn of the millennium, the dominant narrative had shifted from worries over 'too many people' to worries over 'too few people', highlighting the global divergence between negative European population trends and those of less developed states, who still experiencing significant growth. Ethiopia is the 2nd largest populations in sub-Saharan Africa; therefore, the current research attempts to examine the adverse impact (if any) of such population growth (pressure) on environment and development.

1.1. Background of the Study

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. According to Tegegne (2014), 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.

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 according to Tegene cite in (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 adversely affected.

Many worried about human capacity to produce enough food to sustain the growing numbers of people, particularly in Africa and Asia, where population growth was fastest and food security already tenuous (Ehrlich, 1968, World Bank1984). Between 1950 and 2015, however, the world‘s population nearly tripled from 2.5 billion people to 7.3 billion people (United Nations, 2015), and the direst predictions of decades earlier have not come to pass, largely owing to new technologies that have enhanced the efficiency of global food production to a degree previously thought impossible(David, 2011).

1.2. Statement of the Problem

Population is one of the most important element of one nation (state) and population is a capital of one nation, however the important of these population have to go with the economic development of the state .so if the population growth of one nation is not growth with the growth of economic of the nation it become pressure on the nation ,due to this the population growth of one nation must much with the economic growth ,unless and otherwise population for this nation is considered as something worth rather than the important element.

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, et al., 2001; Etter et al., 2006; Pabi, 2007; Boone et al., 2007; Nguyen, 2008).

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 Tegegne (2014) as cited in Mamo (1995), Embaye (2000), and Tefera (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.

. Regarding to this the main target of this research is to address the effect of population growth on environment for the provision of prospects guaranty of food security in the case of Degem woreda in North Showa of Oromia Regional State. Discussions of population and sustainable development once were dominated by a concern that world population growth would eventually exceed the planet's carrying capacity in particular with respect to the availability of natural resources, especially since the mid-twentieth century a time of unprecedented global population growth.

In the current study area, there has been overcrowded population settlements which have created shortage of farming land and which have made livelihood challenging; due to such factor the surrounding population is more dependent on mixed-farming. At the moment, the youth ls leaving the area owning to the shortage of farm land and migrating to different part of the country such as Arsi, Bale and Gammbella areas. Thus, the researcher is motivated to conduct a study on the area to find out the reason why the young populations the area is leaving their home lands from time to time.

This paper may draw attention to the long-term consequences of even those require institutional adjustments that successfully cope with problems related to population growth.

1.3. Objectives of the Study

1.3.1. General Objective

The main objective of the study is;

To examine the nexus between population pressure and environment in the case of Degem Wereda, North Shoa Oromia Regional State

1.3.2. Specific Objectives

Specifically, the study aims to:

1. Asses the trends and patterns of population growth over the last three decades.
2. Examine the dynamics of land use and land cover change the last three decades
3. Examine the impact of population growth on the land use and land cover changes

1.4. Research Questions

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

- What major land use changes that have occurred as a result of population growth over the past three decades?
- What were the major effects that have happened as a result of population pressure?

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 was 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 was attempted to provide insight on the possible directions 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 through field observation, interview parameter analysis to unveil how the natural environment has changed through time in the district. Consequently, land use/cover map of the study district was 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 has contributed 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 were generated relevant information that had contributed to the development plans of the region in terms of planned population.

1.6. Scope of the Study

To conduct research in all rural Kebele of the district which has environmental problem is difficult task to the researcher due to managing the total process of the study. Therefore, the scope of the study was confined to cover only three rural Kebele of the district, more over the study also delimits itself and concentrates in Yaya Haro Rural Kebele in which there is less access to all necessary information concerning family planning and environmental conservation.

1.7. Limitation of the study

The study is actually expected to show full picture of farmers' perceptions on the effects of population pressure on the environment and their responses. Such study by its nature requires long period of time, adequate budget to increase sample size and geographical coverage. Due to these constraints the study is limited only to 300 households selected from three rural kebele administrations of Degem woreda.

The study was restricted in three rural kebeles3 (out of 25) for detailed demographic and socio-economic survey. However, detail land use/cover study will undertake for the entire district. Moreover, the land use/cover and population dynamics was considered between 1974-2019/20 based on the available the existing primary and secondary data), 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. Finally, interview was conducted with some farmers as the intent of the study and the was largely motivated further reluctance to gather the

correct information on land under their holdings, amount of yield produced and number of livestock possession.

1.8. Organization of the Study

This thesis has five 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 study area description, 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. And the last chapter, chapter five deals with summary, conclusion and recommendations.

CHAPTER TWO: Literature Review

2. Introduction

The review literature of this study has appraised existing theories regarding population and environment nexus. The review further incorporates issues like changes that mediate population as driver, migration, agricultural practices, resettlement, land tenure, and government policies as agents of land use and land cover dynamics.

2.1 Theoretical foundations

With the rapid increasing of population growth, the demands for agricultural land and energy sources are increasing at an alarming rate around the globe, particularly in developing countries. Such population growth in turn escalated the need for the arable land per person. Besides, such a pressure uncultivated land-induced movement to marginal area is unlikely to be a lasting solution since the continued population explosion will eventually inevitably lead to a situation where such a movement becomes impossible (Hassen, 2012).

2.1.1 Malthusian Theory

According to Thomas (1826), Malthusian view analysis population growth as a threat to the natural limit of arable land to provide food, shelter and subsistence. Malthus put forward the theory that whereas human population has a tendency to grow geometrically, agricultural/food production grows only arithmetically. In this way, population growth tends to outstrip the capacity of agriculture/food production and hence the productive capabilities of land resources to support the population. The result is that “positive” checks, such as famine and increased mortality, or “preventive” checks, such as postponement of marriage and limitation of family size, work to reduce population growth. Hence, according to Malthus if not checked by either by preventive or positive checks the consequence would famine, poverty and increased mortality.

The Malthusian viewpoint relies on the concept of,, carrying capacity", which implies that the ability of land to produce food is limited; and exceeding those limits will result in degradation and declining productivity. In more general terms, the Malthusian viewpoint suggests that limited natural resources place a restriction on population growth. the some to this the area where

the research will be conducted has been currently practices some idea with what the Malthusian theory has indicated. This means that in the area at the moment there is the problem of yield crop production ,there is no arable land which is sufficient to the existing population(Malthusian, 2008). The relation between population and environmental impact is often considered Straight forward: More people should have a greater impact on the environment, if all other factors (such as per capita consumption) remain unchanged.

2.1.2 Boserupian Population-Environment Theory

Boserupian theory, named after agricultural economist Esther Boserup (1910-1999), argues that technology is not to be regarded as developing independently from population size and density. Rather, technological innovations are occurring because there is a need for the new technology due to population pressure (Boserup, 1965, p. 1981). This argument is derived from the history of agricultural progress, and is in that way, more or less a parallel to Malthus' work. Both Malthus and Boserup study the question how food supply is related to population, but where Malthus regards technological progress as exogenous to population growth – which means exponential population growth eventually will outstrip the technological progress – Boserup points out that population size – trough population density – allows more labor-intensive technologies to be used, which means that technology is endogenous to population size.

2.1.3 Cornucopian Population-Environment Theory

Cornucopia refers to the horn of plenty from classical mythology. This can be seen as an allegory for the view of Cornucopians that the earth – or even the universe – (Simon, 1980) holds enough resources for all human beings to live a prosperous life, regardless of population developments. Cornucopian theory seems even more positive about the adaptive capacities of society to population growth then Boserupian theory. It differs from Boserupian theory by emphasizing the power of the free market to solve resource scarcity issues, and by its broad scope, which goes beyond purely agricultural development. Rather than exploring the exact pathways of technological and innovations along which larger population can be sustained, it presents natural capital as highly substitutable by other forms of capital, which implies that resources are actually plentiful**.**

2.2. Concept and definitions of terms

Different scholars and organization define population in different ways (Fekadu, 2010).
Population pressure: refers to phenomenon of imbalance between resources of the community and population living within an area due to over-exploitation and over use particularly forest and farm land (Ibid).

2.3 Empirical Finding from World Perspectives

The "population-environment nexus" has become a major issue in the recent literature on sustainable development. A large number of studies have been carried out to show how population affect environment. Some suggested that rapidly growing population not only increases pressure on marginal lands, over-exploitation of soils, overgrazing, over cutting of wood, soil erosion, silting, flooding but also increases excess use of pesticides, fertilizers, causing land degradation and water pollution (Khan et al., 2009).

Numerous researchers have suggested that population growth is the root cause of poverty and human sufferings (Malthus, 1798; Allen & Barness, 1995; Repetto & Holmes, 1983; Rudel, 1989; Ehlich & Holdren, 1971). Boserup (1965) explained how technological advancement and increased innovation in the field of agriculture became the result of increased density of population. According to Trainer (1990) stated that most of the developing countries suffer because of the rapid increase in population, that in turns cause to deplete natural resources, raising air and water pollution, deforestation, soil erosion, over grazing and damage to marine and coastal ecosystem. Because of rapidly growing population there is a tremendous pressure on the environmental resources to produce more food.

The Interaction of Population Growth and Environmental Quality (1994) argued that population growth, by increasing the demand for arable land, encourages the conversion of forests to agriculture. Since the people living in rural areas who are dependent on agriculture as a livelihood, one would expect deforestation to increase with rapid population density as well as rising demand for wood used for both timber and fuel. Cleaver & Schreiber (1994) found a declining trend among food productivity; population growth and natural resources, which deplete soil productivity resulting in vicious circle of population, poverty and environmental degradation. Meadow (1974) concluded that if present trends in the world population,

industrialization, pollution, food production and resource depletion continued with the same pace, the most probable result will be an uncontrollable decline in both population and industrial capacity.

According to Ehrlic & Holden (1971), rising human population is the predominant factor in accelerating pollution and other resources problems, in both developed and developing nations of the world. Thomes (1989) stated that population growth contributes to high rates of deforestation both directly and indirectly. Fekedu (2009) the similar devastation is observed by the researchers around the globe in developed countries as well. A study of Dasgupta and Lubchenco (2000) empirically found relationship between population growth and natural resources in the United States. They stated that the composition and scale of activities in the United States are changing chemistry of the nation's land, water and atmosphere so dramatically that some of these changes are adversely affecting its natural capital and thus, the ecosystem services are required to support its population. There are alternative views on population-environment linkages. Most theories of population and environment are expounded primarily in relation to agricultural resource usage, but they can be applied 'mutandis mutatis' to all types of natural resources.

For the natural science perspective humankind is one of the many species competing for the resources of the biosphere. As the resources of any ecosystem are finite, so is the latter's carrying capacity; hence, beyond a point, each additional inhabitant has a negative impact on the productivity of resources; this in turn depresses labor productivity and incomes. Policy-wise, this perspective leads to advocate population stabilization. At first sight, it thus seems redundant with policy prescriptions that emphasize the need to slow down population growth for the sake of enabling more productive investment and a higher rate of economic growth (Mishra, 1995; Marcoux, 1994, 1999; Bojo and Reddy, 2001; UN 2001). Kafka et al. (2009) examines how human activities are affecting our lives on planet Earth that receives less attention, i.e., the interaction among natural hazards, environmental degradation, and urbanization.

Human actions that cause environmental degradation, as well as the ever-increasing population and built environment in hazard-prone regions, are worsening the devastation wrought by nature. Kafka et.al (2009) again pointed out this nexus of natural hazards, environmental degradation, and urbanization and argued that it is a complex problem that does not tend to yield simple, straightforward scientific answers as to where and when it will actually result in harmful effect.

2.3.1. Causes of Overpopulation

Throughout history causes for overpopulation were numerous. This chapter introduces policies in China and India that aimed to reduce population growth by coercive methods that ignored human rights. The reason for the misunderstanding of family-planning efforts is often transcribed to poverty and illiteracy of nations to use contraceptives. In this chapter, United States policy on legalizing abortion is analyzed, and more background on the procedure of abortion throughout years is provided. The impact of Catholic Church could not to neglected in this context, hence religious ideologies are discussed briefly (Baus, 2017).

2.3.1.1. China

Although China conducted a successful family-planning policy, it was one of the most extreme approaches ever experienced in the human history. In 1978, Chinese scientist Jian Song encouraged Chinese government to advocate for a decrease in population growth by 2000. Otherwise, women will have three children and China's population would reach four billion by 2080 (Baird, 2011). "If China did not reduce its fertility to 1.5 or even one child per woman, the resulting depletion of resources would be disastrous" (Ibid p. 34). Thus, strict government monitoring was in act and women were required to undergo monthly gynecological exams. Those women who opted for abortion were awarded 14 days of paid vacation, and "40 days if it occurred in the second trimester and was quickly followed by sterilization" (Ibid p. 34). Furthermore, parents with one child received priority in housing, better healthcare and educational opportunities, while families with a second child had to pay back those benefits. "Those who had more than two would have their pay docked by 10 per cent for 14 years" (Baird 34). They were also at risk to lose jobs. In rural areas, it was of an extreme importance that male children are born. The one-child policy led parents to kill the newborn female child or aim for a second child to be a male, but before this slightly "lenient" policy in 1983, decade earlier women were forced to abort regardless of the pregnancy stage. China conducted 7.9 million abortions, 13.5 million IUDs, and approximately 7 million sterilizations were committed. The situation got worse in 1983, when "more than 16 million women and more than 4 million men were sterilized; nearly 18 million women were inserted with IUDs and 14 million underwent abortions" (Ibid p. 35). When the medicine and technology allowed for ultrasound, abortions could be taken for a female fetus, increasing the rate of boys from 6 percent to 17 percent by 1995 (Ibid p. 35).

2.3.1.2. India

As of 2016, the current population of India is 1.34 billion and that makes it the second most populous country in the world after China (Indiaonlinepages.com). Despite India's agriculture and improved farming industry, the increasing population lowered India's chances for an acceptable standard of living. During its independence movement, Mahatma Gandhi called attention to population growth and relied on abstinence as a solution. However, the government was first in t world to establish family-planning program first involving birth control, and then moving on to sterilizations. In 1956, seven thousand people were sterilized, and strong campaign advocating along with incentives aimed to encourage couple to limit themselves to two children per family (Aaseng, 1953 p. 80).

When this policy turned out to be ineffective, the government ordered sterilization of men with more than three children, but it soon expanded to sterilizations of even homeless and beggars. "Up to 8 million vasectomies were performed in India in 1976, many of them under questionable circumstances" (Aaseng,1953 p. 82). People fiercely opposed entire family-planning movement and when Indira Gandhi came back to power in 1980, her approach to population control was different than before and she remained silent on birth control. In addition to a lack of attention, different religions in India played a crucial role in population growth. "Approximately 85 percent of the country is Hindu, and 10 percent is Muslim. In addition, there is the small (14 million out of 820 million) but outspoken population of Sikhs" (Ibid p. 83). Muslim religion requires reproduction at the highest and fastest rate, so government policies seemed to be intended for this part of population only. Muslim men were forced to leave their homes and they underwent vasectomies against their will.

Another issue that prevents population growth is poverty and illiteracy. Due to expensive contraception, couples rather neglect birth control than undergo sterilization. Aware of the fear, government offered to pay people for sterilization, but only the poor were attracted to this idea, and the illiterate women, who cannot understand the advantages of family-planning groups. Rumors about contraceptives and family-planning efforts caused misunderstandings and affected population number. "Almost forty years after the efforts started, nearly two-thirds of India's 120 million married women still use no birth control method at all" (Aaseng, 1953 p. 87). With poor

economy, low standard of living increases population by "15 million Indians every year" (Ibid p. 86), almost allowing India to surpass China in the rank of most populated country.

2.3.2. Components of Population Change

According to Solome, cited in Kebede (2009), the size, growth rate and composition of the total population in a country are influenced by the three demographic phenomena, namely fertility, mortality and international migration (immigration-emigration). However, in Ethiopia the two basic factors in determining population changes are fertility and mortality, while the influence of international migration has been observed to be negligible and none of the three censuses collected data on international migration. These two basic components of change (fertility and mortality) as well as internal migration is relevance in the population-environment relationship.

2.3.2.1 Fertility

Fertility refers to the actual childbearing performance of a population. It is a major explanatory force in population dynamics and a major counteracting force to population attrition through mortality. In the absence of substantial migration, at any level of mortality, changes in fertility cause variations in the rate of natural increase and exert a powerful influence on the age structure (Assefa Hailemariam, 1990; 1991). There are two major difficulties in studying past trends in Ethiopian fertility. The first is the lack of detailed data describing fertility and its determinants and the second is the difficulty that the existing demographic data are plagued by reporting errors typical of less developed countries.

Despite these difficulties, data and information from a wide variety of sources pulled together show that fertility has been changing in Ethiopia (Solome & Asseffa, 2009). According to Asseffa & Teller (2005), fertility in Ethiopia appears to have been increasing beginning from late 70s or early 80s until the early 1990s and then it declined moderately. For instance, total fertility rate (TFR) was 5.2 children per woman in 1970, increased to 6.4 in 1990 and to 6.7 in 1994 (Assefa & Teller, 2005). It then declined to 5.5 in 2000 and further declined to 5.4 in 2005.

2.3.2.2 Mortality

According to Solome & Asseffa (2009), mortality is one of the components of population change. It is a general term for the incidence of deaths in a population. In the absence of civil

registration system, data for mortality estimates are obtained from censuses and sample surveys in Ethiopia. Mortality measures such as infant mortality rate and life expectancy at birth reveal a pattern of mortality decline in the recent years. Infant mortality rate declined from 116 deaths per 1,000 live births in 1994 to 97 in 2000. It further declined to 77 in 2005.

2.3.2.3 Migration

According to Solome & Asseffa (2009), migration is the incidence of population movements between countries (i.e., international migration) and within the same country (i.e., internal migration). It involves a change of usual place of residence between clearly defined geographic units. The common forms of internal migration are rural-urban, rural-rural, urban-rural and urban-urban. Adequate data are lacking to examine the levels and trends in migration. However, there is sufficient evidence that both temporary and permanent internal movements of people have been a common feature of the Ethiopian society. In the 1960s and early 1970s, for example, partly because of the feudal type of landholding system and low productivity of peasant agriculture, and partly because of the expansion of mechanized farms, tens of thousands of persons migrated to the urban centers and to the cotton and sugar plantations in the Rift Valley to work as seasonal and permanent farm laborers.

A substantial number of peasants and pastoral nomads lost their traditional farming and grazing areas when these lands were taken over by the emerging commercial farmers and many migrated to coffee growing areas to work as coffee pickers or labourers in the expanding large farms (Assefa, 1994). In addition to rural-rural migration, significant rural-urban migration also existed in pre-1974 Ethiopia. For instance, it was reported that in the 1970s, rural-urban migration accounted for half of the growth of urban population in Ethiopia (Solome & Asseffa, 2009) cited in Hailu (1982). Although the Military Government imposed restrictions on population movements immediately after the 1975, Land Reform Proclamation, some forms of population movement continued throughout the period.

The land reform itself pushed a large number of land-owning families and individuals to urban areas by dispossessing them of their land. Local movement of people also continued because of the unpopular and coercive villagization and resettlement programs of the Military Government in addition to the more extensive movement of drought and war victims. There had also been international migration of small magnitude but with the coming to power of the Military Regime

in 1974, it tremendously increased. Due to drought, famine and war, population movements across international borders increased substantially. Large numbers of Ethiopians migrated to the bordering countries of Djibouti, Kenya, Somalia and the Sudan as refugees.

Many of these returned soon after the Transitional Government was formed in 1991. A number of highly trained Ethiopians also flew to countries in Europe, the United States and Canada, among others. In fact, Ethiopia sustained a tremendous loss in trained manpower during the last three decades. Much of the developed world has tailored its immigration policies to accept the educated or those with skills. This institutionalized brain drains poses further and long-term difficulties for the developing world in terms of maintaining social capital and its ability to generate retain and utilize the highly educated members of its populations, which will be necessary to solve impending problems.

There are few countries today as severely affected by the brain drain as Ethiopia did. It is worth pointing out that citizens from neighboring countries, particularly from Somalia and the Sudan, have also been moving into Ethiopia on account of political instability in their own countries (Solome & Asseffa, 2009), cited in Assefa(1994). The migration statistics reported in the 1984 and 1994 censuses stated that out of the total population enumerated by the two censuses, 16.4% and 14.1%, respectively, were reported to be migrants (PHCC, 1991; 1999). In both censuses migrants are those who, in the course of their lives, have lived elsewhere other than the area of enumeration while non-migrants are those who have resided in the area of enumeration continuously since birth.

2.4. Major Negative Effects of Population Pressure

Population can be a limiting factor to economic development because of the following reasons:

1. Land Degradation: according to(Khatun, 2017) India is an agricultural country. In the study area agriculture is the main occupation of most people. It is clear that most of the land is used for cultivation.

Day by day population increased and at the same time increased demand for food. Cultivation is also increased with growing population but not balanced with growing population. That's why people are busy to three or four times ploughing in a field in the form of crop rotation.

It is one kind of pressure on land. People are also busy to use insecticide and pesticide for increasing cultivated production. Most of farmer of India are uneducated or not so much knowledge about cultivation in comparison with other countries. So, they are not maintaining crop rotation method properly. That's the other cause for land degradation.

2. Soil erosion: It is the problem that related with land degradation. It is the direct impacts of agricultural development on the environment arise from farming activities, which contribute to soil erosion, land salination and loss of nutrients. Using high number of pesticides, insecticides and fertilizers for fulfillment of demanding food or food security are an important factor for soil erosion. Flood causes major soil degradation. Soil lost its nutrients material. Gullies and ravines are the factors of soil degradation. Floods occur every year in the river Ganga of the study area. Brick field industry is also effects on soil erosion in the study area. Devegetation is another important factor of soil erosion of the area. Constructional purpose like rail, roads also effects on environment through soil erosion.

3. Water Scarcity and Water Pollution: Safe drinking water and proper sanitation is the basic need of community people. But in the study area availability of safe drinking water in many house-holds is non-existent. Arsenic, iron and Fluoride are the main water pollutant of the study area. Eutrophication is common problem due to land-locked pond with settlements. Medical wastes and urban wastes both are playing important role in water pollution. Most of the blocks of that area are Arsenic affected due to continuous and unplanned use of groundwater. Some blocks are highly affected. Most of the people are used non-treated water. It causes many diseases like diarrhea, Blackfoot, trachoma, hepatitis and fluorosis. Poor sanitation management system is also responsible for these diseases. (Khatun, 2017)

4. It reduces per Capita Availability of Capital: The large size of population also reduces per capita availability of capital in less developed countries. This is true in respect of underdeveloped countries where capital is scarce and its supply is inelastic. A rapidly growing population leads to a progressive decline in the availability of capital per worker. This further leads to lower productivity and diminishing returns.

5. Adverse Effect on per Capital Income: Rapid growth of population directly effects per capita income in an economy. Up to 'income optimizing level', the growth of population

increases per capita income but beyond that it necessarily lowers the same. In a sense, so long as the rate of population growth is lower than the per capita income, rate of economic growth will rise but if population growth exceeds the rate of economic growth, usually found in the case of less developed countries, per capita income must fall.

6. Vegetation Cover/ Deforestation: In that area vegetation cover is very poor and gradually it's getting lost its density because for agricultural demand, housing, food for animal and constructional purposes and little bit industry also. As a result, increase CO2 on the Earth (reason of temperature growth), soil erosion and some wild habitats are critically endangered and caused flood.

7. Large Population creates the Problem of Unemployment: A fast growth in population means a large number of persons coming to the labour market for whom it may not be possible to provide employment. In fact, in underdeveloped countries, the number of job seekers is expanding so fast that despite all efforts towards planned development, it has not been possible to provide employment to all. Unemployment, underemployment and disguised employment are common features in these countries. The rapidly rising population makes it almost impossible for economically backward countries to solve their problem of unemployment.

8. Habitat destruction Bio-diversity is an important thing in earth's biological component. Biodiversity has direct consumptive value in food, agriculture, medicine etc. The greatest threat to biodiversity is not destruction of plants and animals but rather the destruction of their habitat. Rapid population growth is the factor for biodiversity destruction. Population growth leads to expanding human settlements and increasing demand for food, clothes, and fuel and building materials. Agricultural modernization also threatens biodiversity habitat. The habitats are threatened due to various developmental programs like- reservoirs, forest cleaning, mining and transport network.(Khatun, 2017)

9. Rapid Population Growth creates Food Problem: Increased population means more mouths to feed which, in turn, creates pressure upon available stock of food. This is the reason; the under-developed countries with rapid growing population are generally faced with a problem of food shortage. Despite all their efforts for raising agricultural production, they are not able to feed their growing population. Food scarcity effects economic development in two respects.

Firstly, inadequate supply of food leads to undernourishment of the people which lowers their productivity. It further reduces the production capacity of the workers, Secondly, the deficiency of food compels to import food grains which places as unnecessarily strain on their foreign exchange resource

10. Population and Farming:

In less developed countries the majority of population lives in, where agriculture is their mainstay. The growth of population is relatively very high in rural areas and it has disturbed the land man ratio. Further it has increased the problem of disguised unemployment and reduced per capita farm product in such economies, as the number of landless workers has largely increased followed by low rate of their wages. The low farm productivity has reduced the propensity to save and invest. As a result, these economies suffer largely for want of improved farm techniques and ultimately become the victim of the vicious circle of poverty. Thus, retarded farming and the process of overall development.

11. Population and Vicious Circle in Poverty: Rapid growth of population is largely responsible for the perpetuation of vicious circle of poverty in underdeveloped countries. On account of rapid growth of population people are required to spend a major part of their income on bringing up their children. Thus, savings and rate of capital formation remain low, reduction in per capita income, rise in general price level leading to sharp rise in cost of living. No improvement in agricultural and industrial technology, shortage of essential commodities, low standard of living, mass unemployment etc. As a result, the entire economy of an underdeveloped country is surrounded by the vicious circle of poverty.

12. Air Pollution: Air pollution also affects environmental degradation. Rapid population growth is responsible for air pollution. Major sources of air pollution of the study area are-

- Methane- emission from cattle and other animals and wetlands.
- Gases like CO2 – from kitchen and domestic heating burning charcoal
- Most of the people burn wood, twigs, leaf litters, cow dung cakes, coal and kerosene oil in the kitchens for cook food (emission CO, CO2, SO2)

- Domestic kitchens Air pollution impacts on plants and animals. Human being and plants are suffering due to air pollution. Human being faces some major chronic due to air pollution.

13. Pressure on Land/ Population Density: according to(Khatun, 2017) For human's population density is the number of people living per unit of an area (sq. mile/ sq.km); then number of people relative to the space occupied by them. Population density indicates how much pressure on land. In terms of population density per sq.km the district rank is fifth after Howrah, Kolkata, North 24th Parganas and Hooghly. Population density of the study area and the rugged train of the topographical of the area playing its role on the land holding size of house hold of the study area .

14. Adverse Effect on Environment: Rapid population growth leads to the environmental change. Rapid population growth has swelled the ranks of unemployed men and women at an alarming rate. Due to this, a large number of people are being pushed in ecologically sensitive areas such as hill sides and tropical forests. It leads to the cutting of forests for cultivation leading to several environmental changes. Besides all this, the increasing population growth leads to the migration of large number to urban areas with industrialization. This results in polluted air, water, noise and population in big cities and towns.

15. Obstacle to Self-Reliance: The excessive population growth is an obstacle in the way of attaining self or reliance because it obliges us to importance and more food articles in order to meet the needs of increasing millions and on the other hand, it cuts down export surplus heavily. Reduction in exports makes us unable to pay for imports and we have to depend on foreign aid. Thus, the aim of self-reliance cannot be achieved without controlling the population.

16. Declining trend of Agricultural Development: In less developed countries, mostly people live in rural areas and their main occupation is agriculture and if the population increases the land-man ratio disturbed. Per capita availability of land for cultivation declined from 1.1 acre in 1911 to 0.6 acre in 1971 in our country which makes the size of holdings very small. The small size of holdings makes adoption of modern technology means of irrigation and mechanization impossible. This also leads to the occurrence of disguised unemployment and underemployment in the agricultural sector. It leads to congestion and moreover to reduction in land available for

farming as well as for building houses, factories, hospitals, shopping centers, educational institutions, roads and railway tracks etc. Thus, the growth of population retards agricultural development and creates many other problems.

17. Growing Population lowers Standard of Living: The standard of living is determined by their per capita income. The factors affecting per capita income in relation to population growth equally apply to the standard of living. The increase in population leads to an increased demand for food products, clothes, houses etc., but their supply cannot be increased due to the lack of cooperate factors like raw materials, skilled labour and capital etc.(Wuletaw, 2018). The cost and prices rise which raise the cost of living of the masses. This brings the standard of living low. Poverty breeds large number of children which increases poverty further and vicious circle of poverty. Thus, the consequence of population growth is to lower the standard of living.

Solid Waste Pollution: Solid wastes are those materials which become useless and treat as garbage. These are new papers, waste water treatment plant, water supply treatment plant, and air pollution control facility, Pathological wastes, Eutrophication, different types of cans, bottles, broken glass, plastic containers, polythene bags, ashes and domestic garbage. Solid waste pollution caused to overpopulation. As the number of populations producing a pollutant increase, pollution will naturally increase. It is applicable same thing in solid waste pollution. Lack of proper proposal of that kind of wastes caused environmental degradation.

18. Climatic Change Due to Global Warming: Recent the most significant problem of the world is global warming which is related to global environmental change (GEC). Due to global warming climate is changed. Anthropogenic factors are mainly responsible for global warming. Causes of global warming are-

- Changing air chemistry through air pollution
- Ozone depletion
- Emission of Greenhouse gases
- Urbanization
- Growing use of fossil fuels
- Changing land use pattern

Above all the phenomena increased temperature of the earth and changed climatic condition through regional to global levels which would affects the hydrological cycle, biospheric ecosystem and food chains. Rapid growth of population effects on it massively. Climate change would cause changes in precipitation pattern, water availability, soil moisture and sea level rise. These would make an impact on agriculture, forestry, wetlands and fisheries. (Khatun, 2017).

19. Pressure on Land/ Population Density: According to. (Khatun, 2017)For human's population density is the number of people living per unit of an area (sq. mile/ sq.km); then number of people relative to the space occupied by them. Population density indicates how much pressure on land. In terms of population density per sq.km the district rank is fifth after Howrah, Kolkata, North 24th Parganas and Hooghly. So, in population density Degem woreda is so scattered relatively when we compared to nearby woredas in case of the total cultivated and settled area in related to total population but the study area is so difficulty for all aspects it is plateau.

2.5. Trends and Components of Population Dynamics

2.5.1. Pattern of Ethiopian population growth

According to Kassahun (2014), Ethiopia is endowed with a large and fast growing population and is globally acknowledged and included among the largest countries in the world (EEA, 1999/2000, p. 53). According to the 2010 revision of the UN's World Population Prospects, Ethiopia's total population was 82.95 million in 2010, compared to 18.43 million in 1950. It is believed that the projected population of 169 million for 2050 will make the country the 9th most populous nation in the world and the 2nd in Africa following Nigeria. Although there were several guesses before the 1984 population census, that year was the first in its kind in Ethiopia and bringing to an end the guesses and serving as basis to estimate different projections. The 1984 population census data shows that the total population was 40.2 million, out of which 20.3 million (51.4%) were males and 19.9 million (49.6%) females.

The second census of the country was carried out in 1994 and the total population reached 53.5 million, out of which 26.9 million (51.3%) were males and 26.6 million (49.7%) females. Accordingly, the data showed that 13.4 million people were added for the country within ten years. The third census was carried out in 2007. According to the PHCC's population and

housing census report in December 1, 2008, Ethiopian population was recorded about 73.85 million, out of which 37.3 million (50.5%) were males while 36.6 million (49.5%) were females. The census showed that 20.4 million people were added from the 1994 census and 33.7 million from the 1984 census (CSA, 1984, 1994 & 2007). These three censuses also revealed that Ethiopian population was mostly rural based as overwhelming majority about 35.6 million (88.6%) of the population resided in rural area while that of only about 4.5 million (11.4%) were urban in 1984. Similarly, out of 53.5 million about 46.2 million (86.4%) were rural based while that of about 7.3 million (13.6%) were urban residents in 1994.

The same is true for 2007 census. Of 73.9 million population, about 62 million (83.9%) were rural people while that of 12 million (16.1%) were urban inhabitants. Although the size of population increased about 62 million in 2007 from 35.6 million in 1984 and 46.23 million in 1994 in rural area, the percentage was decreasing 83.5% in 2007 from 88.6 in 1984 and 86.3 in 1994. The proportion of the urban population was increasing in the respective years. The reason is that people migrate from rural to urban areas due to push and pull factors in the respective areas. According to Hassne referring World Bank data (2010) depicted that with a total population of around 22.6 million in 1960, Ethiopia experienced a population blast that resulted in more than 82.8 million people by 2009. Indeed, the population size doubled between 1985 and 2009, signifying a doubling time of about 24 years.

According to United Nations prediction (UN, 2011a), a total population ranging from 98.768 million (under the low-fertility scenario) to 108.059 million (under the constant-fertility scenario) will inhabit Ethiopia by the year 2020. Only under the hope of medium or low fertility is the population of Ethiopia projected to have a turning point before the year 2100 (after reaching 157.908 million in 2075 and 126.514 million in 2056 under the medium and low fertility scenarios, respectively). Though the total population size was increasing over time (and is likely to do so for some decades to come), it seemed that the rate at which population size rises has currently stabilized at about 2.6% per annum (UN, 2011a).

Similarly, in the current study area, the population growth trend is more or less analogues to what has been indicated in the country pattern. As a result, the following Table depicts the population growth pattern of Degem woreda, North Showa Zone from 2000 to 2021.

Table 2.1. Summary of population growth pattern and trends of Degem woreda from 2000-2021

year	Population sex ratio		Total population	Population Growth rate
2000	Male	45599	93104	-
	Female	47500		
2001	Male	46155	94269	1165 individuals
	Female	48114		
2002	Male	46725	95476	1207
	Female	48752		
2003	Male	47315	96714	1238
	Female	49399		
2004	Male	47898	97939	1225
	Female	50041		
2005	Male	48468	99129	1190
	Female	50666		
2006	Male	49023	100315	1186
	Female	51292		
2007	Male	49597	101516	1201
	Female	51919		
2008	Male	50157	102698	1181
	Female	52541		
2009	Male	50711	103872	1174
	Female	53161		
2010	Male	51269	105051	1179
	Female	53782		
2011	Male	51844	106273	1222
	Female	54429		
2012	Male	52411	107478	1205
	Female	55067		
2013	Male	52949	108620	1142
	Female	55671		
2014	Male	53496	109785	1165
	Female	56289		
2015	Male	54021	110909	1124
	Female	56880		
2016	Male	54452	111848	939
	Female	57396		
2017	Male	54849	112715	867
	Female	57866		
2018	Male	55180	113452	737
	Female	58272		
2019	Male	55434	114040	588
	Female	58606		
2020	Male	55626	114505	465
	Female	58879		
2021	Male	55760	114859	354
	Female	59249		

Source: https://www2.census.gov/programs-surveys/international-programs/tables/time-series/pepfar/ethiopia.xlsx

From the Table, we can conclude that the population growth pattern and trends of Degem woreda from 2000 to 2021 has demonstrated there is a normal pattern of growth in number of populations even though this number of populations require additional natural resources to survive. This means that such arithmetic progression of population growth has an adverse impact on the natural resources; this in turn has great impact on population pressure and create imbalance between population and environment.

To calculate population growth rate

$$Gr = N/T \text{ ,where as}$$

N=change in population (numbers of individuals)

T= time

$$N = \frac{P2 - P1}{t}$$

P2=final population

P1=intial population

$$Gr = \frac{p2-p1}{t}$$

2.6 Demographic Components

According to the Royal Commission of Environmental Pollution, (2011) changes in population size are a consequence of two distinct sets of factors – the relationship between the birth and death rates of the currently resident population (sometimes called natural change) and the balance between inward and outward international migration. Population projections are calculated by making assumptions about three measures: the number of births (related to the fertility rate), the number of deaths (related to life expectancy) and net migration (the difference between migration into and out of the country). Predicting future population numbers is, therefore, very challenging – all population projections require assumptions to be made and are subject to uncertainties, and the further into the future they go the more uncertain the numbers become.

2.7 Population Policy

Ethiopian government promulgated its first ever explicit, comprehensive and multi sectoral population policy in 1993. The policy aimed at harmonizing population growth rate with that of

the economy and the capacity of the country for sustainable socio-economic development. As with any population policy, there are important lessons to be learnt from the problems and challenges encountered during its implementation (Woldetsadik, 2003)

Legislative measures were also taken to remove harmful traditional practices. However, the pace of implementation has been slow and there are areas where not much progress was made. Conclusion: Despite the progress made, there are critical challenges. Failure to establish the National Population Council; weak coordination and institutional arrangement due to absence of legally defined structure for implementation, lack of monitoring and evaluation system, absence of a comprehensive population program and financial constraints, among others are the major barriers. There is need to revise the policy and address these impediments and continuing and evolving challenges (Muluneh, 2003)

To reduce the fertility to the expected level, Ethiopia has been providing family planning services by considering a significant contribution of family planning in reduction of fertility. The Ethiopian population policy also enforced that the minimum age at marriage should be 18 years and emphasized this change as one of the key factors in lowering fertility. Despite these efforts, uninhibited fertility has been persisting in Ethiopia and adversely influencing the socioeconomic, demographic and environmental development of the country (Tegegne, 2014).

2.8 Empirical Evidences from Ethiopian Perspectives

According to Fekadu as cited in (Markos 1997; Abiy, 2002) indicated that in developing countries like Ethiopia land degradation is one of the greatest threats which strike at the basic resource of the population. The degradation process is so acute in Ethiopia that millions of people have fallen in to poverty. The situation in Oromia is not different. Accordingly, the major problem regarding land use in Oromia is the rapid growth of population (BOLEP, 2008). This has led to fragmentation of farmlands, decrease in sizes of landholding and productivity, an increasing cultivation of marginal land and critical shortage of grazing land are the most notable one.

Similarly, it also indicated that because of rapid population growth, large forest and crop areas are required to satisfy the needs of the nations. However, with deforestation, little was done to maintain the vegetation cover, and there was no effective a forestation program. To describe the

magnitude of these problem, for instance according to the Global Forest Resource Assessment (GFRA, 2005), between 1990 and 2000, Ethiopia lost an average of 140,900 hectares of forest per year. This amount of an average annual deforestation rates 0.93 percent. Between 2000 and 2005, the rate of forest change increased by 10.4 percent to 1.03 percent per annum. In total, between 1990 and 2005 Ethiopia lost 14 percent of its forest cover or around 2,114,000 hectares (FAO, 2005).

This uncontrolled encroachment and clearing of forest land has been taking place and will continue until management plans are put in place. Measuring the total rate of habitat conversion for the 1990-2005 intervals, Ethiopia lost 3.6 percent of its forest and woodland habitat due to firewood collection, conversion of farmland, over grazing, and use of forest wood for building materials (FAO, 2005). As a result, Ethiopia will face a difficult future due to her dependence on forest resources. Another study by (Aynalem, 2006) regarding land use patterns and environment in Ethiopia also indicated that land productivity is seriously constrained by land degradation in most parts of the country. This, coupled with rapid increases in population numbers and growth rates, brings a rise, rather than a decline, in poverty levels.

The study by Japan International Cooperation Agency (JICA, 1999) also cited the following land use and demographic factors for the country's economic and environmental woes: Population pressures, particularly on the highlands, Conversion of forest land into agriculture, resulting in soil erosion and environmental degradation, and Conversion of crop residues and animal waste into fuel, thus depriving the soil a chance to replenish itself. Different findings (Aynalem, 2006; Markos, 1997; MOFED, 2008) revealed that Ethiopia is the most environmentally devastated country in Africa. According to this study, every year almost 3 billion metric tons of top soils are washed away.

On the other hand, per capita land size has been declining as a result of increasing population as the size of farm households increases; redistribution of the land has continued reducing the pre capital land holding. Currently, according to MOFED (2008), average land size per house hold has fallen to less than 1 hectare in 7 out of the eleven regions or almost 62 percent of the household. This makes a large number of households to be dependent on inadequate and unproductive plots.

Previous studies such as Mulugeta (1992) & Markos (1997) have shown that farmers who belong to different social and economic classes exhibit certain demographic characteristics are more likely to perceive and respond to the impacts of population on the environment .To support this (Abiy, 2002; Hiruy,2008; Lemesa,2009) found that in Ethiopia the major social factors that affect farmers' awareness on the effects of population pressure on the environment were educational levels of people ,participation in social organization are most noted.

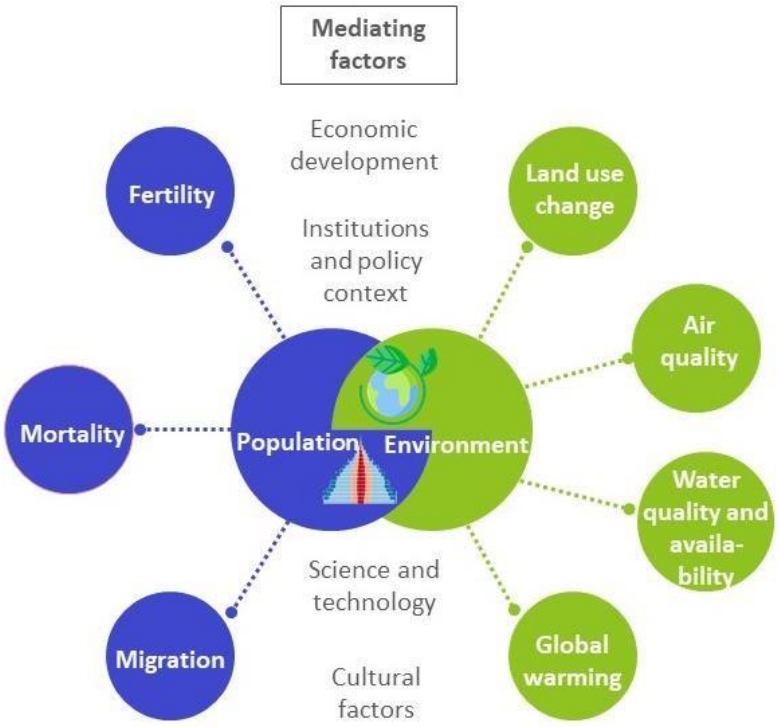


Figure 2.1 Conceptual framework (adapted from Hunter, 2000 p. 4)

CHAPTER THREE

3.1. Study Area Description

Geographically the study area is located in Oromia Regional State of North Shoa Zone, Degem Woreda, which is located at 11º04‘30 -11º05 latitude and 36º52‘-36º54‘longitude. Its capital is Hambiso, one of 16 Woredas town in North Showa Zone. It is located 10km North West of Fiche the capital Town of North Showa zone along the road from Addis Ababa through Gojjam. The borders of the woreda are indicated in Figure 3.1.

According to Central Statistical Agency (CSA), Degema Wereda has cold temperate, and dry climate. The landscape is mostly covered with rain fed croplands. The climate is of the woreda is classified in to three: Dega, Woynadega and Kola. The altitude ranges between 1500-3541 ma.s.l (Lemma, 2011).

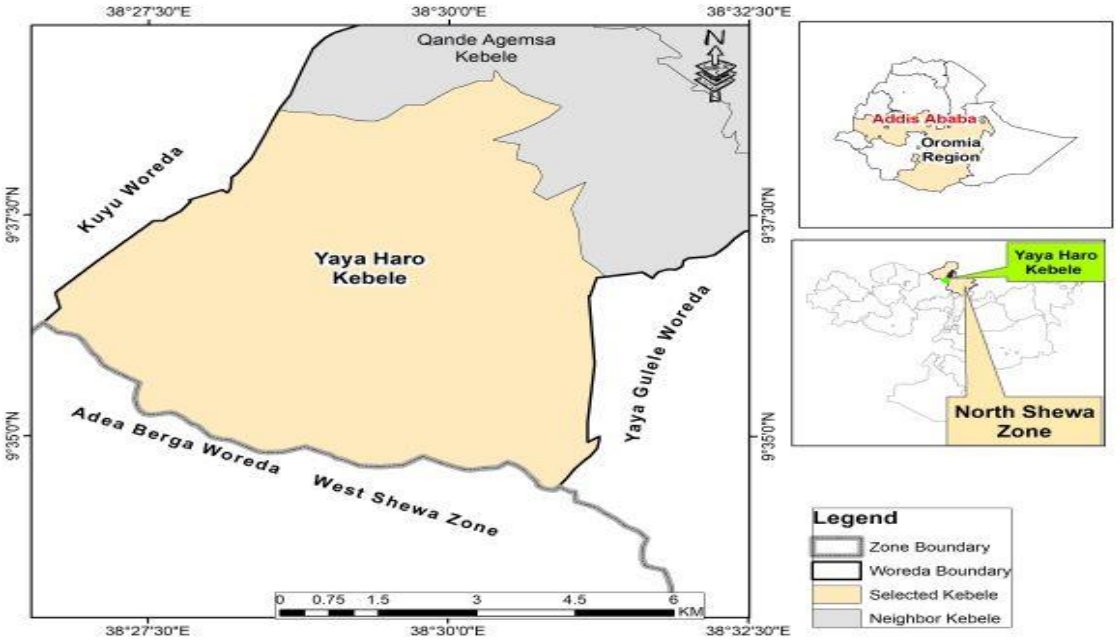


Figure 3.1. Location Map of the Study Area (Degem Woreda and Yaya Horo Kebele)

3.2. Research Design and Methodology

This part deals with the study design, target population, the sources of data, the way of sample selection, instrument development about questionnaire, data collection sources and data processing.

3.2.1 Research Design

A cross sectional and descriptive survey design method was employed to assess the nexus between population growth and the environment in case of Degem woreda in Oromia north Showa zone. The survey design was used because it provides a quantitative description of trends and opinions of a population by studying a sample of that population. The appropriateness of this design for such study was noted by many scholars for example, Koul (1996:405) states that descriptive survey design becomes useful particularly where one needs to understand some particular information. The researcher was used based on both qualitative and quantitative survey design collected through questionnaire and interview. The subject of this study was those who live in rural area of Degem Wereda of north Shoa of Oromia regional state.

3.2.2 Source of Data

In this study, primary and secondary sources were used to gather information to examine the nexus between population pressure and environment in Degem werda Yaya Haro kebele. To obtain reliable and objective information, data needed for this study were collected from various sources. The primary sources were Yaya Haro households and the Woreda DAs. The secondary sources were used to strengthen the primary sources; these include, GIS and remote sensing, books, journals, and articles. The internet was also used to avoid the inadequacies of the data and to make the study reliable.

In order to achieve the objective of the study, both quantitative and qualitative data was gathered from primary sources as well as secondary sources.

3.2.3 Sampling Methods

In order to gather the required information from the study population, Yaya Haro kebele was purposively selected. From this, a total sample of 300 households were randomly chosen from three villages in the kebele. This makes 30% of the study population that enhanced sample efficiency.

3.2.4 Instruments of Data Collection

Instruments of data collection may vary in their complexity, design administration and interpretation. Each tool is appropriate for collection of certain types of evidence or information; hence, using complementary tools is important for triangulation according to (Dejene, 2013) as cited in Cohen & Manion (1996). Questionnaires, interview and observation were used as data gathering instruments. Therefore, employing multiple data collection instruments helps the researcher to combine, strengthen and amend some of the inadequacies of the data and for triangulating it (Cresswell, 2003 p. 62).

3.2.5 Questionnaires

Questionnaires were used to collect relevant and first-hand information from the subjects. The items of the questionnaires were largely close-ended; twenty-five questions accompanied by five open ended questions. The reason why a questionnaire was used was that it is easier to handle and is simpler for the respondents to answer within a short period of time.

The data collection was conducted with letters written from CEDS to Degem Woreda administration and finally to sampled Kebele. All the concerned bodies, were informed about the objectives of the study by the researcher. After all, the researcher distributed the questionnaire and conduct interview. The researcher administers the instruments in such a way that the questionnaire prepared for Household was administered in their respective home. The general purpose of the study was explained by the researcher. In addition, the researcher provided oral instructions to the necessary clarification.

3.2.6. Interview

Structured interview was used to collect data from woreda Development Agents and elders. The reason why structured interview was employed was that the procedure to be used is standardized and determined in advance as well as to obtain answers to carefully phrase questions. An interview was also conducted through disclosing the purpose of the study based on the permission and willingness of the participants by the researcher for kebele DAs and for selected Elders.

3.2.7 Secondary data sources

Secondary sources were used to gather necessary information on the nexus between population pressure and environment in the study area. This was done to strengthen the data obtained through questionnaires and interview. Due to this reason, journals, books, and articles related to population, environment, component of population changes impact population pressure on environment and nexus between population and environment as they are important sources of data to explore the nexus between the two groups. Supporting this, Dejene (2013) cited in Best and Khan (2012) have noted that document analyses are important and relevant sources of data, and useful in yielding information and exploring educational practice. After document analysis, finally, the rapports and interviews were collected, narrated and analyzed by using tables and appropriate statically tools.

3.3. Procedures of Data Collocation

This study was incorporate different stages, at the initial stage; review of literature was made to develop the background and instrument of data collection. Documents, statistical abstracts and reports were assessed to connect relevant information. Then based on the review of literature and the information obtained, through discussion, data collecting instruments were developed and piloted to cheek the appropriateness of data collecting tools.

3.4. Method of Data Analysis

It is common to see that quantitative and qualitative methods can be mixed in the design of a sample. Among these ways, the combination of the methods could begin with a qualitative method (for example a semi-structured interview) which could be followed by a questionnaire as an intermediate step before the results from both steps are deepened and assessed in a second qualitative phase (Grabska,, 2005). Grabska further stated that the different methodological perspectives complement each other in the study of an issue, and this is conceived as the complementary compensation of the weakness and blind spots of each single method. Further he argues that the qualitative and quantitative methods should be viewed as complementary rather than as rival kebeles.

Furthermore, the data collected from open-ended questionnaires and structured interview were analyzed qualitatively through narration following each quantitative analysis for the purpose of

strengthening it. In general, interpretations were made based on the result of the analysis of each table subsequently. The data was analyzed using cross sectional and descriptive method using mean, variance, standard deviations, frequency distributions, ratios and percentages, and the qualitative data were qualitatively analyzed.

3.5. Ethical Consideration

Ethics in research is concerned primarily with the interaction between the researcher and the people involved in the study. The researcher is expected to explicitly consider the needs and concerns of people involve in the study. In light of these, the following ethical issues were taken into account while the research was undertaken.

Here are some specific points to be considering as ethical issues when conducting the research.

- Have grantee the permission of the people before conduct research involving them as voluntary participation
- Confidentiality and anonymity – emphasis to agree not to reveal known the identity of the participant by to anyone.
- Not to do anything that would cause mental and physical harm to the subjects consists in the study.
- Freedom to withdraw for participants form the study at any time without penalty
- Getting institutional board approval when conducting the study to get any data regarding the problem.
- Give great emphasis to the accuracy when reporting the outcomes what are the data which get from different sources.

CHAPTER FOUR

DATA ANALYSIS AND INTERPRETATION

Introduction

This chapter deals with presentation and analysis of the data which have been obtained through questionnaire. As such the study sought to examine the effect of population pressure on environment Oromia Region North Shoa Degem Woreda.

This was the further transformation of the processed data to look for patterns and relationship between and/or among data groups by using descriptive and inferential (statistical) analysis. The SPSS was used to analyse the data obtained from primary sources. Specifically, descriptive statistics (mean, correlation, and standard deviation) and inferential statistics (correlation analysis) was employed in this study

4. Characteristics of respondents

Demographic characteristics of the respondents were analysed by using descriptive statistics. Respondents were given two weeks to complete the questionnaires; 300 questionnaires were disseminated to the sample populations and returned with non-response rate.

4.1. Demographic Background of the Respondents

The demographic profile of the respondents was presented in this section. The personal profile of the respondents was analysed as per their gender, age, levels of educational and years of service in the organization. Descriptive statistics were performed on the demographic variables as a means of describing the respondents.

Table 4.1 Gender of the respondents

Gender		Frequency	Percent (%)
	Male	167	55.7
	Female	133	44.3
	Total	300	100.0

Source: Own Survey, 2021

As far as the composition of gender is concerned, Table 4.1) indicates that in Ejersa Jara sub kebele, the majority of the respondents 167(55.7%) were male, and 133 (44.3 %) were females. For this we can say that the number of males is considerably higher than females in the case area.

Table 4. 2. Households Respondents to Age Category

Age		Frequency	Percent (%)
	31-35	79	26.3
	36-40	48	16.0
	41-45	129	43.0
	51-55	44	14.7
	Total	300	100.0

Source: Own Survey, 2021

With regard to age, the highest number of respondents fall under the age group of 41-45 years, which accounts 129 (43%) of the total sample. 79 (26.3%) respondents are on the age group of 31-35, whereas 48 (16%) respondents are at the age of between 36-40 years. The least number of respondents found on the age group were 51-55 which is 44 (14.7 %). In this regard, it can be observed that more of the population 129 (43%) in this kebele were productive age.

Table 4.3. Educational Status

Educational Status		Frequency	Percent
	Read and write	166	55.3
	highest grade completed	134	44.7
	Total	300	100.0

Source: Own Survey, 2021

Table 4.3 shows the educational profile of surveyed households. The data presented in Table 4.3 therefore reveals that only166 (55.3 %) of the respondents can read and write. Only 134(44.7%) could completed highest grade.

Table 4.4 Respondents' responses on population pressure and shortage of farming land

No.	Items		Responses		Total
			Yes	No	
1	In your opinion, do you think that there is population pressure and shortage of farming land in your community?	Frequency	270	30	300
		Percent	90.0	10.0	100.0

Source: Own Survey, 2021

The above table shows that 270(90%) responses yes and 30(10%) responses No. These show that there were high population growth and shortage of farm land because of population pressure

If yes for Q above. # how do you respond to this problem of population pressure?				
	Educating young women	Reducing early marriage (early child bearing)	Being involved in family planning programs	Total
Frequency	99	113	120	300
Percent	33.0	37.7	40.8	100.0

In the above table respondents' responses to the population pressure are 120(40.8%) responses to question number 1 would be alleviated by being involved in family planning programs. This indicated that the population growth is mainly caused owing to the lack of training on family planning.

Table 4.5 Respondents' responses on Population pressure should be controlled to alleviate environmental degradation?

3	Is Population pressure should be controlled to alleviate environmental degradation?		Yes	No	Total
		Frequency	285	15	300
		Percent	95.0	5.0	100.0

In the above table 4.5 the respondents 285(95%) responses **Yes** and15 (5%) responded **No** this show that the population pressure should controlled to alleviate environmental degradation.

No.	Items		Responses		Total
			Yes	No	
1	Do you believe population pressure affect the productivity of agricultural land in your kebele administration?	Frequency	280	20	300
		Percent	93.3	6.7	100.0

Source: Own Survey, 2021

In the above table 280(93.3%) of the respondents' responses **Yes** 20(6.7%) of the respondents responded **No.** This show that the population pressure affects the productivity of agricultural land in the Kebele

Table 4.6 Respondents' responses on agricultural land degradation

	Decline in soil fertility	Reduction in crop yields	Drought/famine	Total
Frequency	100	135	65	300
Percent	33.3	45.0	21.7	100.0

Source: Own Survey, 2021

The above table show that the respondents 135(45) responded reduction in crop yield, 100(33.3) responded decline in soil fertility and 65(21.7%) of the respondents responded to drought/famine. These show that the population pressure would reduce crop yields.

Table 4.7 Respondents' responses on cultivable land

Items		**Responses**		**Total**
		Yes	**No**	
Do you own cultivable land?	Frequency	300	0	300
	Percent	100.0	0.0	100.0

Source: Own Survey, computed in SPSS, 2021

The above table (4.7) responses 300 (100%) of the respondents' responses, the populations had their own cultivable land but, the following table responded how the land were held. The table shows that 124 (41.3%) inherited, 136 (45.3%) rented for crop sharing, 40(13.3%) during redistribution this show that few farmers were got land during redistribution of the land which accounts 40(13.3) and 136(45.3) of the farmers rented the land for crop sharing this also show that the total population affects the land degradation on Yaya Haro village.

2	If yes for Q# 1, how do you obtain it?				
		Inherited	Rented for crop sharing	During re distribution	Total
	Frequency	124	136	40	300
	Percent	41.3	45.3	13.3	100.0
3					
		Cultivable land	Grazing land	Forested areas	Total
	Frequency	134	150	16	300
	Percent	44.7	50.0	5.3	100.0

Source: Own Survey, 2021

The above table (4.8) indicated that 136(45.3) of house hold are rented for crop sharing, and 124(41.3) inherited and 40(13.3) were got during distribution, this show that most of respondent are depending on rented for crop sharing, on another hand 134(44.7) Cultivable land, 150(50%) Grazing land and 16(5.3) Forested areas. The above show that the farmers used their lands for grazing

Table 4.8 Respondents' responses on shortage of farm land

Items		**Responses**		**Total**
		Yes	**No**	
Do you think there is shortage of farmland in you kebele administration presently as compared to 30 years ago and above?	Frequency	267	33	300
	Percent	89.0	11.0	100.0

Source: Own Survey, 2021

The respondents responds that 267(89%) response Yes,33(11%) of the responds No. This show that 89% of the farmers have shortage of farm land in their kebele presently as compared to 30 years ago. This show that as numbers of population increase there is the scarcity of farming land in areas under study.

2	If yes for Q# 4 what factors are responsible for this shortage of farm land?				
		Population growth	In-migration to the area	Expansion of urban settlements	Total
	Frequency	170	36	94	300
	Percent	56.7	12.0	31.3	100.0

Source: Own Survey, 2021

The above tables show that the factors that were responsible for the shortage of farm lands 170(56.7%) were population growth.

Table 4.9 Respondents' responses on shortage of farm land

Items		**Responses**		**Total**
		Yes	**No**	
Do you think there is shortage of farmland in you kebele administration presently as compared to 30 years ago and above?	Frequency	267	33	300
	Percent	89.0	11.0	100.0

Source: Own Survey, 2021

The above table (4.9) show that the problem of farmland related to shortage limiting family size 128(42.7%), introducing incentive farming techniques 128(42.3%), migrating to other area 45(15%) but here limiting family size were solving the problem of shortage in farm land.

Table 4.10 Respondents' responses on the shortage of grazing land

Items		**Responses**		**Total**
		Yes	**No**	
Do you think the community has a shortage of grazing land?	Frequency	291	9	300
	Percent	97.0	3.0	100.0

Source: Own Survey, 2021

The above table (4.10) show that 291(97%) of the responses responded that there was shortage of grazing land in Yaya Haro kebele.

Table 4.11 Respondents' responses on mitigating the problem of farm land

If yes, what do you think should be undertaken to mitigate this problem?				
	Reduce farmlands to allow grazing lands,	Abandon reforestation areas,	Introduce selected productive cows to reduce livestock population pressure,	Total
Frequency	99	121	80	300
Percent	33.0	40.3	26.7	100.0

Source: Own Survey, computed in SPSS, 2021

The above table (4.11) responses for table (4.10) that to mitigate the shortage of farmland the community should abandon reforestation areas which 121(40.3%) responses

Table 4.12 Respondents' responses on the land needs of households

As compared to the land needs of your household requirements, how do you see your present landholding?		It is more than enough	It is just enough	It is insufficient	Total
	Frequency	102	66	132	300
	Percent	33.9	21.9	43.9	99.7
. If insufficient what size of land would be enough for your household? (1 hectare = 4 timad)		1 to 2 timad (0.25 hect. to 0.5 hect.)	3 to 4 timad (0.75 to 1 hect.)	More than 4 timad (> 1 hect.)	Mean
	Frequency	102	99	97	2.04
	Percent	33.9	32.9	32.2	

Source: Own Survey, 2021

Table 2.12 showed that the present land holding of the house holds 132(43.9%) responses the land was insufficient and the insufficient of the land 99(32.9) holds 3 to 4 timad (0.75 to 1 hect) this show that the land the community have been holding were insufficient. 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.

Table 4.13 Respondents' responses regarding productivity of farm land

3	At present time, do you think that the productivity of your farm land has decreased?		**Responses**		**Total**
			Yes	**No**	
		Frequency	214	86	300
		Percent	71.0	29.0	100.0
4					
		Frequency	Percent		
	1. Land degradation due to population pressure	199	66.3		
	No use of fallowing,	101	33.7		
	Total	300	100.0		

Source: Own Survey, 2021

The above Table (4.13) show that the productivity of the farm land 214(71%) were decreased. And 71(29) said increased .and 199(66.3) said that he main factors responsible for declining in the productivity of the farm land were land degradation due to population pressure and 101(33.7) were responded that it is because of no use of fallowing. From this what we conclude that there is a population pressure which determined the agricultural yield production.

Table 4.14 Respondents' responses on maintaining the fertility of soil

How do you maintain the fertility of the soil in your locality's farmland at most?		**Frequency**	**Percent**
Valid	Fallowing	47	15.7
	Crop rotation	77	25.7
	Contour ploughing -	49	16.3
	Use of modern (chemical) fertilizers	127	42.3
	Total	300	100.0

Source: Own Survey, 2021

The above table (4.14) show that the community has been maintain the soil for farm lands 77(25.7%), 49 (16.3%) contour ploughing and 127(42.3%) but here 127(42.3%) of the community used modern(chemical) fertilizers to maintain the fertility of the soil in their locality farmlands.

Table 4.15 Respondents' responses regarding the disadvantage of deforestation

In your opinion, what are the disadvantages of deforestation prevailed in your area?		**Frequency**	**Percent**
Valid	Drought	99	33.0
	Soil erosion	105	35.0
	Shortage of fire wood	59	19.7
	Loss of biodiversity	37	12.3
	Total	300	100.0

Source: Own Survey, 2021

The community responses for the disadvantages of deforestation prevailed 99(33%) drought, 105(35%) soil erosion, 59(19.7%) fire wood and 37(12.3%) loss of biodiversity. This indicated that 105(35%) of the deforestation prevail due to soil erosion.

Table 4.16 Respondents' responses regarding problems of deforestation

If deforestation is considered the main problem in your community, what are the factors for this problem at most?		**Frequency**	**Percent**
Valid	Due to population pressure that leads to new areas of settlements and agricultural activities.	90	30.0
	Cutting trees for different purposes	31	10.3
	Lack of environmental education and awareness	143	47.7
	Due to poverty	36	12.0
	Total	300	100.0

Source: Own Survey, 2021

In the above table 90(30%) due to population pressure that leads to new areas of settlements and agricultural activities, 31(10.3%) cutting trees for different purposes,143(47.3%) lack of environmental education and awareness and 36(12%) lack of poverty. This show that the main problems of deforestation were 143(47.3%) lack of environmental education and awareness, and the problem of environmental policies that we are follow the to control our environment from human activities.

4.2 Land use land cover change at Yaya Haro kebele (results from GIS and remote sensing, from 1986-2021)

- Geo-eye (2019) Very Resolution Imagery from Google Earth Pro (1m resolution) for accuracy assessment
- Landsat TM (2000) medium resolution (30 m resolution) and panchromatic (grey scale 15m) for classification of LULC 1986
- Landsat 7 ETM + (2000) medium resolution - blue, green, red and near infrared (30 m resolution) and panchromatic (grey scale 15m) for classification of LULC 2000
- Sentinel – 2A medium resolution - blue, green, red and near infrared (10 m resolution for classification of LULC 2021.

4.4.1. Generation of Land use/Land cover map

- Lu/Lc classes: Water body- River with significant width, Forest (includes trees mixed with shrubs found on hillsides), plantation (bunch of trees mixed shrubs and found on agricultural farms), grassland (includes areas covered with grass and short shrubs), bare land (areas with no vegetation, degraded or quarries, or road segments), cropland (mosaic of small holder farms dominantly).
- Visual Interpretation and supervised classification were applied to classify the images into Lu/Lc classes listed above using Arc GIS ver 17.1)
- Excel was used to generate summary tables, graphs etc.

4.4.2 Classification Accuracy Assessment

Accuracy assessment is an important part of any classification project. It compares the classified image to another data source that is considered to be accurate or ground truth data. Ground truth can be collected in the field; however, this is time consuming and expensive. Ground truth data can also be resulting from interpreting high-resolution imagery, existing classified imagery, or GIS data layers. Producer accuracy and user accuracy are calculated in the following table.

Table 4.17 Accuracy Assessment for the 2021 Lu/Lc Classification in Yaya Haro Kebele

		Land use/Land cover (Field Observed)						User Accuracy	
		Water body	Forest land	Plantation	Grassland	Bare land	Crop land		
		No.	No.	No.	No.	No.	No.	No.	%
Land use/Land cover (office interpreted)	Water body	8	1	0	0	0	0	9	88.9
	Forest land	1	12	1	0	0	0	14	85.7
	Plantation	0	1	10	1	0	1	13	76.9
	Grassland	0	1	1	18	0	0	20	90.0
	Bare land	0	0	1	0	15	1	17	88.2
	Cropland	0	0	1	0	2	16	19	10.5
Producer Accuracy		9	15	14	19	17	18	92	85.9

Source: Own Survey, 2021

Overall accuracy = **85.87**

Kappa Index = 0.829

- Kappa Index > 0.80 Strong accuracy (degree of agreement)
- 0.40 > Kappa Index > 0.80 Moderate accuracy (degree of agreement)
- Kappa Index < 0.40 Weak accuracy (degree of agreement)

Very high-resolution imagery and some GPS points (collected in the field from each lu/lc classes) were used to assess the accuracy the classification based on Kappa Index of agreement and confusion

User accuracy = total number of correct classification/row total*100

Producer accuracy = total number of correct classification /column total*100

Over all Accuracy= Sum of the diagonal *100 = 85.87

The value of Kappa coefficient is calculated as:

$p_o = p_{11} + p_{22}$, sum of diagonal results

$p_e = p_{.1}p_{1.} + p_{.2}p_{2.}$, multiplying each total observed field with office interpreted result and sum of the total multiplied result.

So,

$$\kappa = \frac{p_o - p_e}{1 - p_e}$$

Therefore, from the above calculation, accuracy assessment of the year 2021 shows that the overall accuracy is very strong i.e., 82% which is greater than requirement for strongly acceptable classification. The user and producer accuracy assessment were also calculated for

each class and it shows acceptable agreement. The Kappa coefficient is also calculated to be 0.85.8which is greater than 0.8 and represent strong agreement.

In general, in Yaya Haro kebele, there is a population effect on the environment in several ways, destroying the natural resources to fill fil their own needs. The forest land/plantation of the area was decreased while crop land and grass land increased, this leads to deforestation and soil degradation.

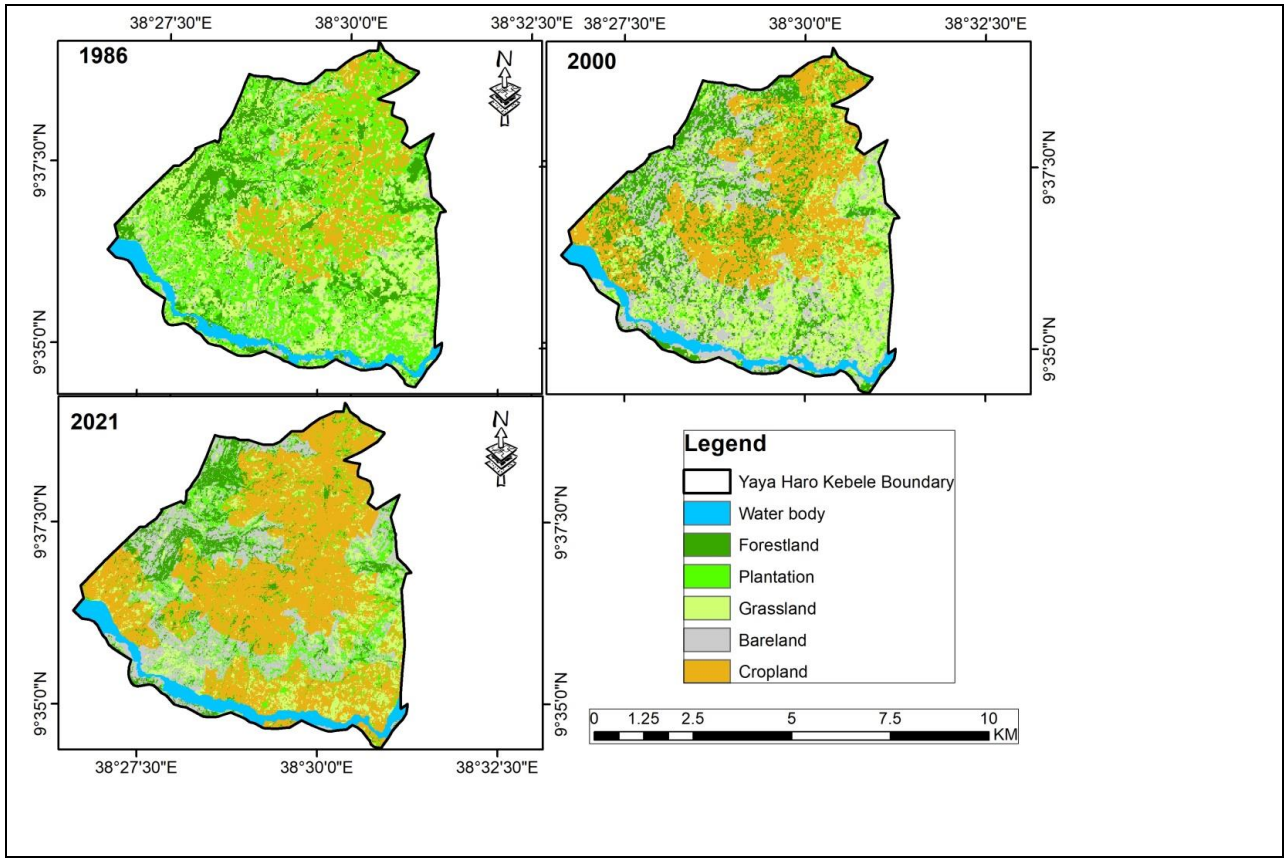


***Figure 4: Lu/Lc Map of* Yaya Haro Kebele, Degem Woreda, North Shewa in 1986 - 2021.**

Source: Own survey data (2021)

The above map shows forest/plantation was the largest coverage of the area. The bare land and crop land were constituting small coverage area, and grass land was covered by little area. At this period there is no area covered by forest/plantation and as early as the 1986 land sat image. In 2000, crop land and bare land area have increased due to several reasons. For instance, deforestation, shifting cultivation fallowing etc. From the map above, most of the land of area

was covered by cropland and bare land site area in 2021. This is because of many reasons including high rate of population growth, and demand of farming land also increased.

Table 4. 18 Percentages of Land use/Land cover in Yaya Haro Kebele during the period 1986 – 2021

Lu/Lc type	1986		2000		2021		Change 1986-2000		Change 2000 – 2021		Change 1986 – 2021	
	Ha.	%	Ha.	%	Ha.	%	Ha.	%	Ha.	%	Ha.	%
Waterbody	206	4.4	206	4.4	249	5.3	-0.2	-0.1	43.5	21.1	43.3	21.0
Forestland	729	15.5	839	17.8	436	9.2	110.3	15.1	-403.8	-48.1	-293.6	-40.3
Plantation	1518	32.2	402	8.5	565	12.0	-1116.8	-73.5	163.8	40.8	-953.0	-62.8
Grassland	1230	26.1	1192	25.3	480	10.2	-38.3	-3.1	-711.9	-59.7	-750.2	-61.0
Bareland	372	7.9	863	18.3	829	17.6	491.6	132.2	-34.3	-4.0	457.3	123.0
Cropland	658	14.0	1212	25.7	2157	45.7	553.5	84.1	945.1	78.0	1498.6	227.6
Total 1986	4714	100	4714	100	4716	100	0	0	0	0	0	0

Source: Own survey data (2021

Analysis of 1986 land sat image show that the land use land cover change reveals that yaya Haro kebele has 206 ha (4.4%) water body, 729ha (15%) forest land, 1518ha (32%) plantation, 1230ha (26.1) grass land, 372 ha(7.9)bare land and 658ha(14.0%) crop land and total land of 4714 ha this analysis show that yaya Haro kebele was largely covered bay plantation and forest. Analysis of 2000 land sat image show that the land use land cover change types that yaya Haro kebele has 206 ha(4.4) water body, 839ha(17.8%) forest land ,402ha(8.5%) plantation, 1192ha (25.3%)grass land, 863ha (18.3%) bare land and 1212ha (25.7.0%) crop land and total land of 4714 ha ,from this what we concluded that plantation decrease by 1116ha(23.7%) and bare land increase by 491ha(10.4%) and cropland also increased by 554ha(11.7%) From the above table what we understand that the net change that happened in the study area from 1986-2021 is/was crop land and bare land is extremely increased when forest /plantation decrease. this is because of the several reason population growth, which their demand increase for farming land by distracting forest land and due to over grazing.

Table 4.19 Land use/Land cover change matrix in Yaya Haro during the period 1986 – 2021

		Land use/Land cover types 1986													
	Lu/Lc type	Waterbody		Forestland		Plantation		Grassland		Bareland		Cropland		Total	
		Ha.	%	Ha.	%	Ha.	%	Ha.	%	Ha.	%	Ha.	%	Ha.	%
Land use/Land cover types 1986	Waterbody	198.8	96.5	12.7	1.7	12.4	0.8	8.2	0.7	16.9	4.5	0.0	0.0	249.0	5.3
	Forestland	0.2	0.1	223.7	30.7	64.6	4.3	125.4	10.2	13.9	3.7	7.7	1.2	435.5	9.2
	Plantation	0.4	0.2	140.0	19.2	200.0	13.2	172.4	14.0	32.5	8.7	20.2	3.1	565.5	12.0
	Grassland	0.2	0.1	42.5	5.8	158.5	10.4	192.9	15.7	54.7	14.7	31.1	4.7	479.9	10.2
	Bareland	4.8	2.3	174.5	23.9	303.5	20.0	239.0	19.4	104.3	28.0	3.0	0.5	829.1	17.6
	Cropland	1.7	0.8	135.7	18.6	780.4	51.4	493.1	40.1	149.6	40.2	596.4	90.6	2156.9	45.7
	Total	206	100	729	100	1519	100	1231	100	372	100	658	100	4716	100

Source: Own survey data (2021)

The land use land cover change matrix of yaya Haro from 1986-2021, crop land and bare land was increased when other land feature like water and forest decrease. This is because forest is destroyed for different purpose like for farm land, for construction ,for wood ,for charcoal for timber and the like ,the driving force for this activity is the an alarmingly increase of population.

Table 4.20 Land use/Land cover change during 1986 - 2000

	Persistence		**Gains**		**Losses**		**Net Change**	
Lu/Lc Type	**Ha**	**%**	**Gains (ha)**	**%**	**Losses (ha)**	**%**	**Ha**	**%**
Waterbody	192.7	93.7	12.9	0.4	-13.1	-0.4	-0.2	0.0
Forestland	205.9	28.2	633.4	19.69	-523.2	-16.3	110.3	3.4
Plantation	146.4	9.6	255.2	7.935	-1372.1	-42.7	-1116.8	-34.7
Grassland	405.8	33.0	786.0	24.44	-824.3	-25.6	-38.3	-1.2
Bare land	113.1	30.4	750.2	23.32	-258.7	-8.0	491.6	15.3
Cropland	433.1	65.8	778.8	24.21	-225.3	-7.0	553.5	17.2
Total	1497.1	31.76	3216.5	100	-3216.5	-100	0.0	0.0

Source: Own survey data (2021)

The above table indicate that there is a great net change land categories particularly plantation loss from 146 (9.6**%**) to 11168.8 (34.7**%)** and also there is change in crop land which shows

change by (17.2%) of net change followed by bare land ,this indicate that there is the persistence change on all lu/lc/ types. Generally speaking, there is the land use land cover change in the study area due to the population.

Table 4.21. Land use/Land cover change during 2000 – 2021

	Persistence		Gains		Losses		Net Change	
Lu/Lc Type	**Ha**	**%**	**Gains (ha)**	**%**	**Losses (ha)**	**%**	**Ha**	**%**
Water body	204.0	99.0	45.3	1.407	-1.7	-0.1	43.6	1.4
Forestland	183.2	21.7	253.5	7.882	-545.9	-17.0	-292.3	-9.1
Plantation	72.7	18.1	493.8	15.35	-1445.8	-44.9	-951.9	-29.6
Gras land	234.4	19.6	246.6	7.667	-995.8	-31.0	-749.2	-23.3
Bare land	310.0	35.8	522.5	16.25	-61.8	-1.9	460.7	14.3
Crop land	1025.8	84.4	1136.1	35.32	367.5	11.4	1503.5	46.7
Total	2030.1	42.94	2697.8	83.87	-2683.4	-83	14.4	0.4

Source: Own survey data (2021)

The above Table shows that decline in plantation, and grass land with the net change of (-29.6%) and (-23.3%) respectively; crop land and bare land increased by net change of (46.7%) and (14.3%) respectively when water body remain unchanged between 200and 2021. The reason why grass land and plantation decline might be due to agricultural farming and settlement; this means the plantation was destroyed for different purpose.

Table 4.22. Land use/Land cover change during 1986 – 2021

	Percistence		Gains		Losses		Net Change	
Lu/Lc Type	**Ha**	**%**	**Gains (ha)**	**%**	**Losses (ha)**	**%**	**Ha**	**%**
Waterbody	198.8	96.5	50.2	1.561	-6.9	-0.2	43.3	1.3
Forestland	223.7	30.7	211.8	6.584	-505.4	-15.7	-293.6	-9.1
Bareland	200.0	13.2	365.5	11.36	-1318.5	-41.0	-953.0	-29.6
Grassland	192.9	15.7	287.0	8.923	-1037.3	-32.2	-750.2	-23.3
plantation	104.3	28.0	724.8	22.53	-267.5	-8.3	457.3	14.2
Cropland	596.4	90.6	1560.5	48.52	-61.9	-1.9	1498.6	46.6
Total	1516	32.15	3200	99.48	-3197.4	-99	2.3	0.1

The Table above shows that plantation losses huge amount of ha, and bare land and crop land also increased in amount of ha, as data indicated that crop land shows a net change 1498.6(46.6) in grass land, and bare land gain. This shows that highest rate of losses occurred due to increase of crop land, grass land, in the study area

Table 4.23 Land use categories Changed to Cropland (1986-->2000)

Lu/Lc Type	Ha	%
Waterbody	0.0	0.0
Forestland	93.0	7.7
Plantation	381.0	31.4
Grassland	240.7	19.9
Bareland	64.2	5.3
Cropland	433.1	35.7
Total	1211.9	100.0

The above Table shows that crop land, plantation and grass land were highly changed in to crop land between 1986- 2000 by (35.7%), (31.4%) and (19.9%) respectively. and bare land and forest Land were changed at a small. This show that there were an agricultural expansion and deforestation activity in the study area.

Table 4.24. Land use categories Changed to Cropland (2000-->2021)

Lu/Lc Type	Ha	%
Waterbody	1.4	0.1
Forestland	321.3	26.5
Plantation	151.4	12.5
Grassland	467.0	38.5
Bareland	194.9	16.1
Cropland	1025.8	84.6
Total	2161.9	178.4

The above Table shows that crop land, plantation and grass land were highly changed in to crop land between 2000- 2021 by (84.6%), (38.5%) & (26.5%) respectively. And bare land and forest Land were changed at small rate. This indicates that there might be agricultural expansion and deforestation activity in the study area.

Table 4.25 Land use categories Changed to Cropland (1986-->2021)

Lu/Lc Type	Ha	%
Waterbody	1.7	0.1
Forestland	135.7	11.2
Plantation	780.4	64.4
Grassland	493.1	40.7
Bareland	149.6	12.3
Cropland	596.4	49.2
Total	2156.9	178.0

Fig.10. Land use categories Changed to Cropland (1986-->2021)

The above Table shows that plantation, crop land and grass land were highly changed in to crop land between 1986- 2021 by (64.4.7%), (49.2%) and (40.7.9%) respectively. and bare land and forest Land were changed at small scale. Additionally, I had interview with development agent of Degam woreda and the elders from households of the Yaya Haro kebeles y. In my interview; many issues were raised concerning about the environmental impact of population pressure. According to the experts of development agent of the Degam woreda:

> "*Most environmental degradation occurred due to the mala adjustment of the population growth and the natural resource. This is because there is a direct relationship between environment and population growth, this means that population have the direct engagement in a distraction of natural resources for their own purpose "."*

The respondents were asked 'the cause of environmental degradation; 83.33% of the respondent are reacted that it happened due to population growth and unwise use of natural resources. 17% percent of respondent were responded that it is the lack of know-how about the proper use of natural resources. Generally, from the respondent what we conclude that when the numbers of population increase, paradoxically the land remain constant. The respondents asked 'about what is the population pressure mean? The development agents responded that population pressure is the gradual increment of population and their question raised to the environment and when the environment an able to answer their question it is what we call population pressure on the Environment. That means when the carrying capacity of environment is maladjustment with numbers of population it is said to be there is a population pressure.

The elder respondents replied that the question in two dimensions, most of them said the population pressure is what God exerted on planet earth, when the other group responded as population is considered as an asset rather than debit. The respondents were also asked again what is the opinion of their current family size compared to their farming land...? 75% of respondent said that the current farm land size what they had is not enough to feed the numbers of families they had, so their opinion is to had extra farming land which able to feed their current families, and 15% of them were answered that their family size and the farming land they holding now is matched with their family size. This means that the farming land that they holding at the moment can feed their current families.

The respondent asked based on their Age structure, who are more concerned about the impact of population pressure on environment? both of the woreda development agent (DA) directly forwarded the responsibility to the Elders because the elders have more experienced, what they shared in their life and they stayed a long period of times on this planet and they more know about how they can manage the existing natural resources, as well as they learned from the past lesson. On the other hand, all elders responded that all the community members should take care of using the existing natural resources for themselves and for the next generation.

Finally, the respondent asked about who are the most important to provides an information on the impact of population pressure on the environment to the communities? Most of the respondent said that /Elders/ the government would be the center of the information particularly institutional agent would be the center of information. For example, health care workers, DAs would be the center for information about the family planning and wise use of natural resources respectively; environmental protection authority would be the center of information about the environmental protection; therefore, for local communities, continuous training to create awareness, and using family planning, and wise use of natural recourses,(afforestation, fallowing, intercropping, applying of duck on pieces of land to increase a yield of production)and the DA responded that all the communities particularly the elders and governmental institution incorporate the create awareness and would be the center of information which is important to the communities about impact of population pressure on Environment.

CHAPTER FIVE

SUMMARY, CONCLUSLON AND RECOMMERDATIONS

5.1. SUMMARY AND CONCLUSION

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).

During the last few decades, Ethiopia has experienced massive environmental degradation due to population pressure, unwise use of its natural resources and unsound ecological practice. This is because Ethiopia is one of the SSA countries known for their **fast** population growth and accelerated environmental degradation. Furthermore, this condition revealed that as population grows arable land per capita declines and fragmentation through over use increases. Therefore, the environmental degradation and their related problems became the major problems facing Ethiopia in general and the study area in particular. The growing population has increased the demand for agricultural land and forest resources due to their dependency on these resources.

If the current situation continues, the purpose for which farmers use environmental resources- to provide for basic needs and increase the quality of life of a rapidly growing population will be undermined. Local peoples' attitude and practice on their environment is decisive to the sustainability of the resources. The response of the people at large and community of the study area in particular to the impacts of population pressure on the environment, are indeed decisive to the sustainability of resources. People's perception of what is happening to their environment due to their growing numbers serves as a basis for any future intervention strategies. Therefore, for environmentally and socially sustainable development there is an urgent need to promote awareness and understanding of the interdependency of natural, socio-economic and political systems at local and national levels. Understanding the current status regarding the interrelationship between population pressure and environment is very important. Thus, this study focuses on identifying the nexus between population pressure and environment in North Shoa Zone Degem WoredaYaya Haro Kebele

Generally, the relevance of discussing the conditions of land and forest resource in the study area is not only because they are indicators of degradation but also they are the fundamental basis of survival for peasant life. This is because rural people entirely depend on land and forest resource for their living as indicated in the findings. Therefore, degradation of these fundamental resources is believed to have formidable influence on people's behavior.

Therefore, on the basis of this and the results of the study we can draw the following conclusion in relation to public perception about the impacts of population pressure on agricultural land use and forest resources. Finally, the responses that the communities of the study area undertake to mitigate the environmental problems are addressed. Accordingly:

- There were high population growth and shortage of farm land and grazing because of population pressure.
- The population pressure will be alleviated by being involved in family planning programs.
- The population pressure affects the productivity of agricultural land in the Kebele.
- There are farmers have shortage of farm land in their kebele presently as compared to 30 years ago.
- The main factors responsible for declining in the productivity of the farm land were land degradation due to population pressure.

5.2 CONCLUSION

The study attempted to describe the nexus between population pressure and environment and their impact on socio-economic characteristics of an area. In Ethiopia, in general, the existence of high fertility rate creates the occurrence of high population pressure from time to time. This in turn creates high adverse impact on environment from place to place. For instance, the average household size for the study area revealed variation between the local people and migrants where the former has an average family size of seven and the latter is six. 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 over the last three decades. Similarly, average land holding size also shows the same trend over the last three decades 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. On other hand, the young and productive population group at moment leave their home villages due to the shortage of farming lands and permanently migrating to the area where there is supposed to be excess farming. As a result of this and other factors, older population group are forced to live alone and they are left without supporters.

5.3. RECOMMENDATIONS

On the basis of the findings of the study, some important issues are forwarded for policy considerations. Thus individuals, communities, civic society, local, regional, national government officials can employ many strategies to address the complex linkage between population and environment Therefore, a multi-faceted recommendation is needed, including the following elements.

- Increase family planning services targeting both men and women in order to lower population growth and to relieve pressure on natural resources and social services.
- Give a high priority to raising the status of women by increasing female participation in the educational system at all levels. This is because as indicated in discussion parts of the study, women are at lower level of perception and response to the impacts of population pressure on the environment. This could reflect the different roles given to men and women in the society and the limited opportunities available to women. Thus, the decisive role of women and their right to have equal opportunities with man should be enhanced in all aspects.
- Awareness creation through local indigenous knowledge should be identified, and used wherever possible to overcome the existing problem in relation to the impacts of population pressure on the environment
- Conditions shall be created that will support community and individual resource users to sustainably manage their own environment and resources.
- Raise public awareness and promote understanding of the essential linkages between population and environment

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Appendixes

Addis Ababa University

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Center for Environment and Sustainable Development

Annex 1. Questionnaires to be filled by household heads and development agents

Dear respondents,

The questionnaire is prepared to gather data necessary for conducting study on population pressure nexus Environment: The case of Degem Werda Oromia region North shoa Zone; for partial fulfillment of MA degree in Environment and Sustainable Development. Thus, your opinion and views are valuable so as to establish clear picture of the issue under the study and for its successful completion.

The information you provide will be used only for academic purpose and assessed by the researcher alone, so cooperate honestly with no fear, as your response kept strictly confidential and anonymous. Please try to respond to every question as per the instruction there of and if you face any problem or confusion you can contact the researcher through the address indicated here.

Thanks in advance for your relevant answers and cooperation!!

Abera Nigussie (The student researcher)

Address: phone: 0912208368/0942138167

E-mail: **abexselale@gmail.com**

NB:

- ✓ No need to write your name
- ✓ To fill questions with choices (part I part 2 part 3), please check circle on your choice.

And write your answer clearly on space provided for open ended questions.

Part I: <u>Your Personal Information</u>

Instruction: Please indicate your answer by circling on your choice as provided below for each question. If you have answer out of the alternatives indicate it in the blank space provided.

1. Your age

31-35	36-40	41-45	46-50	51-55	56-60

2. **your sex**

Male	Female

3.Education status

Read and write	highest grade completed

Part 2 Question related to population pressure on the environment and nexus.

1. In your opinion, do you think that there is population pressure and shortage of farming land in your community? 1. Yes 2. No 3. Do not know

2. If yes for Q. #1, how do you respond to this problem of population pressure? 1/. Educating young women 2/Reducing early marriage (early child bearing) 3/ Being involved in family planning programs 4/. If there are others specify _____

3. Is Population pressure should be controlled to alleviate environmental degradation? 1/. Yes 2/. No 3/. Do not know

4. Do you believe population pressure affect the productivity of agricultural land in your kebele administration? 1/. Yes 2/ No 3/ Do not know

5. If yes for Q. #4, how do you describe the effects of population pressure on agricultural land in your community? 1/ Reduces fallowing period 2/ It causes land fragmentation. 3/ Over cultivation 3/ Lack of grazing land 4/ Others (specify) _____

6. Do you respond to this problem? 1/. Yes 2/ No 3. Do not know

7. What is/are the manifestation of agricultural land degradation? 1/ Decline in soil fertility 2/ Reduction in crop yields 3/Drought/famine 4 /Others (specify)

PART 3 QUESTION RELATED LAND USE LAND COVER CHANGE

1. Do you own cultivable land? 1/. Yes 2/No

2. If yes for Q# 1, how do you obtain it? 1/. Inherited 2/. Rented for crop sharing 3/. During re distribution 4/ Others specify _____

3. What is the total land you are using for your needs in times? Specify as follows

1/ Cultivable land 2/Grazing land 3/Forested areas 4/Others specify Amounts in timed ----------

4. Do you think there is shortage of farmland in you kebele administration presently as compared to 30 years ago and above? 1/. Yes 2/. No 3. Do not know

5. If yes for Q# 4 what factors are responsible for this shortage of farm land? 1/ Population growth 2/. In-migration to the area 3/ Expansion of urban settlements 4/. Others specify _____

6. How about their awareness to the problems related to shortage of farm lands in your locality? 1. Limiting family size 2. Introducing intensive farming techniques 3. Migrating to other area 4. Others specify _____

7. Do you think the community has a shortage of grazing land? 1. Yes 2. No

8. If yes, what do you think should be undertaken to mitigate this problem? 1. Reduce farmlands to allow grazing lands, 2. Abandon reforestation areas, 3. Introduce selected productive cows to reduce livestock population pressure, 4. Do not know.

9. As compared to the land needs of your household requirements, how do you see your present landholding? 1. It is more than enough 2.It is just enough 3. It is insufficient

10. If insufficient what size of land would be enough for your household? (1 hectare = 4 timad) 1. 1 to 2 timad (0.25 hect. to 0.5 hect.) 2. 3 to 4 timad (0.75 to 1 hect.) 3. More than 4 timad (> 1 hect.)

11. Do you think that land degradation particularly soil erosion is an environmental problem in your kebele? 1. Yes 2. No

12. If yes for Q. #11, what are the major causes of soil erosion? 1. Land fragmentation 3. Over grazing 2. Absence of following 4. Over cultivation 5. Other (specify) _____

13. At present time, do you think that the productivity of your farm land has decreased? 1. Yes 2. No

14. If yes for Q. # 13 what is/are the main factors responsible for declining in the productivity of farm land? 1 = Yes 2 = No 1. Land degradation due to population pressure 2. No use of fallowing, 3. Others (specify) _____

15. How do you maintain the fertility of the soil in your locality's farmland at most? 1.Fallowing 2. Crop rotation 3. Contour ploughing 4 .Limiting family sizes 5. Use of modern (chemical) fertilizers 6. Others (specify) --------

16. Do you believe that population pressure affects forest resources in your locality? 1. Yes 2.No 3. Do not know

17. From your observation of your immediate locality deforestation is ------- 1. Increasing 2.decreasing 3. No change at all

18. If deforestation is increasing how you do you respond to this problem at most? 1. Tree planting 2. Wise uses of forest resources 3. Limiting family size 4. Modern farming 5. Controlle grazing 6. Others (specify) _____.

19. In your opinion, what are the disadvantages of deforestation prevailed in your area? 1. Drought 2. Soil erosion 3. Shortage of fire wood 4. Loss of biodiversity 5. Others specify

20. What is your main source of fuel wood? 1. Private tree 2.Markets 3. Natural forest 4.Others specify……...

21. If deforestation is considered the main problem in your community, what are the factors for this problem at most? 1. Due to population pressure that leads to new areas of settlements and agricultural activities. 2. Cutting trees for different purposes 3. Lack of environmental education and awareness

4. Due to poverty 5. Others specify _____

22. In the household has environmental degradation ever disused as a problem? 1. Yes 2.No

23. Do you want to limit the number of your children? 1. Yes 2. No

24. If yes for Q. # 23 what is your desired family size? 1. Less than four 2.Greater or equals to eight

3. Five to seven 4 Social Organizations/Institution and Information

25. Do you have any contact with development agents or health extension workers? 1. Yes 2. No

26. In which organization employee do you have close contact? 1. Development Agents (DAs) 2.Non-governmental employees 3. Health extension worker (HEW) 4 Others (specify) 5. Both DAs and HEW

27. Based on information obtained from DA's/HEW and the like about population and environmental issues, are you responding to the problem so far discussed with them? 1. Yes 2. No

28 . Are there social organizations like "idir", "mahiber" and "equb" in your kebele? 1. Yes 2. No

29. If yes for Q. # 28 do you participate in these social organizations operating in your community? 1. Yes 2. No

30. During discussion on societal problems in your community have you discussed on population and environmental related issues? 1. Yes 2. No

31. . Do you have radio? 1. Yes 2. No

32. If yes for Q. # 31, how often you listen to the radio? 1. Every day 2.Sometimes 3.Do not know

33. From which/whom do you get information on population and environment related issues? 1. Radio 2. HEW 3. DAs

4. In-depth interviews of key informants (elders Kebele representative and woreda sectoral representative as indicated in methodology section)

1. What does environmental degradation mean?
2. What are the main causes of environmental degradation? and how can we prevent environmental degradation
3. What does population pressure mean?
4. What is your opinion about the current status of your family size as compared to your farm land?
5. Who are more concerned about the impacts of population pressure on the environment? (Basing on age structure)
6. Who are the most important to provide information about the impacts of population pressure on the environment to the community?

Annex .2

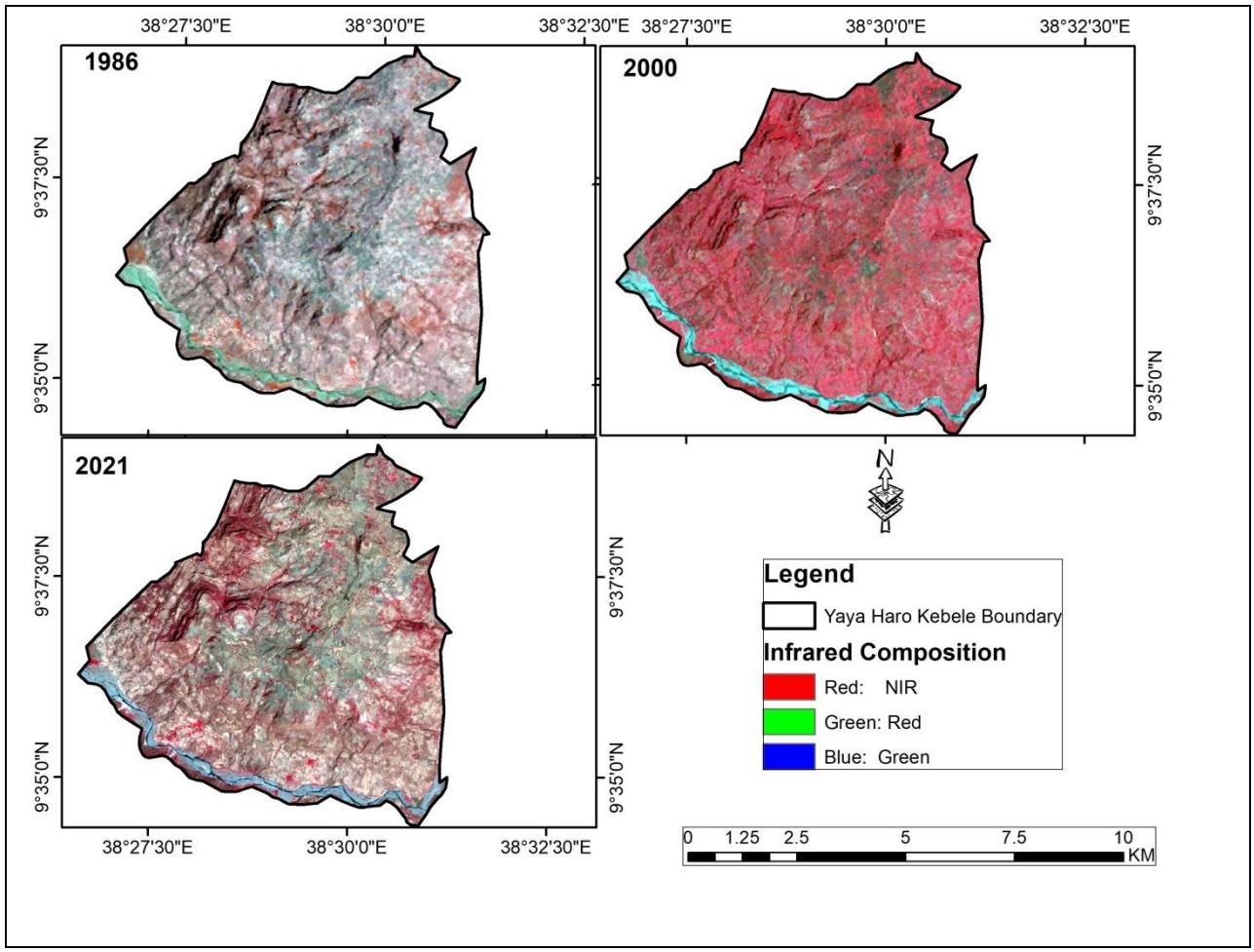


Fig 3: Infrared Display of Landsat (1986, 2000) and Sentinel (2021) Imageries

Annex 3. Accuracy Assessment of Lu/Lc Classification of the 2020 Imagery

		Ground Truth						Total	Producer Accuracy
		Forestland	Grassland	Bareland	Cropland	Rural Settlement	Urban Builtup Area		
		No.	No.	No.	No.	No.	No.	No.	%
Classified	Forestland	7	1	0	0	0	0	8	87.5
	Grassland	0	7	1	0	0	0	8	87.5
	Bareland	0	1	6	0	0	1	8	75.0
	Cropland	0	1	1	14	0	0	16	87.5
	Rural Settlement	0	1	0	0	6	1	8	75.0
	Urban Builtup Area	0	0	0	0	1	11	12	91.7
User Accuracy		7	11	8	14	7	13	60	100.0

Annex 4. Land use/Land cover change matrix in Yaya Haro during the period 1986 – 2000

		Land use/Land cover types 1986													
	Lu/Lc type	Waterbody		Forestland		Plantation		Grassland		Bareland		Cropland		Total	
		Ha.	%	Ha.	%	Ha.	%	Ha.	%	Ha.	%	Ha.	%	Ha.	%
Land use/Land cover types 2000	Waterbody	192.7	93.7	2.7	0.4	4.3	0.3	2.1	0.2	3.8	1.0	0.0	0.0	205.6	4.4
	Forestland	0.6	0.3	205.9	28.2	249.5	16.4	249.1	20.3	44.6	12.0	89.6	13.6	839.3	17.8
	Plantation	0.5	0.3	77.3	10.6	146.4	9.6	109.1	8.9	28.4	7.6	39.9	6.1	401.7	8.5
	Grassland	1.3	0.6	144.8	19.9	430.9	28.4	405.8	33.0	117.6	31.6	91.4	13.9	1191.8	25.3
	Bareland	10.6	5.2	205.4	28.2	306.4	20.2	223.4	18.2	113.1	30.4	4.5	0.7	863.4	18.3
	Cropland	0.0	0.0	93.0	12.8	381.0	25.1	240.7	19.6	64.2	17.3	433.1	65.8	1211.9	25.7
	Total	206	100	729	100	1518	100	1230	100	372	100	658	100	4714	100

Annex.5 . Land use/Land cover change matrix in Yaya Haro during the period 2001 – 2021

		Land use/Land cover types 2000													
	Lu/Lc type	Waterbody		Forestland		Plantation		Grassland		Bareland		Cropland		Total	
		Ha.	%	Ha.	%	Ha.	%	Ha.	%	Ha.	%	Ha.	%	Ha.	%
Land use/Land cover types 2021	Waterbody	204.0	99.0	1.4	0.2	2.6	0.6	6.1	0.5	35.2	4.1	0.0	0.0	249.3	5.3
	Forestland	0.0	0.0	183.2	21.7	34.7	8.6	43.8	3.7	132.0	15.2	43.0	3.5	436.8	9.2
	Plantation	0.3	0.1	107.3	12.7	72.7	18.1	200.2	16.8	115.3	13.3	70.8	5.8	566.6	12.0
	Grassland	0.3	0.1	38.8	4.6	54.5	13.5	234.4	19.6	79.1	9.1	74.0	6.1	481.0	10.2
	Bareland	0.2	0.1	190.8	22.6	86.8	21.6	243.4	20.4	310.0	35.8	1.4	0.1	832.5	17.6
	Cropland	1.4	0.7	321.3	38.1	151.4	37.6	467.0	39.1	194.9	22.5	####	84.4	2161.9	45.7
	Total	206	100	843	100	403	100	1195	100	867	100	1215	100	4728	100

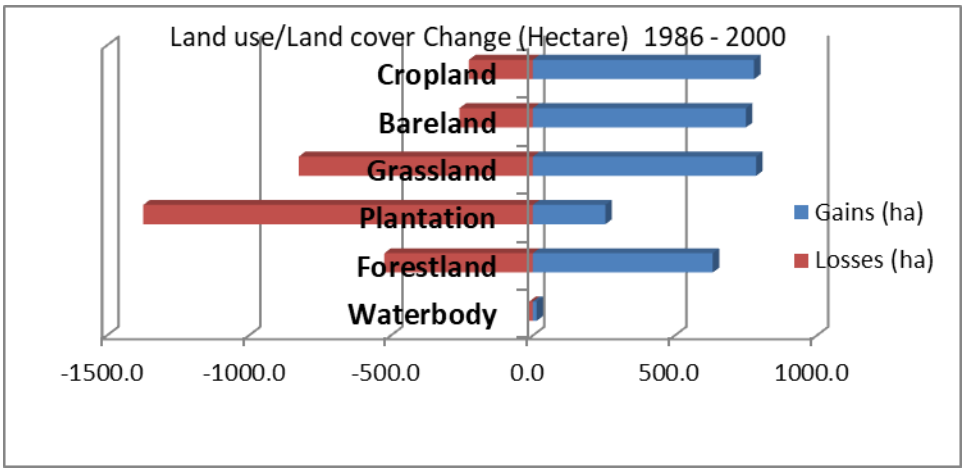
Annex 6.. Land use/Land cover change matrix in Yaya Haro during the period 1986 – 2021

		Land use/Land cover types 1986													
	Lu/Lc type	Waterbody		Forestland		Plantation		Grassland		Bareland		Cropland		Total	
		Ha.	%	Ha.	%	Ha.	%	Ha.	%	Ha.	%	Ha.	%	Ha.	%
Land use/Land cover types 2021	Waterbody	198.8	96.5	12.7	1.7	12.4	0.8	8.2	0.7	16.9	4.5	0.0	0.0	249.0	5.3
	Forestland	0.2	0.1	223.7	30.7	64.6	4.3	125.4	10.2	13.9	3.7	7.7	1.2	435.5	9.2
	Plantation	0.4	0.2	140.0	19.2	200.0	13.2	172.4	14.0	32.5	8.7	20.2	3.1	565.5	12.0
	Grassland	0.2	0.1	42.5	5.8	158.5	10.4	192.9	15.7	54.7	14.7	31.1	4.7	479.9	10.2
	Bareland	4.8	2.3	174.5	23.9	303.5	20.0	239.0	19.4	104.3	28.0	3.0	0.5	829.1	17.6
	Cropland	1.7	0.8	135.7	18.6	780.4	51.4	493.1	40.1	149.6	40.2	596.4	90.6	2156.9	45.7
	Total	206	100	729	100	1519	100	1231	100	372	100	658	100	4716	100

Annex.7 Land use/Land cover change during 1986 - 2000

	Persistence		Gains		Losses		Net Change	
Lu/Lc Type	Ha	%	Gains (ha)	%	Losses (ha)	%	Ha	%
Waterbody	192.7	93.7	12.9	0.4	-13.1	-0.4	-0.2	0.0
Forestland	205.9	28.2	633.4	19.69	-523.2	-16.3	110.3	3.4
Plantation	146.4	9.6	255.2	7.935	-1372.1	-42.7	-1116.8	-34.7
Grassland	405.8	33.0	786.0	24.44	-824.3	-25.6	-38.3	-1.2
Bareland	113.1	30.4	750.2	23.32	-258.7	-8.0	491.6	15.3
Cropland	433.1	65.8	778.8	24.21	-225.3	-7.0	553.5	17.2
Total	1497.1	31.76	3216.5	100	-3216.5	-100	0.0	0.0

Source ; own survey data(2021)

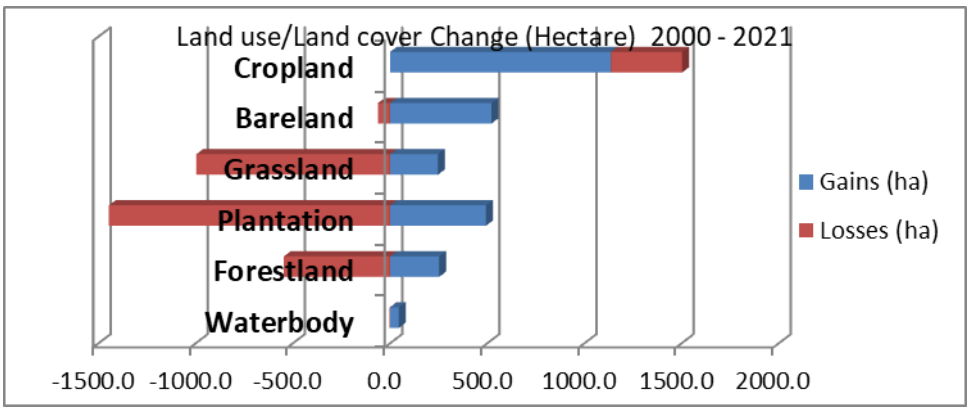


Annex 8 Land use/Land cover change during 2000 – 2021

	Persistence		Gains		Losses		Net Change	
Lu/Lc Type	Ha	%	Gains (ha)	%	Losses (ha)	%	Ha	%
Waterbody	204.0	99.0	45.3	1.407	-1.7	-0.1	43.6	1.4
Forestland	183.2	21.7	253.5	7.882	-545.9	-17.0	-292.3	-9.1
Plantation	72.7	18.1	493.8	15.35	-1445.8	-44.9	-951.9	-29.6
Bareland	234.4	19.6	246.6	7.667	-995.8	-31.0	-749.2	-23.3
Bareland	310.0	35.8	522.5	16.25	-61.8	-1.9	460.7	14.3
Rural Settlement	1025.8	84.4	1136.1	35.32	367.5	11.4	1503.5	46.7
Total	2030.1	42.94	2697.8	83.87	-2683.4	-83	14.4	0.4

Source ; own survey data(2021)

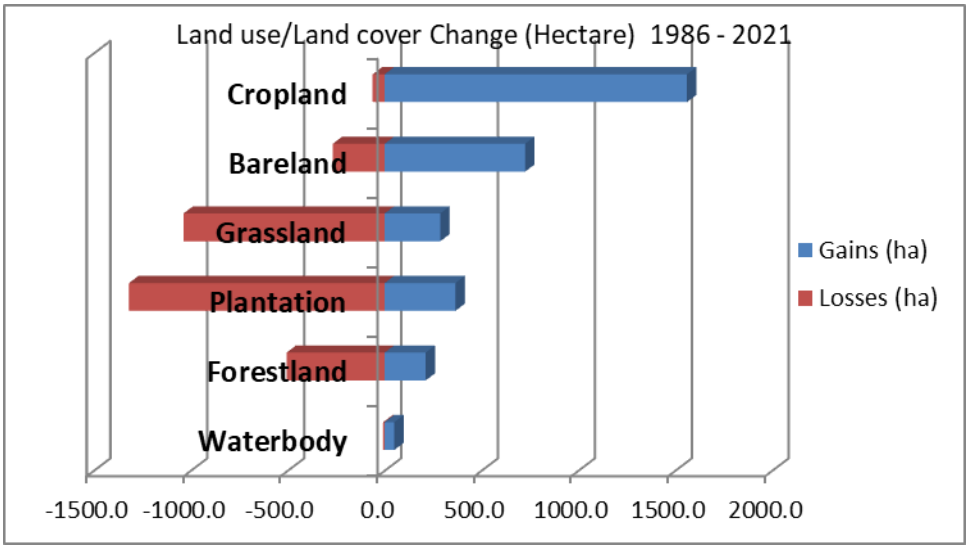
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Annex .9. Land use/Land cover change during 1986 – 2021

	Persistence		Gains		Losses		Net Change	
Lu/Lc Type	**Ha**	**%**	**Gains (ha)**	**%**	**Losses (ha)**	**%**	**Ha**	**%**
Waterbody	198.8	96.5	50.2	1.561	-6.9	-0.2	43.3	1.3
Forestland	223.7	30.7	211.8	6.584	-505.4	-15.7	-293.6	-9.1
Plantation	200.0	13.2	365.5	11.36	-1318.5	-41.0	-953.0	-29.6
Grassland	192.9	15.7	287.0	8.923	-1037.3	-32.2	-750.2	-23.3
Bareland	104.3	28.0	724.8	22.53	-267.5	-8.3	457.3	14.2
Cropland	596.4	90.6	1560.5	48.52	-61.9	-1.9	1498.6	46.6
Total	1516	32.15	3200	99.48	-3197.4	-99	2.3	0.1

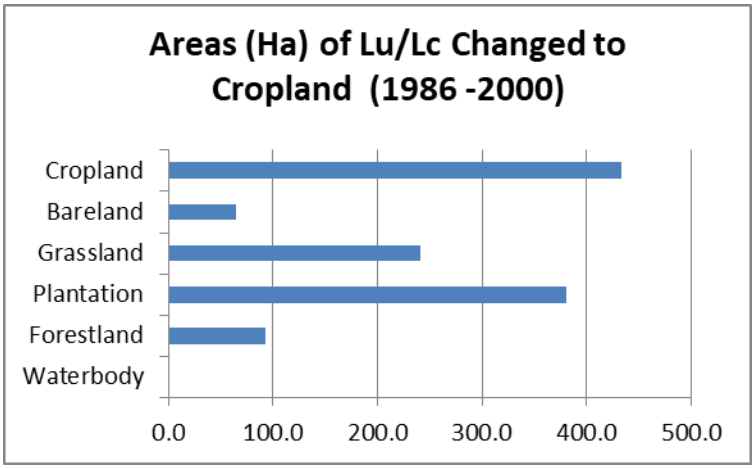
Source ; own survey data(2021)



Annex. 10. Land use categories Changed to Cropland (1986-->2000)

Lu/Lc Type	Ha	%
Waterbody	0.0	0.0
Forestland	93.0	7.7
Plantation	381.0	31.4
Grassland	240.7	19.9
Bareland	64.2	5.3
Cropland	433.1	35.7
Total	1211.9	100.0

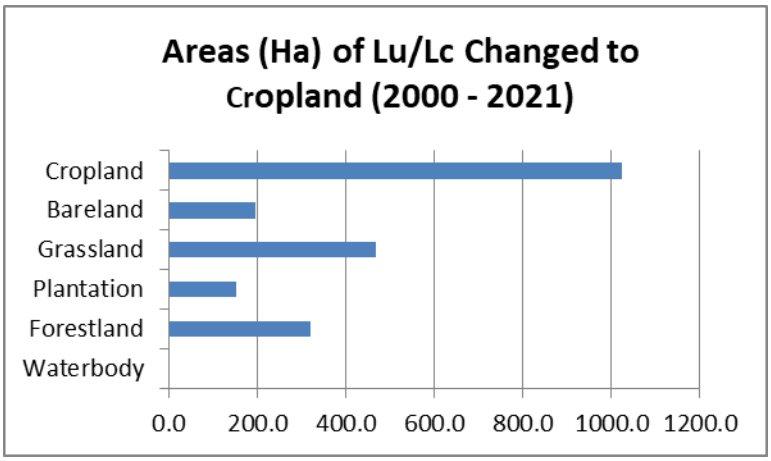
Source ; own survey data(2021)



Annex .11. Land use categories Changed to Cropland (2000-->2021)

Lu/Lc Type	Ha	%
Waterbody	1.4	0.1
Forestland	321.3	26.5
Plantation	151.4	12.5
Grassland	467.0	38.5
Bareland	194.9	16.1
Cropland	1025.8	84.6
Total	2161.9	178.4

Source ; own survey data(2021)



Annex..12.Land use categories Changed to Cropland (1986-->2021)

Lu/Lc Type	Ha	%
Waterbody	1.7	0.1
Forestland	135.7	11.2
Plantation	780.4	64.4
Grassland	493.1	40.7
Bareland	149.6	12.3
Cropland	596.4	49.2
Total	2156.9	178.0

Source ; own survey data(2021)

