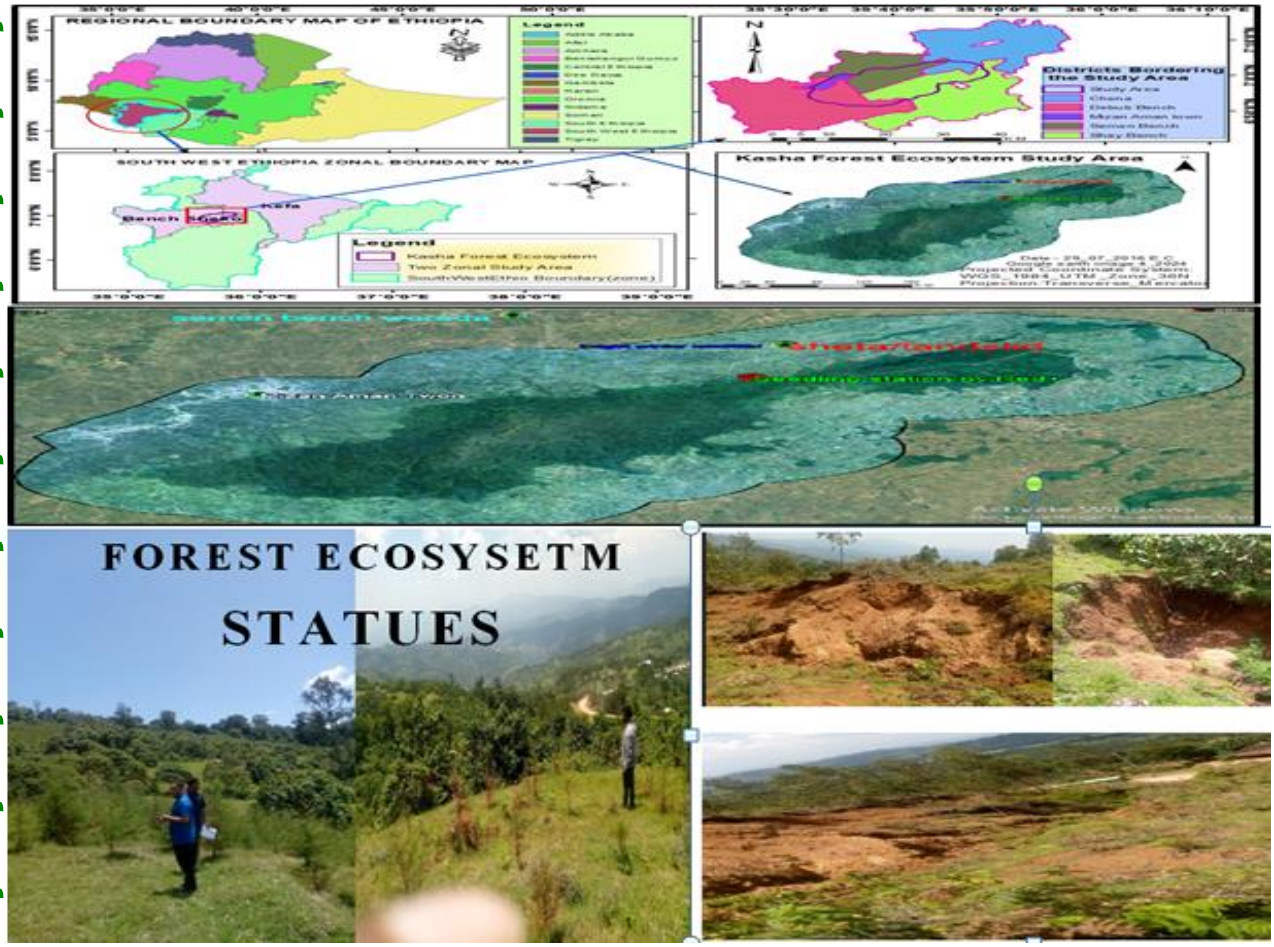
The Federal Democratic Republic of Ethiopia Environment Protection Authority

FACT-SHEET OF KASHA FOREST ECOSYSTEM

In The South West Ethiopia Region



Prepared By State of Environment Data Study and Report Preparation Desk

ADDIS ABABA, 2024

Contents

List of Figure ii
List of Table iii
Acronyms and Abbreviations iv
1. General Background 1
1.1. Environment for Green Economy Development 1
1.2. Frameworks /Approaches 12
1.2.1. The Driver-Pressure-State-Impact-Response Framework 12
2 Social and Economic Environment 19
2.1 Social Environments 19
2.1.1 State and trends of Social Environment 20
2.1.2. Drivers and Pressure of *Social Environment Change* 26
2.1.3. Impacts *of Social Environment Change* 27
2.1.4. Responses to Social *Environment Change* 28
2.1.5. Outlook for Social Environment 30
2.2. Economic Environment 30
2.2.1. State and Trend of the Economic Environment 30
2.2.2.Drivers and Pressures of the Economic Condition 31
2.2.3. Impacts due to the Economic Condition 32
2.2.4. Response of Economic environment 32
2.2.5. Outlook for Economic Condition 33
2.2.6. Options for future Action 34
3. Physical Environment of Kasha 35
3.1. Land Use Land Cover Change of Kasha Ecosystem 35
3.1.1 State and trend of Land Use Land Cover Change of Kasha Ecosystem 35
3.1.2 State of Land Degradation in Kasha forest ecosystem 42
3.1.3 Drivers and pressures for land Use Land Cover Change 44
3.1.4 Impacts of land use land cover change and Land Degradation on Kasha Forest ecosystem 46
3.1.5 Response measures in improving the status of land use land cover change 46
3.1.6 Outlooks 47
3.2. State and Trend of Forest Faunal and Flora in Semen Benche 42

3.2.1. State and Trend of Flora and Fauna in Kasha Forest Ecosystem 46
3.2.2 Driver and Pressure of Deforestation and Forest Degradation 48
3.2.3. Impacts of Forest and Woodlands degradation..... 53
3.2.4 Response for Forest Degradation 59
3.2.5. Outlook 61
3.3. State and Trend of Water on Kasha Forest Ecosystem..... 61
3.3.1. State and Trends of fresh Water resource in Kasha Forest Ecosystem 62
3.3.2. Driver and Pressure of Deterioration of Water Bodies in North Benchi Woreda Around Kash Forest Ecosystem..... 65
3.3.3. Impact of the Decline of Water Bodies on the Local Community 66
3.3.4. Response 67
3.3.5 Outlook..... 67
3.4. Baseline State and Trends of Climate of Southwest Region (1960-1990) 67
3.4.1. State and Trends of Climate Variables for Kasha Forest Ecosystem (1990 – 2020) 71
3.4.2. Driver and Pressure for Climate Change..... 76
3.4.3. Impacts of Climate Change 80
3.4.4. Response to Climate Change Impacts..... 82
3.4.5. Outlook..... 85
3.4.6. Recommendation..... 86
Reference 89
Writers 91

List of Figure

Figure 1 Environmental functions supporting economic growth. 5
Figure 2 The Link Between Economic Growth And Environment 9
Figure 3 Environment Kuznets Curve. 11
Figure 4 Study Map of Kasha Forest Ecosystem..... 37
Figure 5 LULCC map of Kasha Forest Ecosystem from 2002 to 2024 G.c 38
Figure 6 LULC map of that shows the Extent of Kasha forest..... 40
Figure 7 Slope view of Kasha Forest ecosystem 43
Figure 8 Partial view of degraded land in Kasha forest ecosystem 44

Figure 9 Degraded land modified due to ecluptus plantation by the local community 47
Figure 10Kasha Forest Ecosystem 50
Figure 11 Partial View of Kasha Forest Ecosystem 55
Figure 12Dominant Tree Species in the Kasha Forest Ecosystem 56
Figure 13 Gully Formation on The Kasha Ecosystem 57
Figure 14 Partial view of Kasha forest Ecosystem 58
Figure 15 Reforestation on The Kasha Forest Ecosystem 58
Figure 16 Replantation on the Kasha Forest Ecosystem 59
Figure 17 Stream Network in Kasha forest Ecosystem 64
Figure 18Year to Year Annual Mean Maximum(left) and Minimum(Right) Temperature Variability and Trend over Ethiopia 68
Figure 19 Time Average Surface Temperature Map of Ethiopia 69
Figure 20 Year to Year Variablity of Annual Rainfall over Southwestern Ethiopia Expressed in Normalized Deviation 70
Figure 21 Transects of Mean 1960-1989 and 1990-2009 June-September rainfall, Along with 2010-2039 projected rainfall (transects taken along 8^0 N) 71
Figure 22 Kasha Average Monthly rainfall from 1990-2020 72
Figure 23 Kasha annual Rainfall from 1990- 2020 72
Figure 24 Kasha Average Maximum Temperature 73
Figure 25 Kasha Average Minimum Temperature 74
Figure 26 Kasha Average Annual Minimum Temperature 75
Figure 27 Kasha Average Annual Minimum Temperature 75
Figure 28 The vicious triangle of climate, livelihood and Forest Ecosystem 87

List of Table

Table 1PopulationTrend Ssemen Bench Woreda(2020-2024). 21
Table 2 Students, teachers and number of schools in Dara *Woreda* in Academic year2024..... 22
Table 3 Health Institutions in SEMEN BENCH Woreda of 2020 and 2024 23
Table 4 Types and length of Roads, Existing Semen Bench woreda in the year 2020-2024 24
Table 5 Land use Land Cover Change of Kasha Forest Ecosystem, North Benchi Woreda..... 38
Table 6 Forest Coverage 40
Table 7 land use land cover change Matrixes between 2002 and2024 40

Table 8 Flora (plant) Species are found in the study area. 46
Table 9 Faunal species are found in the area. 47
Table 10 Land uses land cover change detection 2024 48
Table 11 Kasha Average Monthly rainfall from 1990-2020 71
Table 12 Kasha Average Maximum Temperature 73
Table 13 Kasha Average Minimum Temperature 73

Acronyms and Abbreviations

AGP—Agricultural Growth Program

CBD—Conventions on Biological Diversity

CDM- Clean Development Mechanism

CH4 - Methane

Climate Resilient Green Economy

CO_2 - Carbon dioxide

CO2e - Carbon dioxide equivalent

COP – Committee of Parties

CRGE – Climate Resilience Green Economy

CSA: Central Statistics Agency CRGE

DLUMDR: Department of Land use Management directorate report 2011

DPSIR: Driver Pressure State Impact Response

DPSIR: Driver, Pressure, State, Impact and Response

EPA – Environmental Protection Authority

EPA-Environment Protection Authority

FAO –Food and Agriculture Organization

FAO: Food for Agricultural Organization

FGD – Focal Group Discussion

FGD: Focus Group Discussion

FGD: Focus Group Dissection

GDP: Gross Domestic Product

GDP: Growth Domestic Product

GHG – Green House Gas

GHG: Green House Gas

GIS-Geographical Information System

GTP: Growth and Transformation Plan

Ha: Hectare

IPCC – Intergovernmental Parties for Climate Change

IPCC: Intergovernmental Panel on Climate Change

IUCN: International Union for Conservation Nature

KI: Key informants

LULCC: Land Use Land Cover Change

LULCC-Land Use Land Cover Change

Avr – Average

MAOD: Meteorology Agency office

Max – Maximum

MDG-Millennium Development Goals

Min – Minimum

MOWIE -Ministry of Water Irrigation and Energy

Mt – Million tones

MUDCO-Ministry of Urban Development and Construction

N_2O - Nitrous oxide

NAFTA). North American Free Trade Agreement

NGO - None Governmental Organizations

OWR-Ministry of Water Resource

PFM: Participatory Forest Management

RF- Rain Fall

SNNPR- Southern Nation and Nationality Peoples Representative

T – Temperature

TEEB: Total Economics of Ecosystems and Biodiversity

UNCED United Nations Conference on Environment and Development

UNEP: United Nation Environmental Program

UNFCCC - The United Nations Framework Convention on Climate Change

WMO: World Meteorological Organization.

1. General Background

1.1. Environment for Green Economy Development

According to a report of *World Economic Outlook* (2020), economic growth is projected to rise by 3.3% in 2020 and 3.4% in 2021 in comparison to 2.9% in 2019. The increase in economic growth has resulted in worsening of environmental quality. As per International Energy Agency (2018) report, the level of production of goods and services doubled at a global scale from 1990 to 2015, which increased 45% of greenhouse gas (GHG) emissions and reached up to 50 gigatons (Gt) of carbon dioxide equivalent. It is well known that economic growth is crucial for giving greater opportunities to poor people, but it should be accomplished using more energy-efficient and environmentally sound models of growth. Moreover, continuous growth is necessary to develop more environmentally safe and adequate technologies to achieve sustainability goals. There is a strong link between the environment and sustainability, which is considered as a holistic approach for social well-being without any discrepancy. Now, one of the primary challenges is to assure that the developmental policies made for economic growth should be executed in a manner that works in harmony with environmental sustainability. The problems of environmental degradation and climate change have gained much attention over the past years, as they affect both developed and developing countries, though, the world has shifted toward a sustainable approach for meeting the demands of production and consumption. But still, the pace of this transition is not fast enough to reduce the extent of environmental problems.

However, in 1992, the relationship between environment and development was first discussed on a common platform at Rio in Brazil, which is known as “Earth Summit” or the United Nations Conference on Environment and Development (UNCED). This conference introduced the concept of “Sustainable Development,” which created more awareness in both developed and developing countries. However, for developing countries, where poverty is a major issue, environmental problems are gaining more attention, which requires the acceleration of economic growth. From the past few decades, economic growth is the primary aim of policymakers, which is considered as the tool for sustainable development. A fast-growing economy is always in demand due to its favourable socioeconomic outcomes; but at the same time, it also requires a

healthy environment. In different studies, it has been established that the connection between economic development and the environment is intricate (Coondoo and Dinda, 2008; Grossman and Krueger, 1995; Lee and Lee, 2009; Lopez et al., 2014; Akbostanci et al., 2009). All human activities have a direct or indirect impact on the environment, which is formulated and implemented for economic growth to meet the needs of a country. The argument on the relationship of economic growth with the environment in the 1970s and for a significant part of the 1980s was mainly governed by the material balance paradigm. It strongly suggested that ceteris paribus, i.e., economic development contributes to ecological degradation and that if a financial framework is physically in a steady state it can be environmentally sustainable. The amount of resources used in production for the well-being of humans is restrained to a level that does not over utilize its natural assets and exhaust nature's sinks (Stagl, 1999; Smulders, 2000).

Understanding the role of the natural environment in the economic growth of a country is necessary to meet the goals of sustainable development. Environment consists of terrestrial and aquatic assets and also the atmosphere, altogether which are essential for the economy. For the production of goods and services, nature provides the material inputs and also acts as a sink in which the wastes arising from economic activities are dumped. Natural resources have been serving mankind for several decades, and still they are an important part of economic development. The environment functions as a life support system for mankind. Any variation in the social and economic fields may have a positive or negative effect on the earth's environment and vice-versa, and most of the time, the negative results are irreversible. It is necessary to address the environmental issues now, as we are facing the challenge of environmental degradation and climate change across the globe.

In today's world, one of the biggest challenges faced by several economies is accomplishing a harmony between reducing environmental degradation amid the requirement for economic development and environmental feasibility. However, for the protection of the environment, several policies have been adopted by countries around the world, for example, the reduction of GHG emissions and prevention of climate change. It is now a well-known fact that carbon dioxide emission and other GHGs are mainly responsible for global climate change and the greenhouse effect (Lee and Chang, 2009). In transportation, the CO_2 emissions contribute around

90% of all released GHGs (Nocera and Cavallaro, 2011). Therefore, CO_2 emissions have been a subject of considerable attention concerning the reduction of polluting gases. As per the IPCC report (2018), anthropogenic sources, such as emissions of GHG and land-use land-cover (LULC) changes, have resulted in approximately 1°C of global warming which is higher than preindustrial levels, i.e., from 1850 to 1900. Between 2030 and 2052, global warming will reach around 1.5°C; if in case it keeps on expanding at the current rate it will increase to, for example, about 2°C every decade. By 2100, global warming is supposed to reach 3–4°C above preindustrial levels with conceivably further warming in the future. It has been proposed that climate change will substantially decrease economic development in several developed and developing nations. Monetary and technological changes are fundamental to limit the worldwide temperature increase to 1.5–2.0°C above premodern levels. The major components of such transition include the rapid decoupling of financial development from energy consumption and emissions of CO_2 and the adoption of low and zero-carbon or carbon-negative techniques globally.

In the early 1990s, certain questions were a significant part of several important studies (Apergis and Payne, 2010a, 2010b; Chang et al., 2009; Cheng, 1999). Will the constant economic growth prove to be more detrimental to the environment and earth or will higher incomes help in the recovery of the degraded environment? These studies proposed an inverted U-shaped relationship between per capita income and environmental deterioration related to pollutants such as SO_2, NOx, etc., and emission of carbon which was commonly known as Environment Kuznets Curve (EKC). The hypothesis of EKC received enormous attention in research and formulation of policies. This relationship for the first time stated the fact that economic growth could benefit the environment in several ways. EKC hypothesis describes an inverted U-shaped relationship, which means that as the income level increases the different indicators of environmental degradation initially decline and subsequently fall when income crosses some threshold limit.

Despite decades of research, there is no general acceptance of how development and environment are connected and the factors determining this relationship. This is mostly because of the absence of appropriate data and observational proof and a short period of time to allow

robust connections and reliable projections. There is still significant scientific inaccuracy in characterizing the discussion, for example, on the utilitarian relationship between certain air and water contaminants and economic development, between climate change and economic development, and between natural resource utilization and economic development. Some of the researches in the literature describe "growth optimism" concerning the effect of growth and environmental quality and accomplishing sustainability of the environment, while others discover evidence for "growth pessimism" i.e., economic development is causing harm to the earth, in short, and/or long term. Thus, the objective of this chapter is to explore the relationship between the natural environment and economic growth and vice-versa. The current work gives a general survey of the existing literature on EKC, which deals with the "energy-environment growth" nexus for both specific and multiple-country studies. Studies from different countries show that the connection between economic growth and pollution emissions differs significantly. These studies may be useful to draft policy recommendations for conservation of energy, emission reduction, and better efficiency in economic growth. For certain pollutants and certain countries, there is proof for EKC; however, its existence locally does not imply that it is a predefined, predictive, or robust Relationship on a larger scale and across time, and it is not meant for all forms of environmental constraints. Therefore, it is preferable to perform a separate investigation for each country to determine the major factors influencing certain indicators of the environment precisely.

Role of natural resources and the environment in economic growth

The natural environment assumes two vital roles in economic development. First, the environment supplies resources, which work as raw material for the manufacturing of goods and services. Manufacturing of goods relies upon advancements of fundamental services, movements of removed natural goods (organic and geographical, inexhaustible and exhaustible), and ecosystem services provided by natural frameworks. The Millennium ecosystem services (2005) has divided the services provided by nature into four broad categories: *Provisioning service*s: products like fresh water, air, food, wood, medicines, biochemical, etc., *Regulating services:* regulation of natural processes, climate, water purification, erosion, disease control, air quality, etc. ,*Supporting services:* soil formulation, photosynthesis, nutrient and water cycling,

etc. and *Cultural services***:** tourism, recreation, spiritual enrichment, intellectual development, etc.

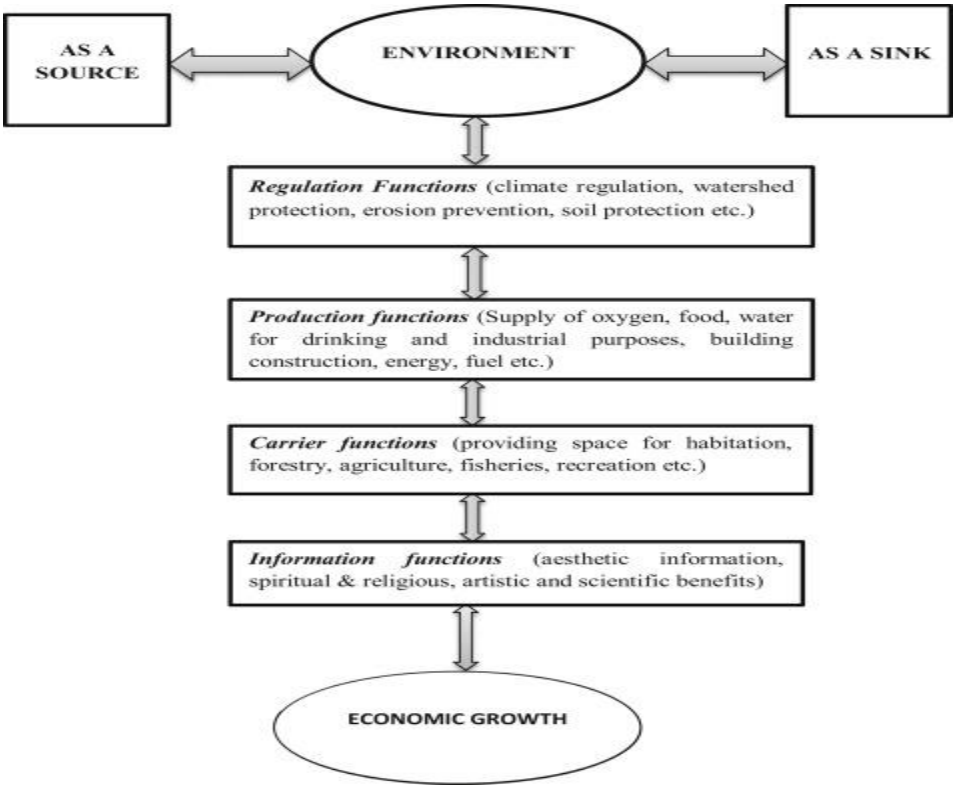


Figure 1 Environmental functions supporting economic growth.

Source: Heywood, V.H., Watson, R.T., 1995. Global Biodiversity Assessment, vol. 1140. Cambridge University Press, Cambridge.

The amount of wastes discharged to the earth's atmosphere depends upon the volume of material yield and on the development of services originated from another type of presumption by society, which is implemented to cope up with the undesirable effects of goods produced inside the economic structure. In literature, such kinds of services are outlined with the shorthand "by-products management capital" (Toman, 2003). The term "by-products management" refers both to pollution control (decrease in unwanted harmful results in comparison with wanted goods) and end-of-pipe solutions that reduce the harm caused by physical emissions. The inputs can be direct or indirect. Second, the natural environment functions as a sink to the pollution which arises from economic productions and utilizations. Models incorporate harmful air, water, and

solid contaminations, which are dispersed in the environment, which is additionally a storehouse for solid and hazardous waste.

At the point when the elements of the natural environment are truly impeded, economic development decelerates or can be negative. This is the situation when access to natural resources goes down quickly, for example, aquatic resources, woods, and minerals are being drained, or when nature's ability to assimilate or disperse waste and toxins is surpassed and when ecological quality is decreased. When the environmental quality is degraded, it has detrimental impacts on economic profitability, leading to a decline in the efficiency of diverse environmental services and some natural resources. It also has an immediate adverse impact on having spread out the different pathways through which natural assets and the environment are related to economic development and human well-being. Development might also be constrained because of policy measures which need huge investments for the reduction of pollution, which have lower economic profitability and returns in contrast with alternative costs.

From the past few decades, the environment is under immense pressure due to overexploitation by humans to meet their needs by being dependent on air, and water resources. Along with this, the environmental degradation is also caused by deforestation, species loss, climatic change, etc. Unrestricted utilization of natural assets has led to their quantitative and qualitative deterioration. For example, overfishing caused a reduction in catch per effort and subsequent changes in several aquatic systems disturbing the balance in ecological species. Overexploitation of groundwater has led to the deprivation of safe drinking water in several cities. Irrational exploitation of groundwater in coastal regions has led to seawater intrusion and salinization. For example, saltwater intrusion and salinization in coastal Bangladesh, coastal farms, and forests in southeast United States and California are caused by sea-level rise, storms and tides, droughts, and water resources management practices. Extensive deforestation has caused the loss of biodiversity and vegetation, which results in degradation and depletion of the soil. Several environmental problems such as eutrophication of water resources, global warming, climate change, and depletion of ozone have been caused due to industrialization. The natural environment is essential for economic activity and growth, as it provides the resources we require to produce goods and services, and uptakes and treats the

undesired by products in the form of pollution and waste. The environment manages threats to economic and social activity, as it helps to control flood risks, regulate the local climate, and retain the supply of clean water and other resources. This serves as the basis for economic activity and social welfare, and so balancing and restoring the natural assets is an important aspect in sustaining growth for the long term. Environmental performance and economic growth should run parallel to achieve sustainable development goals.

The environment and economic growth linkage

During the 1980s, there was a significant milestone in understanding the relation of economic development with the environment which identified the connection that existed between them. The environmental issues were incorporated in the planning process with an emphasis on a sustainable approach in the developmental process (World Commission on Environment and Development, 1987; Pearce and Warford, 1993). Grossman and Krueger (1991) supported inverted U-shaped linkage of economic growth (estimated by a rise in income per capita) with certain environmental quality indicators in their revolutionary effort of studying the probable impact of the North American Free Trade Agreement (NAFTA). The relationship is termed as Environmental "Kuznets curve" (EKC).

The growth-environment nexus has drawn the attention of researchers and academicians for discussions in different countries for a long time, and there is remarkable literature available on this relationship. Panayotou (1993), Grossman and Krueger (1993), and Selden and Song (1994) concluded that the positive or negative connection between economic development and the quality of the environment cannot be constant along developmental trajectories of a nation. It can change from positive to negative at an income level where people of the country need and support a strong economic base and a healthier natural environment. The environmental quality may produce positive or negative external factors that can stimulate economic growth by affecting human health. The relationship between energy vectors, economic development, and the quality of the environment was a matter of contradiction among the policymakers. This implies that understanding the dynamic linkage is essential to know the current policies on energy and environment, and it is one of the basic frameworks for designing robust economic guidelines with substantial goals.

The relationship of economic growth with the environment is, and may always remain, a subject of controversy. Most of the countries have achieved economic development without considering the environmental consequences. They are now facing several environmental problems like air and water pollution, pesticides in the food, ultraviolet rays penetrating the ozone layer, emission of greenhouse gases causing global warming, and so on. Some of the complexities in meeting the challenges of economic growth are the occurrence of new pollution problems, failure in dealing with rising global temperatures, and the ever-increasing population. However, due to advancements in the field of technology, great progress has been made in providing sanitation facilities; improved air quality in major cities, and constant progression in human conditions. Economic growth degrades the environment through increasing pollution, while the degraded environment in turn limits the probability of further economic growth. Exhaustion of resources and waste production get accelerated as agricultural production and industrialization increase.

Onthe other hand, at higher developmental levels, the organizational transformation towards information-based services, effective technological approach, and the necessity for improving the quality of environment results in stabilization with a gradual reduction in environmental deterioration (Panayotou, 1993).

Nature is a sink for the undesirable byproduct of commercial activities that have normally not been given much attention. Nature disseminates harmful air, water, and solid pollutants as a sink, which is the storehouse for millions of tons of garbage and hazardous chemicals. Once the environment's capacity to absorb waste crosses a certain limit, environmental quality is affected and may limit the process of economic growth. This may be because degraded environmental quality demands cleaner technologies or mitigation efforts. It further lowers the investment returns, or maybe the damage caused to the ecosystem is such that it is beyond restoration. It finally establishes a new less productive and stable state.

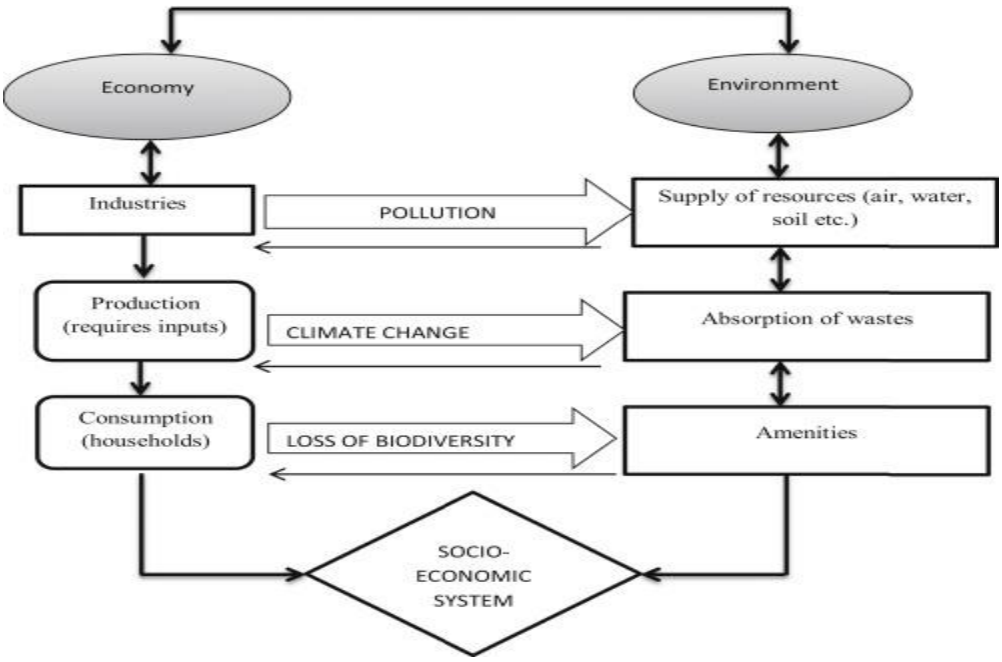


Figure 2 The Link Between Economic Growth And Environment

Expandable and sustainable natural resources contribute to the generation of numerous products and services. If the structure of yield and the strategies for production were permanent, at that point harm to the earth would be inseparably connected to the size of the worldwide monetary movement. Yet, considerable proof proposes that improvement leads to a rise in an additional change in what an economy produces (Syrquin, 1989). On a primary level, the efforts promoting the change in the composition and strategies of production might be adequately strong to more than balance the adverse impacts of increased economic activities on the environment.

However, the linkage of economic growth with the environment is often explained with the help of the EKC. This postulate establishes a relationship that is not linear but is relevant for different nations. The primary indicators utilized to depict the variations in conditions of the environment have been designed and used in numerous countries. A higher rate of economic development is a major and long-term goal of both government and people, mainly in developing nations. The accelerated growth of the economy is closely linked to an increase in the manufacture and intake of commodities and services; as a result, this leads to an increase in the maximized goods of the people and consumption of income for each individual. Though evidences are supporting the

existence of the EKC relationship for some countries, still it cannot be used for all types of environmental damage and across all the countries and income levels.

EKC hypothesis: explaining the relation between environment and economic growth

It is a well-known fact that the pollution and economy are closely related to each other since the history of mankind. However, the connection between environmental damage and economic improvement is unpredictable and complex. This linkage depends upon several factors like the economic size, the organization of the industry, the origin of the innovation, the need for better quality of environment, etc. All of these aspects are related to each other. The inconsistent link between the quality of income and per capita income can be identified practically and graphically utilizing the advanced tools of economic studies and can also be illustrated by the EKC. This theory was based on the proposition that at different levels of income growth, the distribution of income is not equal. Despite that, as the level of the economy expands, the distribution of income inclines to become even.

The EKC was introduced in 1955 for the first time by Kuznets to analyse the per capita income and environmental quality nexus. This assumes that during initial phases of economic development, the damage to the environment goes up or increases at a higher rate. But, after a certain threshold limit of economic growth, the movement tends to become inverted at a higher degree of economic development (Usenata, 2018). Grossman and Krueger (1991) were the first to apply the EKC, which resulted in an inverse linkage of GDP per capita with an indicator of the quality of the environment. In the early phase of industrialization, pollution in the EKC increases at a faster rate because individuals are more fascinated toward employments and income in comparison to healthy air and clean water. Most of the population is inefficient to even think about paying for reduction of pollution, and also environmental policies are correspondingly weak. With increase in income, the balance gets shifted. The leading industries tend to become cleaner, people start respecting the earth, and regulatory organizations gradually become more operational. Along the curve, pollution decreases in the medium income range but later on falls toward preindustrial levels in higher income range. At relatively lower degrees of per capita GDP, emissions increase with economic progression. At the final stage, when the economic growth increases along with the expansion of agronomy and extraction of different resources, the

rate of resource exhaustion starts to transcend the rate of resource restoration, generating more hazardous wastes. A shift toward information-based industries increased environmental concerns, and implementation of environmental guidelines, improved techniques, and greater environmental costs causes progressive reduction of environmental deterioration at higher levels of development. As income exceeds the EKC turning point (Fig. .3), it is expected that progress toward the improvement of environmental quality begins (Arrow et al., 1995). Thus, the EKC indicates that economic development can be utilized to address the environmental issues as economic development is probably compatible with environmental recovery (Kijima et al., 2010).

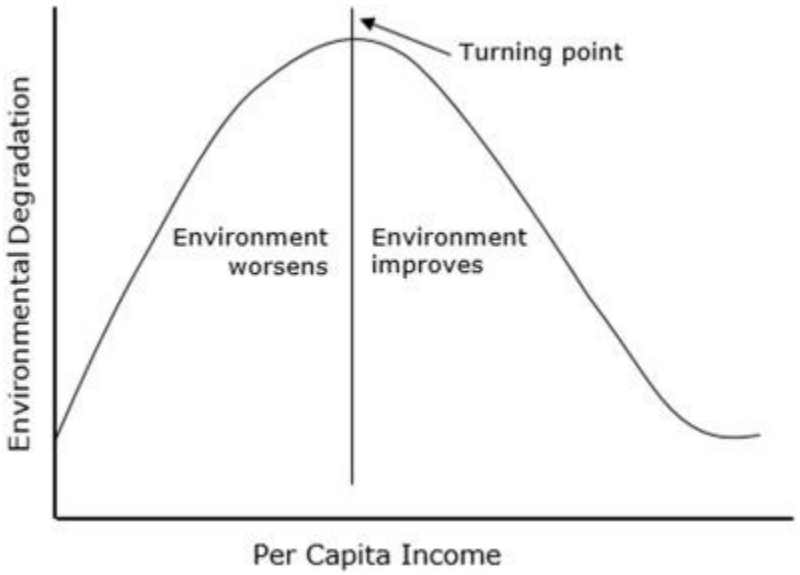


Figure 3 Environment Kuznets Curve.

The world development report 1992, "development and the environment," discusses the possible effects of the expected dramatic growth in the world's population. Industrial utput, use of energy, and demand for food. Under current practices, the result could be appalling environmental conditions in both urban and rural areas. The world development report presents an alternative, albeit more difficult, path - one that, if taken, would allow future generations to witness improved environmental conditions accompanied by rapid economic development and the virtual eradication of widespread poverty. choosing this path will require that both industrial and developing countries seize the current moment of opportunity to reform policies, institutions, and aid programs.

Economic growth will be undermined without adequate environmental safeguards, and environmental protection will fail without economic growth. The earth's natural resources place limits on economic growth. These limits vary with the extent of resource substitution, technical progress, and structural changes.

.

1.2. Frameworks /Approaches

1.2.1. The Driver-Pressure-State-Impact-Response Framework

The“DPSIR” frame work is multi-scalable and indicates generic cause and effect relations with in and among the following: DRIVERS: The drivers are sometimes referred to as indirect or underlying drivers or driving forces and refer to fundamental processes in society, which drives activities having a direct impact on the environment;

PRESSURES: The pressure is sometimes referred to as direct drivers as in the Millennium Assessment (MA) framework. It includes in this case the social and economic sectors of society (also sometimes considered as Drivers). Human interventions may be directed towards causing a desired environmental change and may be subject to feed backs in terms of environmental change, or could be an intentional or un-intentional by-products of other human activities (i.e., pollution);

STATE: Environmental state also includes trends, often referred to as environmental change, which could be both naturally and human induced. One form of change, such as climate change,(referred to as a direct driver in the MA framework) may lead to other forms of change such as biodiversity loss (a secondary effect of climate gas emissions);

IMPACTS: Environmental change may positively or negatively influence human wellbeing (as reflected in international goals and targets) through changes in environmental services and environmental stress. Vulnerability to change varies between groups of people depending on their geographic, economic and social location, exposure to change and capacity to mitigate or adapt to change Human well-being, vulnerability and coping capacity is dependent on access to social and economic goods and services and exposure to social and economic stress;

RESPONSES: Responses consist of elements among the drivers, pressures and impacts which may be used for managing society in order to alter the human– environment interactions. Drivers, pressures and impacts that can be altered by a decision-maker at a given scale are referred to as endogenous factors, while those that can't are referred to as exogenous factor

2 Social and Economic Environment

2.1 Social Environments

The social environment refers to the combination of individuals and groups that interact and display various activities and characteristics. It includes the family environment, school environment, and community

Social environments encompass the immediate physical. Surroundings, social relationships, and cultural milieus. Within which defined groups of people function and. interact.Jul 11, 2017

The social environment *subsumes many aspects of the physical environment*, given that contemporary landscapes, water resources, and other natural resources have.

The social environment refers to an individual's physical surroundings, community resources and social relationships. The physical environment may include such things as housing, facilities for education and health care, workplaces and open space for recreation. Community resources include community structures (e.g. political governance) and organisations, knowledge and support within the community. The social environment is recognised as a key factor influencing an individual's health and better social environments are associated with a range of positive health outcomes including improve child development and reduced risk taking behaviour amongst adolescents.

The term economic environment refers to all the external economic factors that influence buying habits of consumers and businesses and therefore affect the performance of a company. These factors are often beyond a company's control, and may be either large-scale (macro) or small-scale (micro).

Traditionally, Ethiopia including s o u t h w e s t r e g i o n are majorlycharacterized by three agro climatic or agro-ecological zones (Dejene,2003; Mengistu2006b; Chamberlin and Schmidt, 2012):

- *Kolla:*the tropical zone between 500 and 1,500ma.s.l, warm and semi-arid with an annual rainfall of approximately 200 to 800mm.

- *Weynadega:* the sub-tropical zone between 1,500 and 2,300ma.s.l,cool and sub-humid with an annual rainfall from 800 to 1,200mm
- *Dega:* the cool zone between 2,300m and3, 200ma.s.l., cool and humid with an annual rain fall from 900 to 1,200mm Therefore; the three districts were characterized and the results presented based on this classification.

South west region was split off from the Southern Nations, Nationalities, and Peoples' Region (SNNPR) on 23 November 2021 after a successful referendum. It consists of the Keffa, Sheka, Bench Sheko, Dawro, West Omo Zones, and Konta special woreda..Concerning religion Christians form the majority of the population. Islam is the second most followed religion, with 31.3% of the population being adherents. 2.6% of the population (mainly in the far south and southwest) follow traditional religions; other religions (the Bahá'í Faith, Judaism, etc.) make up the remaining 0.6%.

Semien Bench is a woreda in South West Ethiopia Peoples' Region, Ethiopia. It is named for the Bench people. Part of the Bench Maji Zone, Semien Bench is bordered on the southwest by Debub Bench, on the west by Sheko, on the northwest by the Sheka Zone, on the east by the Keffa Zone, and on the southeast by She Bench. Semien Bench is part of former Bench woreda.

Based on the 2007 Census conducted by the CSA, this woreda has a total population of 106,490, of whom 51,993 are men and 54,497 women; 5,331 or 5.01% of its population are urban dwellers. The majority of the inhabitants were Protestants, with 64.28% of the population reporting that belief, 19.29% practiced traditional beliefs, and 6.58% practiced Ethiopian Orthodox Christianity.

2.1.1 State and trends of Social Environment

2.1.1.1Population

The two main factors affecting population growth are the birth rate (b) and death rate (d). Population growth may also be affected by people coming into the population from somewhere else (immigration, i) or leaving the population for another area (emigration, e)

Here, altitude and the attendant climatic differences determine the distributional pattern of the Ethiopian population more than any other single factor, but not in the manner it affects global population distribution.

Table 1PopulationTrend Ssemen Bench Woreda(2020-2024).

YEAR (G.C)	Ruralpopulate		
	MALE	FEMALE	TOTAL
2020	49050	51248	100298
2021	49133	53456	102589
2022	43688	51234	94922
2023	45480	50981	96461
2024	45101	53456	**98557**
Total Rural population	**98557**		

Source:-Semen Bench woreda AFO (2024)

In this woreda the population size is decreasing time to time, this shows that rural urban migration is considered to be the major factor however Resource use, and environmental degradation are accelerated due to their economic interest, the demand on infrastructure, food security, energy source, health facilities and basic necessities as a whole is increased. So that the pressure in Kasha Mountain Forest is high .

2.1.1. 2 Education

Education is the most important factor that plays a leading role in human development. It promotes a productive and informed citizenry and creates opportunities for the socially

andeconomicallyunderprivilegedsectionofthesociety.OneoftheprimarygoalsofFDREMinistry of Education is promoting primary education in every corner of the country, based on the motto "education for all". Accordingly, regions and City administrations are working in line with this objective. In semen bench woreda 55..91% of the population were considered literate; 8.76% of children aged 7–12 were in primary school; 1.82% of the children aged 13–14 were in junior secondary school; and 2.36% of the inhabitants aged 15–18 were in senior secondary school.

Source, Semen bench bureau of finance and economic development website.

When comparing the enrolment of female students in all level is good, but the number of female teacher is also more less than as compared with male teachers .

Table 2 **Students, teachers and number of schools in Dara *Woreda* in Academic year2024**

NO	**Level ofSchool**	**Number of schools**	**Studentsin Semen Bench wereda 2020- 2024**		
			Male	**Female**	**Total**
1	Elementary schools (1-6)	22	5805	559	11,395
2	PrimarySchool(7-8)	35	1340	1504	2844
3	HighSchool (9-12) preparatory	2	829	857	1002
4	Number of teachers		743	259	1002

Source:SBWEO(2024)

2.1.1. 3 Health

Health affects growth by augmenting worker productivity, by increasing average life expectancy and subsequent human capital accumulation, and by reducing the burden of disease. In the Indian context, the main source of increases in worker productivity has come from improving nutrition.

The Health service sector is one of the key sectors for economic development. Adequate health service is one aspect of social service that communities aspire to get from the government. To this end, the Government of Ethiopia is putting the maximum possible effort to set targets towards societal development such as GTP goals and targets, and other policies and strategies. This is exhibited by increasing number of health institutions being established indifferent regions and city administrations including the rural clinics.

Health Institution & Health Coverage in Semen Bench woreda

Currently the health coverage of the *Woreda* was reached to90 % percent. Between 2020 and 2024the number of health institution increment is relatively good within five years

Table 3 Health Institutions in SEMEN BENCH Woreda of 2020 and 2024

No	Types of Health Institutions	year				
		2020	2021	2022	22 2023	2016 2024
1	Governmental Health Center	2	2	3	3	3
1.1	Primary Hospital	0	0	0	0	0
1.2	Private pharmacy	2	2	2	2	2
1.3	Health post	21	21	21	21	21
2	PrivateHealthCenters	0	0	0	0	0
2.1	PrimaryHealthclinics	0	0	0	0	0
	Total	25	25	26	26	26

Source:-semen bench WeredaHealthReport2020and 2024

2.1.1.4 Road and Transport

Road is an essential infrastructure for a given area for economic and social development. It easesmobilizationofresourcesandcommunicationandtherebyhastenthesocioeconomicdevelopment ofagivenarea.The total existing road in the semen bench *Woreda* is very poor no enough access to rood transport. The population who has access to Road infrastructure is around 32 % this shows that rood infrastructure is one of the biggest problem for the semen bench woreda community.

Table 4 Types and length of Roads, Existing Semen Bench woreda in the year 2020-2024

No	**Roadtype**	**Lengthinkm**	%ofpopulationwhohasaccess toRoad
1	Asphalt	27	**10**
2	All weather rood	60	32
3	Dray weather rood	28	10
	Total	115	52

Source:(Semen bench wereda transport office 2016)

2.1.1.5 Water Supply

In semen bench *woreda*, there are a number of small stream and rivers among the revers ,however currently due to various environmental problems some streams and springs were dried including the biggest river , while the volume of existing small streams and river as well as the discharge rate of springs has been decreasing from time to time. Recent data shows that, the water supply coverage of the *woreda* is **47%** of the total population has access to clean drinking

water. (*SBWWO, 2024*) this indicates that access to clean water for the community is not enough as compared with the number of population of the woreda.

According to the formal discussion of (KI) Key informants and Focus Group Discussions (FGD) KASHA Mountain Forest Ecosystem has been the major water source of the area. However now a time because of different environmental factors water quality and quantity is decreasing time to time. Among the deferent environmental factors which contribute to water problem deforestation can take the larger share.

2.1.1.6 Electricity

The use of electrical energy can be more efficient than the use of other forms of energy, such as gasoline or oil, because electrical devices do not produce any emissions or pollutants. However, the production of electrical energy can have an impact on the environment, depending on the methods used to generate it.

Energy infrastructure may contribute to economic growth and development in several ways. First, electricity serves as a key factor of production for firms which, as research shows, has low substitutability with other factors of production and thus may constrain output when unavailable .*Electricity* is an essential infrastructure for a given area of economic and social development. In Semen bench *woreda* the total coverage of Electricity is 44.5percent, from 20 kebeles only 12kebeleshave accesses to electric services,(that means from the total population 27350 have accesses to electric light) . The other residents used fuel wood, charcoalas the source of energy and also they used kerosene as a source of light.

2.1.1.7 Communication services

Effective communication enhances productivity, resolves conflicts, and promotes innovation. It also enables individuals to express thoughts, feelings, and ideas, fostering personal and professional growth. However, communication also has disadvantages. Miscommunication can lead to confusion, mistrust, and conflict.

Communication plays a vital part in building up a strong relationship across the world, either in organizational structure or outside of it. It is an essential pillar for people in sharing the ideas, delegating responsibilities, management of a team, building up a healthy relationship .Communicationin Semen Bench *Woreda*, has 24 hours telephone mobile services is available for all community and almost 45381of the population has access to communication service.

2.1.1.8 Housing

Housing is one of the three basic needs for human being; there is no problem of housing as mentioned during key informant, group discussion and semen Bench *final* report. In the woreda the houses mostly where constructed by different materials like woods, stoneand mud. Generaly there is no house problem in the woreda .

2.1.2. Drivers and Pressure of *Social Environment Change*

Agricultural expansion continues to be the main driver of deforestation, forest degradation and forest biodiversity loss. The global food system is the primary driver of biodiversity loss, with agriculture alone being the identified threat of more than 85 per cent of the 28,000 species at risk of extinction.

Kasha mountains forest Ecosystem is one of highly degraded ecosystem. The main drivers for the deterioration of the ecosystem are mainly deforestation and natural resource exploitation due to quire site that leads to forest and Natural resource degradation. The society use Kasha forest for fuel wood and for different household's construction materials and stone for asphalt constriction.

Drivers are human-related factors/activities and/or natural-system dynamics that help "drive" ecological resource. Drivers tend to be large scale, long term, and not easily controlled or changed. They are influencers of change in natural systems. Examples of drivers include: Climate change.

The biggest drivers of environmental degradation are the following

- Population The human population on Earth is expanding rapidly, which together with even more rapid economic growth is the main cause of the degradation of the

environment. Humanity's appetite for resources is disrupting the environment's natural equilibrium.

- Fossil fuels – coal, oil and gas – are by far the largest contributor to global climate change, accounting for over 75 per cent of global greenhouse gas emissions and nearly 90 per cent of all carbon dioxide emissions. As greenhouse gas emissions blanket the Earth, they trap the sun's heat.

- Ecosystem degradation important direct drivers include climate change, nutrient pollution, land conversion leading to habitat change,
- Overexploitation, and invasive species and diseases. That happen intermittently. Changes in ecosystem services can feed back to alter drivers.

2.1.3. Impacts *of Social Environment Change*

It is only logical that an increase in the world's population will cause additional strains on resources. More people means an increased demand for food, water, housing, energy, healthcare, transportation, and more. And all that consumption contributes to ecological degradation, increased conflicts, and a higher risk of large-scale disasters like pandemics. An increase in population will inevitably create pressures leading to more deforestation, decreased biodiversity, and spikes in pollution and emissions, which will exacerbate climate change. Ultimately, unless we take action to help minimize further population growth heading into the remainder of this century, many scientists believe the additional stress on the planet will lead to ecological disruption and collapse so severe it threatens the viability of life on Earth as we know it.

Each spike in the global population has a measurable impact on the planet's health. According to estimates in a study by Wynes and Nicholas (2017), a family having one fewer child could reduce emissions by 58.6 tonnes CO_2-equivalent per year in developed countries.In Kasha mountain forest area, forest coverage is increased in extent level however deforestation to the demand for farm land increased .

2.1.4. Responses to Social *Environment Change*

Water shortages, soil exhaustion, deforestation, air and water pollution afflicts many areas. If the world population continues to multiply, the impact on environment could be devastating. Capita are depleting natural resources and degrading the environment.Population and Environment Linkages. As the population increases, more and more land is deforested and over-farmed. Forest coverage has declined from 40 percent 75 years ago to only 3 percent today. People must travel farther and farther to find firewood, the principal fuel, which reduces time spent farming. Without firewood, many resort to burning animal dung, instead of using it to fertilize their depleted soil. Without trees to help hold it in place, the soil erodes from the steep highlands. As a result, many previously habitable areas have now been transformed into dry lands and deserts.

This vicious cycle exacerbates the effects of Ethiopia's droughts, leading to severe and ever more frequent crises. The 2003 famine affected more than 13 million people, and at least 6 million people now suffer from permanent food insecurity. But drought is not entirely to blame, as Haile wryly pointed out: Ethiopia "faces famine when we have a bumper harvest and when we have drought" since the amount of arable land per person is so low (1/2 hectare for 8 people). Ethiopia's population growth compromises its ability to achieve the productivity gains necessary to break the cycle and eradicate extreme poverty and hunger.

This situation is highly unstable, and could make Ethiopia vulnerable to future conflict. Haile pointed out that the country meets six of the eight demographic criteria associated with instability and conflict in **The Security Demographic** (Cincotta et al., 2003):

- a high proportion of young adults;
- rapid urban population growth;
- diminishing levels of per capita cropland;
- high mortality rates among working-age adults;
- differential growth rates among ethnic groups; and

- Rapid migration.

The youth bulge is especially prominent: since Ethiopia's school age population of 21 million is 29 percent of the population, Haile believes that "how we address the youth challenge today will determine whether we are heading in the right direction or not."

Women's Health: The Key to Development

The poor state of women's health is also a barrier to development. Ethiopia is one of the lowest ranked countries in Save the Children's 2004 "Mother's Index." One out of every 14 women dies from complications during pregnancy, and 114 infants die for every 1000 live births. A majority of girls get married at an early age, continue child-bearing until late in middle age, and are not encouraged to use modern family planning methods. Reproductive rights are improving, however: new laws allow women to terminate pregnancies for compelling reasons, set the legal marriage age at eighteen, and prohibit traditional female circumcision practices. Yet, Haile said, "The unmet need for family planning in Ethiopia still remains at 36 percent, which means [there is] still work to be done."

Increasing girls' education and women's opportunities can help improve women's health and stabilize population growth. Although Ethiopia spends a "laudable" 19 percent of its budget on education, reproductive health is not yet well integrated into the curriculum. As in other countries, Haile observed, "young girls get less opportunities than boys because of domestic responsibilities." Although Ethiopia has increased its overall primary school enrolment rate from 20 percent in 1993 to an impressive 62 percent, female secondary school enrolment remains staggeringly low, at only 14 percent.

Developing Policies, Implementing Solutions

Underlying these problems is the Ethiopian government's poor implementation of policies. Although the government has committed itself to reducing poverty and meeting the Millennium

Development Goals, its programs are not horizontally integrated, and focus on immediate crises rather than long-term environmental and population problems. Haile estimated that Ethiopia will need $122 billion in the next decade to achieve the Millennium Development Goals, but less than 0.5 percent of this amount has been allocated for reproductive health needs.

Although Ethiopia has developed an environmental policy that recognizes the impact of population factors on the environment, "like most of our policy documents, this one… suffers from lack of implementation," said Haile, who noted with frustration that Ethiopia's government seems to be "more interested in developing policies than implementing them." Government support is critical, since "any development initiative that is not adopted by the government" has little chance of success. "If we want to…have a national impact, and a long-term sustainable impact, the government has to adopt that program.

2.1.5. Outlook for Social Environment

98,557peoples is living in Semen bench *woreda*. , deforestations occur as a result of conversion of forest and shrub to farm land. Additional demands for farm land. Due to this reason, from 1990-2015 Crop land is increased by 1857 hectare while forest 4%, shrub,18,9 % and bush decreased respectively (source woreda agriculture office)

In the *woreda*. If the whole system continue as it is, soil erosion, land degradation and deforestation aggravate, and increase loss of soil fertility this Cause decries in agricultural productivity.

2.2. Economic Environment

2.2.1. State and Trend of the Economic Environment

Agriculture is the most important determinant of the Region’s economy and it will continue to play the leading role in the overall economy development of the region. The livelihood of the people is dependent on agriculture, however, agricultural system in the region is at subsistence level and food insecurity problem is increasing at alarming rate.

According to the current (WAOF) report in 2024, Contribution of Agriculture and other sectors to Semen bench *woreda* gross domestic product (GDP) is very high, which is:-

- Agriculture Sector 56%
- Industry Sector24%
- InvestmentSector10 %
- Service sectors 2%

As Information collected key informant and group discussion the main food crops utilized are maize, vegetables and root crops. They mainly consume cereal based foods together with vegetables and live stock product. Maize, sorghum, barley, wheat, teff and coffee are the major crops grown in the area. However, the topography of the woreda soil erosion, climate variability, deforestation etc are resulting in low production and productivity due to this facts agricultural productivity is decreasing by 15% in each year moreover more than 1525 peoples are affected by flood within 25 years. The proportion of Agricultural land 12578.85h/a, grazing land 1217 h/a, forest and wood land 12115.36 h/a land, water body 193.12 6h/a other purpose are 14888.5 h respectively

According to the woreda Agricultural office information the average land distribution per house hold is 0.85 h/a. However from the total agricultural land ,rill erosion, 3% sheet erosion 2% gully erosion 0,5%, flooding18% affect the land respectively.

The major trend of agricultural practices in the woreda

- Despite the Semen bench woreda is rich in agricultural history, it faces various challenges in the sector today. The majority of farmers are smallholders with limited access to resources, modern technology, and market linkages. Land fragmentation, inadequate infrastructure, and climate change impact further hinder agricultural productivity. Additionally, reliance on rain-fed agriculture makes the sector vulnerable to erratic weather patterns, leading to fluctuations in yields.

2.2.2.Drivers and Pressures of the Economic Condition

The driving force behind economic policy-making lies in the macro-economic objectives. The macro-economic objectives should be environmentally and socially sustainable. Obviously, the macro-economic objectives are: economic growth measured in terms of the percentage change in the Gross Domestic Product (GDP), employment, price stability, and equity. The very concept of

studying population dynamics and economic environment is that its interlinked nature. Natural resources.

2.2.3. Impacts due to the Economic Condition

The nature of economic growth can be analyzed according to economic sectors. Three indicators of environmental pressure, namely sectorial composition, sectorial rate of growt hand a change in sect oral production methods and techniques can be considered to understand the economic growth.

The Natural resources of semen bench woreda Kasha Mountain forest Ecosystem where degraded Approximately 35%, .according to the woreda agriculture and natural resource office report from the total proportion of land affected by deferent factors such as rill erosion , sheet erosion ,gully erosion and flooding caused loss of soil fertility .

2.2.4. Response of Economic environment

There are many potential policy responses to the environmental implications of local population pressure. The population policy of Ethiopia aims at

i. Closing thegapbetweenhighpopulationgrowthandloweconomicproductivitythroughPlannedreduction of population growth;
ii. improvingthecarryingcapacityoftheenvironmentbytakingappropriateenvironmentalprotectionmeasures; and
iii. Improvingthesocialandeconomicstatusofvulnerablegroups(women,childrenandelderly).

A number of livelihood strategies were adopted by the communities at a grass root level to reduce their vulnerability to risk situations and recover from the unhealthy events. For instance, income diversification,engagedinoff-farmactivities,livestockfattening,andchanging the cropping pattern from subsistence crop to perennial cash crops e.g., banana ,Coffee ,other spaces(Coro Rima, Jigger) and to develop crop rotation practices from cereal crops to leguminous crops which facilitate soil development/increasing soil fertility to increase production and productivity. In addition, population policy, family planning policy, forest protection policy and health policy(familyplanning,humanhealth),educationpolicyandsectorplan(qualityeducationforall) has

practically implemented at grass root level. To alleviate the problem and attain the Millennium Development Goals both the government and society are working together to achieve sustainable natural resource conservation.

Apart from the above major responses by the Government of Ethiopia, a new plan has beencoinedandputintopracticebydifferentcomponentsofthegovernmentinthisfiscalyearGrowth and Transformation Plan (GTP II).

GTP II focuses on ensuring rapid, sustainable, and broad-based growth by enhancing the productivity of the agriculture and manufacturing sectors, improving the quality of production, and stimulating competition within the economy.

The major objectives of GTP are to:-

- Expandandensurethequalitiesofeducationandhealthservicesthereby achievingtheMDGsinthesocial sectors,
- Establishfavorableconditionsfor sustainablestatebuilding throughthecreationofstabledemocratic and developmental state.
- Ensuregrowthsustainabilitybyrealizingalltheaboveobjectiveswithi nstablemacro-economicframework.
  - Thisbroadsocial,economic,andpoliticalaspectoftheGTParem anagedonthefollowingmajorpillars
- Sustainingfasterandequitableeconomicgrowth
- Maintainingagricultureasamajorsourceof economicgrowth
- Creatingconducive conditionsfortheindustrytoplaykeyrolein the economy
- Enhancingexpansionandqualityofinfrastructuredevelopment

2.2.5. Outlook for Economic Condition

The number of population in the study area is incising year to year it reduces the quality and quantity of natural resources through overexploitation, intensive farming and land fragmentation.

Regions with high population pressure face scarcity of arable land, which leads to shortened/removed fallow period, declining soil fertility and farm income due to farm subdivision. And the subsistence mode of economic situation that based on farming, Animal husbandry fuel wood collection will minimum the limited natural resources. Then natural environment could not be able to provide the environment service.

2.2.6. Options for future Action

Ethiopia is gifted with abundant natural resources of adequate landmass, fertile soil, favorable climate, water, wildlife, and others. Many of its resources are not properly identified, well managed, and fully exploited. In Ethiopia, natural resources are under the influence of various interconnected factors like population pressure, agricultural expansion, migration, rapid urbanization, resettlement, climate change, and environmental pollution. Its huge population number had been putting a great burden on the sustainability of almost all types of natural resources. There is, therefore, serious degradation of land, water, forest, rangeland, and wildlife resources that appear to feed off each other. This results in severe soil loss, low vegetative cover, unsustainable farming practice, continuous use of dung and crop residues for fuel, overgrazing, and destruction and/or migration of wildlife, which again are intensifying the degradation of available resources in a vicious circle.

The Ethiopian governments have taken several steps to address these problems like launching soil and water conservation campaign, tree planting programs, and others; success to date, however, has been limited.

- Special attention has to be given to properly manage the natural resources and ecosystems; so that, it can continue to provide the goods and services the population need.

- Awareness creation should be given on the links of climate change, overpopulation natural resource degradation to the overall environment

- Control and limit human population, this is the major source of environmental degradation. Use only renewable and sustainable products, materials and energy. Protect natural and biological biodiversity. Limit and reduce economic growth, which comes at enormous environmental costs.

3. Physical Environment of Kasha

3.1. Land Use Land Cover Change of Kasha Ecosystem

3.1.1 State and trend of Land Use Land Cover Change of Kasha Ecosystem

The definition of land use and land cover has been used interchangeably in the land use research community because of the availability of many existing information systems. However, these two terms explain two different issues and meanings. Land cover refers to the observed biophysical cover on the earth's surface including vegetation, bare soil, hard surfaces, and water bodies. Whereas land use is the utilization of land cover type by human activities for agriculture, forestry, settlement, and pasture by altering land surface processes including biogeochemistry, hydrology, and biodiversity. Changes in land use and land cover are caused by direct and indirect consequences of human activities on the environment to have a better life.

Land use / Land cover change plays a vital role in the study of global change. Land use / Land cover and human or natural modification have largely resulted in deforestation, biodiversity loss, global warming, and an increase in natural flooding. Thus environmental problems are often related to Land use/ Land cover change. The land use/land cover pattern of a region is an outcome of natural and socio-economic factors and their utilization by the man in time and space. The land is becoming a scarce resource due to immense agricultural and demographic pressure. Hence, information on land use/land cover and possibilities for their optimal use is essential for the selection, planning, and implementation of land use schemes to meet the increasing demands for basic human needs and welfare. This information also assists in monitoring the dynamics of land use resulting from changing demands of the increasing population.

Ethiopia is among the countries characterized by diverse vegetation zones. However, the high demand for agricultural land due to growing human population has contributed to the deterioration and depletion of forest resources of the country. Most recent studies reported the decline of natural vegetation including forests, shrub and woodlands due to conversion to agricultural and grazing lands, opening up settlements areas in different parts of the country Marohn, & Cadisch, 2016; Worku, 2014). FAO (2015) indicated that forests of Ethiopia declined at the rate of 0.8% from 1990 to 2015.

Ethiopia is historically passed significant dynamics in LULC for many decades. However, nowadays, LULCCs and degradation are increasing at an alarming rate, playing a significant role in the increasing rate of soil erosion. The need for more cultivated lands has negatively affected the presence of forest and grasslands, eventually fostering soil erosion

Ethiopia is characterized by a rich but shrinking diversity in biological resources such as forest, woody and grassy lands, shrubs, varied wildlife, and fertile soil. It is also renowned for its massive mountain ranges, high flat plateaus, deep gorges, river valleys, lowland plains, extensive wetlands, and deserts. Landscape degradation by soil erosion has increased considerably in the Ethiopian highlands since the deforestation of the natural mountain forests and the cultivation of large areas, resulting in serious danger to our country.

The type of land use in the study area is two which are open filed farmland and agro forestry. According to (Henoket al.,2017), the agro forestry land of the district is composed of Coffee arabica L., as main cash crop integrated with food crops such as false banana (EnseteventricosumWelw. Cheesman), banana (Musa sapientum L.), taro (Colocasiaesculenta L. Schott) and spices like korarima (Aframomumcorrorima Braun). Moreover, various fruit trees such as mango (Mangiferaindica L.), avocado (Perseaamericana Mill.), papaya (Carica papaya L.) and orange (Citrus sinensis L. Osbeck) are also part of the farming system. Furthermore, native trees like AlbiziagummiferaJ.F.Gmel.C.A.Sm., Cordia africana Lam., MillettiaferrugineaHochst.Baker, PolysciasfulvaHiern. Harms are kept for shade, fodder, firewood, medicinal value and soil fertility maintenance. On the other hand, on the cropland, cereal crops like maize (Zea mays L.) are integrated with root vegetables like taro and park trees (Henoket al., 2017).

Kasha forest is located or surrounded by four districts (woredas) such as in North -semenbench, in South-southeast Shay Bench, northeast- Chena and in South-Debub bench. Also, the forest has different names in the Wordas for example in the North - Sem bench and kasha, in the South - Southern bench, in South East "Yemengest den" and gay shema in North East. For this study purpose, we call it the **Kasha** (gay shema) forest ecosystem. According to North Benchi Land Administration office, Kasha kebele is one of the in the woreda, and also the total area of kasha kebele was 1440 ha.

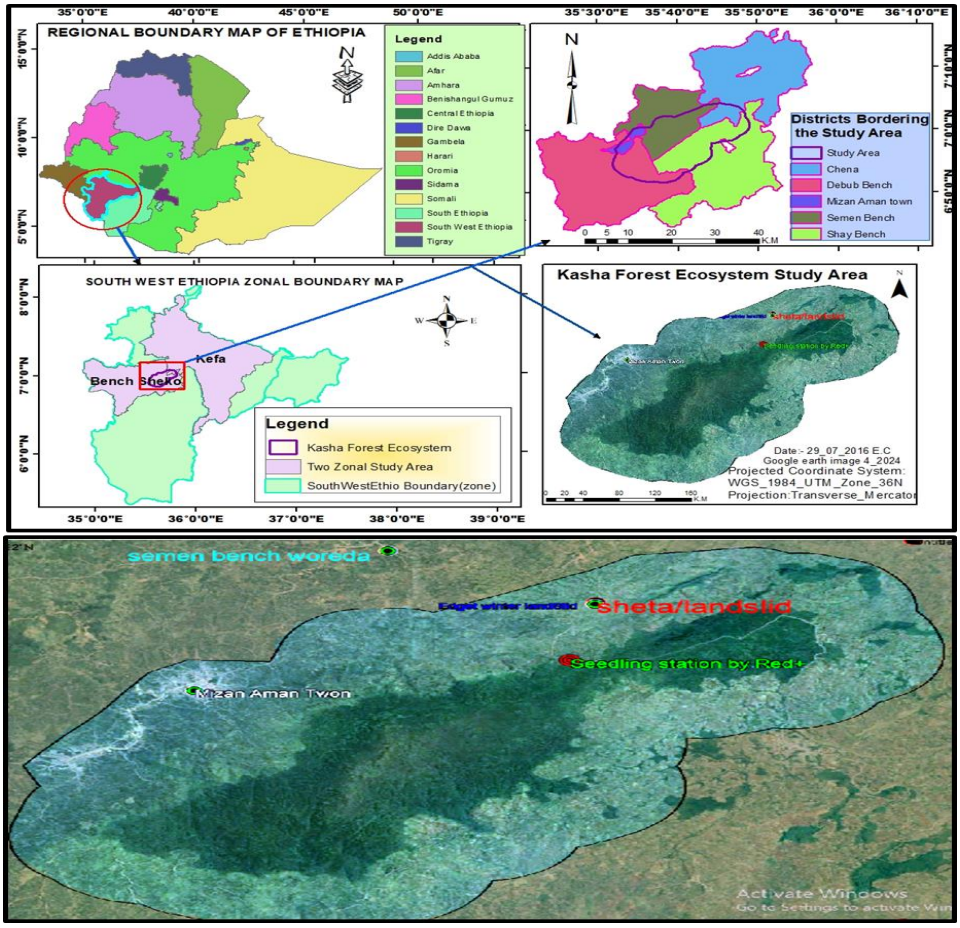


Figure 4 Study Map of Kasha Forest Ecosystem

Figure 5 LULCC map of Kasha Forest Ecosystem from 2002 to 2024 G.c

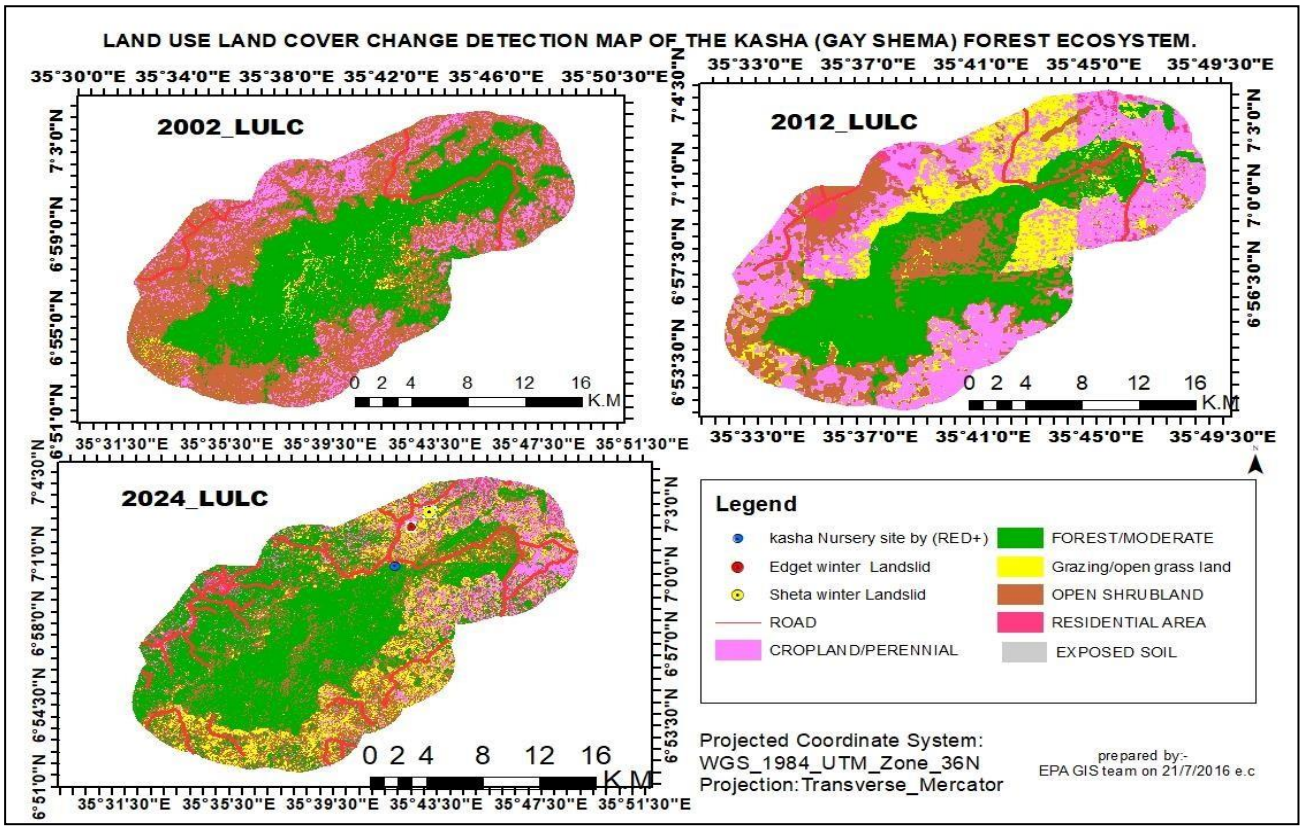


Table 5 Land use Land Cover Change of Kasha Forest Ecosystem, North Benchi Woreda

LULC Class Name	2002_ha	2012_ha	2024_ha
Grazing/grass land	1037.996	6299.354	5429.012
Degraded land	125.754	182.986	161.919
Shrubland	19250.185	9067.055	10522.141
Forest	17125.661	12895.446	20775.847
Settlement	718.360	1288.095	2374.359
Cropland	5864.946	14389.965	4859.624
	44122.902	44122.902	44122.902

Source: - EPA GIS team 2024.

As indicated in the classification scheme Grazing/grass land, degraded land, Shrub land,Forest land, Settlement and crop land are the major LULC classes for the study periods. As it has been observed from the above table, from the year 2002 to 2012G.c, Grazing/grass land was increased

from 1037.9ha to 6299.3 ha farmland but from the year 2012 to 2024 G.c grazing land was declined in to 6299.3 ha to 5429 because of most of grazing lands was changed in to settlement area. Degraded land in the area was increased from 125.7 ha to 182.9 ha from the year 2002 to 2012 G.c, whereas degraded land was declined from 182.9 ha to 161.9 ha because of REDD+ project implement 2012afforestation activity around Kasha forest ecosystem. The other classification scheme like Shrub land was declined from 19250.2 ha to 9067.05 ha from the year 2002 to 2012 but also increased from 9067.05 ha to10522.1ha from the year 2012 to 2024 G.c. The forest area was 17125.661 ha in 2002, 12895.446 ha in 2012 and also 20775.847 ha in 2014. This shows the total coverage was increased due to forest plantation campaign and REDD+ project implement 2012afforestation activity around Kasha forest ecosystem. But, the extent of natural forest was reduced due to lack of buffer zone.

Within 10 years from 2002 to 2012 Grazing/grass, shrub land, and Forest decreased by (5,261.358), (10,183.13), and (4,230.215) hectares respectively. During this period there was high rapid urban and cropland expansion, in other words, cropland, and settlement increased by (8,525.019), and (569.735) hectares respectively. Following this there were very high. Land degradations for example from 2002 to 2012 year's (57.232) hectares of land were damaged.

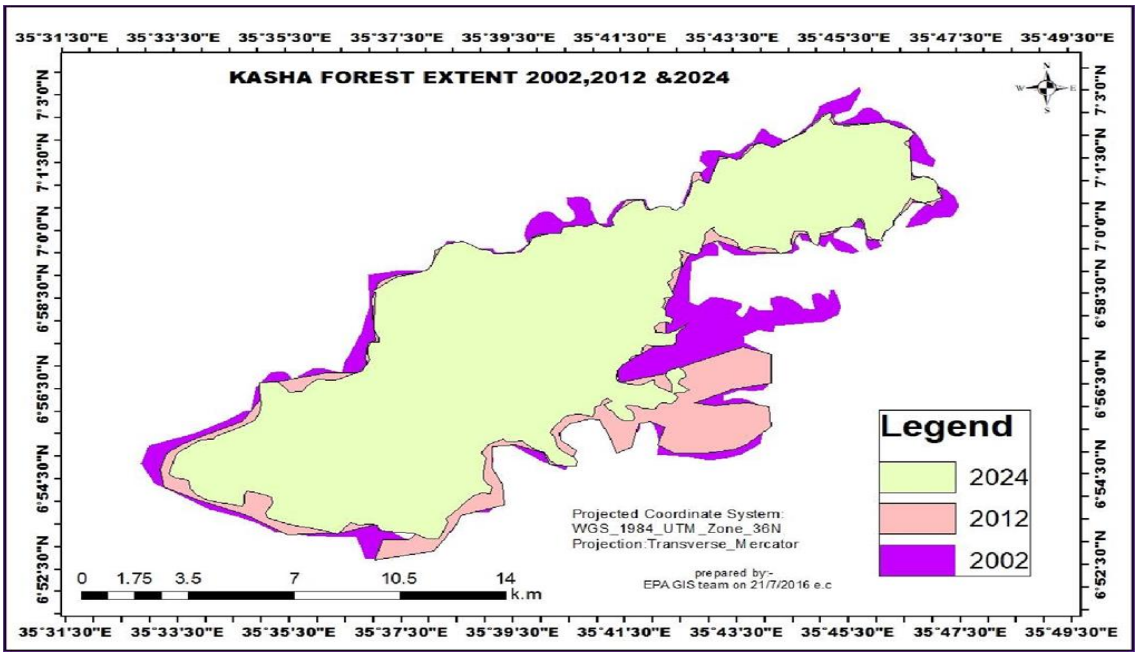


Figure 6 LULC map of that shows the Extent of Kasha forest

Table 6 Forest Coverage

2002_ha	2012_ha	20024_ha
19634.45	16861.27	14663.61

Note: This forest hectare coverage shows the only extent of kasha forest but does not include outside and the forests density and other types of land use classes like shrub and grasslands.

According to the table & map explained in the above, the extent/ degree of forest coverage was 19634.45ha in 2002, 16861.3 ha in 2012 and also 14663.6 ha in the year 2024 G.c. based on this the extent of Kasha forest ecosystem was decreased by 4,970.85 ha. So, the forest coverage was degraded highly from year to year.

Table 7: land use land cover change Matrixes between 2002 and2024

Land Class Name		Land Class_2024						
		Crop Land	Degraded land	Forest	Grazing/grass land	Settlement	Shrub land	Grand Total
class	Crop Land	1308.36	58.11	1708.06	825.18	695.75	1184.36	5779.82
Land Class in 2002	Degraded Land	20.83	7.79	25.78	16.12	24.24	30.96	125.72
	Forest	593.9	8.05	11500.5	1110.15	165.53	3746.4	17124.6
	Grass Land	78.75	2.04	379.63	188.61	20.87	368.08	1037.97
	Settlement/Urban Land	116.27	16.34	216.79	97.17	110.78	160.81	718.15
	shrub land	2726.29	67.13	6928.92	3180.11	1344.52	5000.44	19247.40
	Grand Total	4844.49	159.46	20759.69	5417.33	2361.68	10491.10	44122.902

According to land use land cover change Matrixes between2002 and2024, cropland was mostly converted to Forest, Shrub land, and Grazing/grass land (1708.06), 1184.36, and 825.18, respectively. Table shows that shrub land declined by 8,756.4 hectares from the year 2002 to 2024 the following change matrix table also shows that shrubs converted to forest(6928.92 hectares), and forest to shrub land 3746.42 hectares which takes the highest rank conversion.

According to North Benchi Investment office the total are of land given for investment was 47.75 ha for different investment activity like stone mining, coffee drying, dairy farm(in the forest area) and Stone crusher. This indicates different land uses are changed in to investment land.

3.1.2 State of Land Degradation in Kasha forest ecosystem

Land degradation is defined *as a* negative trend in land condition, caused by direct or indirect human-induced processes including anthropogenic climate change, expressed as long-term reduction or loss of at least one of the following: biological productivity, ecological integrity or value to humans. This definition applies to forest and non-forest land: **forest degradation** is land degradation that occurs in forest land. **Soil degradation** refers to a subset of land degradation processes that directly affect soil.

Land degradation, in turn, includes all processes that diminish the capacity of land resources to perform essential functions and services in these ecosystems. Land degradation is a great threat for the future and it requires great effort and resources to ameliorate. The major causes of land degradation in Ethiopia are the rapid population increase, severe soil loss, deforestation, low vegetative cover and unbalanced crop and livestock production. Inappropriate land-use systems and land-tenure policies enhance desertification and loss of agro biodiversity. Utilization of dung and crop residues for fuel and other uses disturbs the sustainability of land resources. The supply of inputs such as fertilizer, farm machinery and credits are very low. The balance between crop, livestock, and forest production is disturbed, and the farmer is forced to put more land into crop production. Sustainable land management consists of technical and institutional measures initiated by individuals or societies to maintain land productivity and other functions of land resources for present and future generations.

In Ethiopia agricultural land is tilled using an ox-plough system; this exposes the soil to rain, particularly during the onset of the rainy season. The process of soil erosion is a consequence of rainfed farming on steep slopes in the absence of sufficient counter-measures. In the study area (i.e. Semen Benchi woreda) most of

the local community plough high slope area especially around Kasha forest area to improve their production. Due to these the fertile soil resources was highly degraded.

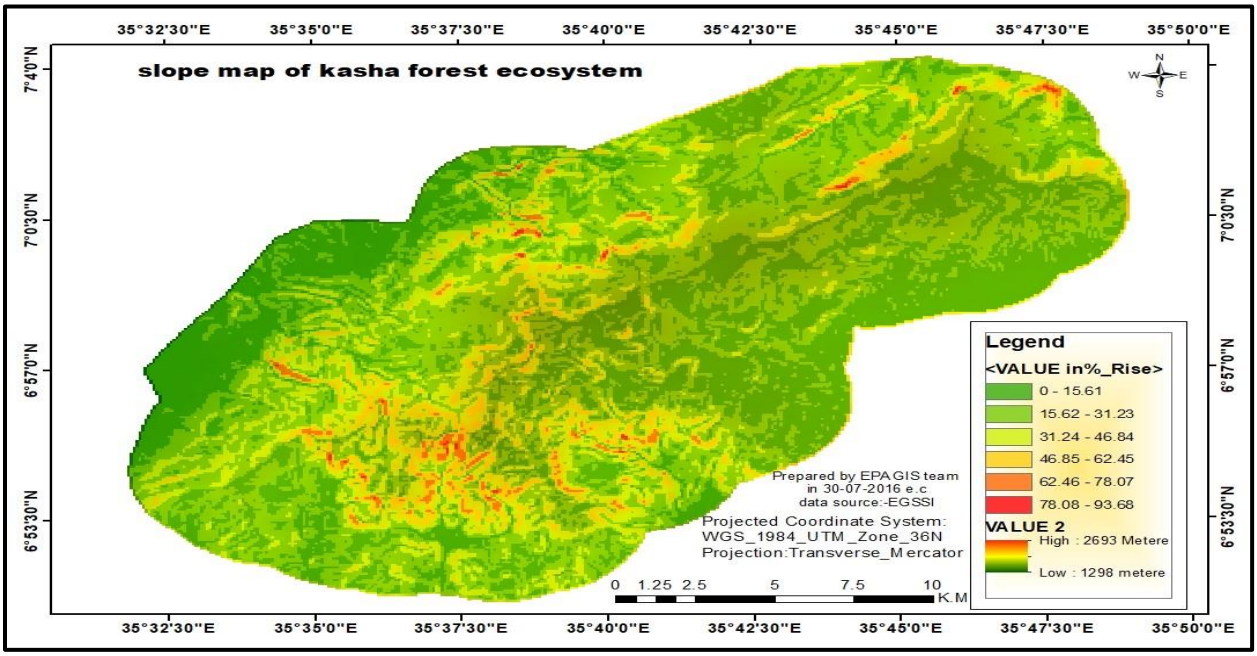


Figure 7 Slope view of Kasha Forest ecosystem

According to the above figure the slope of kasha forest is 2221 m above the sea level and also the local communities plough the land beyond the recommended slope of plaguing land. Due to these the forest land in the surrounding area exposed to landslide.

Soil erosion has been severe throughout the Highlands, but mainly on agricultural land; the current severity and extent of soil degradation seriously threaten food security. In response, a number of soil and water conservation measures have been successfully implemented over the past 35 years in some parts of the High-lands. This is highly encouraging, but greater emphasis must be given to conservation in the coming decades.

Figure 8 **Partial view of degraded land in Kasha forest ecosystem**

(Source: Field photo, 2024)

3.1.3 Drivers and pressures for land Use Land Cover Change

Drivers for land Use Land Cover Change

The fundamental reasons for LULC changes are identified with asset deficiency that prompted an expansion in the power of production, market openings, strategy mediation, disappointment of versatile limit and expanded defenselessness, and change in social association in asset access. This further supported by Yirdaw et al. (2017), (Mganga et al., 2018) and (Alemu et,al,2015), population pressure and unfeasible land-use rehearses came about in LULC changes and prompted declining in food uncertainty and arrangement of environment administrations, social and political precariousness and decrease in biological system's strength to common atmosphere fluctuation. The same work reveals population growth articulated change in LULC the most recent two centuries and the progressions will go quicker later on (Roy et al., 2010). LULC

changes greatly influence catchment hydrologic processes such as surface runoff and stream flows (Gyamfi et al., 2016; Koch et al., 2012; Rientjes et al., 2011). LULC change significantly impacts the productivity of rangelands. Besides, it impacts the climate and weather conditions from local to global scales (Kayet et al., 2016).

- Population Growth:In the 1994 Census, Bench Sheko had a population of 325,878 in 85,236 households, of whom 163,339 were men and 162,539 women; 23,502 or 7.21% of its population were urban dwellers.

  Based on the 2007 Census conducted by the CSA, this Zone has a total population of 652,531, of whom 323,348 are men and 329,183 women; with an area of 19,252.00 square kilometers, Bench Sheko has a population density of 33.89. While 75,241 or 11.53% are urban inhabitants, a further 398 or 0.06% are pastoralists. A total of 157,598 households were counted in this Zone, which results in an average of 4.14 persons to a household, and 151,940 housing units. Based on CSA data the number of population in Benchi Sheko in the year 2007 was increased by twice of 1994 E.c.This indicates that population increment was on of the driving factor for LULC as well as Natural forest degradation in Kasha forest ecosystem.
- Urban settlement: In Ethiopia, urban areas are basically defined as places having a minimum population of 2,000 (Ministry of Urban Development and Construction (MUDCo), 2012) and areas having a population from 2,000 to 20,000 are classified as small towns that account more than 85 percent of the urbanized areas in the country (MUDCo, 2012).

  Ethiopia has experienced the fastest rates of urbanization, and one of the major challenges of urban development in the country has been spontaneously emerging settlements, which have contributed to the country's increasing and unplanned urban growth trends, but spatial drivers for the spontaneity were overlooked. The presence of settlement patches in rural areas is the primary cause of this, and such trends usually intensify between the time an area receives urban entitlement and the preparation of its first formal plan centered on social-cultural services and physical infrastructures, hastening the haphazard urbanization process.

  The social-cultural services are more prevalent at the inception of urbanization, typically forming patches of spontaneously emerging settlements. Physical infrastructures, on the other hand, drive patch connectivity and increase the intensity of the built up spaces, and determine the growth directions of urban areas.

According to GIS data analysis 2024, settlements in the study area was 718.4 ha in 2002 G.c increased 1288.1 ha in 2012 G.c and 2374.4 ha 2024 G.c. So, the urban settlement/residential area was increased by 1656 ha from the year 2002 to 2024 G.c.

- Agricultural Land Expansion:

3.1.4 Impacts of land use land cover change and Land Degradation on Kasha Forest ecosystem

Land use/ land cover change also has impacts on local and regional climate and water resources. The LULCC also affect runoff, evapo-transpiration and surface erosion in a watershed (Esyase, 2010). The destruction of vegetation cover affects rainfall amount. For example, tree canopy and leaf litter can help reduce the impact of raindrops on the ground, hence reduce soil erosion, while roots hold the soil in place and also absorb water. In the absence of vegetative cover, soil erosion will result and there is low productivity. LULC changes also, especially vegetation cover, affect water and energy balances. The type of land cover, obviously, can affect both rate of infiltration and runoff amount. The surface and ground water flows are significantly affected by type of land cover. Low level vegetative cover could also affect infiltration and could lead to reduced ground water levels and therefore the base flow of streams.

Land use land cover change had significant adverse impact on soil quality and sustainability of agricultural production and productivity in the area.

3.1.5 Response measures in improving the status of land use land cover change

REDD+ project implement 2012afforestation activity around Kasha forest ecosystem

The government and local community implement afforestation activity in the surrounding environment

Figure 9 Degraded land modified due to ecluptus plantation by the local community

3.1.6 Outlooks

Based on the CSA, 2007 Census the total population was 652,531; Bench Sheko has a population density of 33.89. Based on CSA data the number of population in Benchi Sheko in the year 2007 was increased by twice of 1994 E.c.CSA, (2007) indicates the total population of study area (Semen Benchi woreda) was 106,490, the population projection shows in the year 2022 the total population of semen benchi rises in to 145,932.within 15 years difference(from the year 2007 to 2022) the population was increased by the number 39,442.As the population growth increases as this amount within the next 30 years it will raised by twofold. This indicates that population increment will directly impact on the total destruction of Kasha forest ecosystem.

3.2. State and Trend of Forest Faunal and Flora in Semen Benche

Ethiopia is gifted with abundant natural resources of adequate landmass, fertile soil, favorable climate, water, wildlife, and others. In Ethiopia, the diverse forest resources available provide goods and services of significant values to the society, environment and economy. Afromontane vegetation, which covered more than 50% of the highlands in Ethiopia, is one of the key biodiversity hotspot areas in the country, with enormous plant species [Teketay,etal 1996). Many of its resources are not properly identified, well managed, and fully exploited. In Ethiopia, where more than 80% of the population is living in rural areas (Beyene 2015; CSA 2015) and depend on subsistence small scale agriculture (Alemu 2017), securing food and livelihood is inseparably linked to the exploitation of natural resources (Baye 2017; Nigussie et al. 2018). Intense pressure from various human activities, and the application of improper farming and management practices had been posing serious threats to the sustainability of the natural resources and maintenance of balanced ecosystems (Gebreselassie et al. 2016; Marques et al. 2016). Ethiopia is endowed with unique ecosystems and biodiversity that provide considerable contribution to people at local, regional, national and global levels. A great proportion of these biodiversity and ecosystem services are mainly prevailing in forest and woodland ecosystem of the country. The livelihoods of most the peoples in the country are highly interlinked directly or indirectly with forest resources. It plays enormous environmental, socio-economic significance and thereby contributes a great role in the sustainable development of the country as well. Forests and woodlands play vital roles in ensuring food security and sustainable livelihoods for millions of households throughout Ethiopia. According to a study report (UNEP, 2016), Ethiopia‘s forests generated economic benefits in the form of cash and in-kind income equivalent to USD 16.7 billion, or 12.9% of the measured value of GDP in the year 2012-13. Recent estimates indicate that about 26-30% of the total coffee production of the country originates from wild and semi-managed coffee forests and the value of wild coffee is estimated at USD 130 million/annum (Tesfaye, 2006; Lemenih, 2009). Furthermore, Ethiopia has also earned USD 12.68 million from the export of gums and incense in the year 2009/10 (MoFED, 2010). Since the 1960s, much effort has gone into designating protected areas in Ethiopia with the hope of saving areas of crucial importance for biodiversity conservation. However, most of the forest fauna and flora resources of Ethiopia are highly exposed to degradation at an alarming rate. A century ago,

forests covered about 40 % of the total landmass of the country. The spatial pattern of the forest has been shown a rapid decrement from 40% in 1900 to 16% in 1954, 8% in 1961, 4% in 1975, 3.2% (Journal of Resources Development and Management, Vol.67, 2020) and now it is estimated to be 17.35 million ha 15.7% (EFCCC 2015). The spatiotemporal forest cover change in Ethiopia has been attributed to natural and more importantly manmade factors. The major drivers of forest cover decline can be grouped as proximate driving factors and underlying driving factors in Ethiopia. Proximate driving factors include; expansion of resettlement, expansion of agricultural practices and charcoal burning and cutting trees for fuel whereas, underlying driving factors include; economic, institutional, technological, cultural, demographic and biophysical factors. The alarming rates of forest fauna and flora degradation have been posing environmental, social, and economic problems. The environmental implications of forest degradation are climate change, siltation of water bodies, and degradation of wetlands, soil erosion, and a reduction in agricultural production. The state of natural resources in Ethiopia is under the influence of various interconnected factors such as population pressure, migration and resettlement, land-use changes for agriculture, environmental pollution, the change in climate, and rapid change in the lifestyle of people among other.

The study was conducted in the South west regional state's Semen Bench-Worda Kasha forest eco system. The total forest ecosystem area is estimated to 44122.902ha of land, from this forest ecosystem covers 31,277.98 ha, and it contains different forest flora and faunal species from those species the natural forest flora is dominant in the ecosystem.

The study collected data from primary sources, including field visits (FGD) of four surrounding kebeles and key informants with kebele administrators and development agents while Secondary data was gathered from published documents, region and woreda reports, and Landsat images to understand the impact of forest cover change and deforestation.Despite the ecological and economic benefits it provides, the forest and woodland ecosystem ofKasha has been and is still heavily exposed to severe degradation over the years. In recent times, unregulated agricultural expansion, unsustainable harvesting and weak institutional capacity have led to the devastation of forests and woodlands and their associated biodiversity. With the increasing population pressure, the natural vegetation is still being cleared at an alarming rate to open up land for agriculture and human settlements).

Key terms

- The Convention on Biological Diversity (CBD) defines biodiversity as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems."
- The Millennium Ecosystem Assessment and TEEB (The Economics of Ecosystems and Biodiversity) demonstrated that biodiversity underpins ecosystem goods and services that are required for the survival of human societies and for the future of all life on the planet. In addition, biodiversity generates considerable economic value through the provision of goods such as food, water, and materials, and services such as climate regulation, pollination, disaster protection, and nutrient cycling.
- In Ethiopia, the forest is defined as land occupied with trees (natural and planted, including bamboo) attaining a height of more than 2 meters at maturity, a canopy cover of more than 20% and covering an area of more than 0.5 ha, with a minimum width of 20 meters (MEFCC 2018). This forest definition differs from the definition used for international reporting to the Global Forest Resources Assessment (FAO) and from the forest definition used in the National Forest Inventory which both applied the FAO (2015) forest definition with the thresholds of 10% canopy cover, a 0.5 ha area, and a 5 m height. The reason for Ethiopia to change its national forest definition is to better capture dry and lowland-moist vegetation resources. In specific, the reason for lowering the tree height from 5 to 2 m is to capture Termilania-Combretum dense woodlands found in Gambella and BenishangulGumuz Regional States which in its primary state consists of trees reaching a height of around 2-3 m and above (MEFCC 2016).
- Drivers -are the social and economic imperatives that seek to fulfill human needs by creating the necessary conditions and, through material consumption, support wellbeing, health, security, and freedom. The provisions for supporting life include food and raw materials, water, shelter, health, culture, security, and infrastructure (Bradley & Yee (2015).
- **Consumption drivers.** This theme reflects the impacts of cities that result from the resources (e.g. food, energy, water, goods) used by its inhabitants and businesses and often have global reach.
- Human pressures. This theme refers to human-induced disturbances (e.g. noise, light and water pollution) of natural habitat within cities' jurisdiction.

- **Pressures-** are human activities that induce changes to the environment, for instance, the discharge of chemical, physical or biological agents, or land use changes. The intensity of the pressures depends on the technology and extent of activities that vary across geographic regions and spatial scales (Bradley & Yee: 2015).
- ***State-*** refers to the physical, chemical, and biological components of the natural environment (i.e. the living and non-living components).
- ***Impacts-*** are the resulting changes in the quality and functioning of the ecosystem that influence living things including the production of ecosystem goods and services.
- ***Responses-*** are actions taken through policies and regulations to prevent, compensate, ameliorate, or adapt to changes in the state of the environment.

Benefits of Forest faunal and flora ecosystem

In addition, forests provide benefits such as medicine, fuel, protection, tools and other uses (Wang2004). Forest land is also important for watershed protection, soil and water conservation, wildlife conservation and recreational value (Eshetu2004).Benefits of forest flora and fauna:biodiversity provides many valuable goods and services –nature's contributions to people. Biodiversityhelps regulate climate through carbon storage and control of local rainfall, filters air and water, and mitigates the impact of natural disasters such as landslides and coastal storms. Direct benefits include timber from forests, fish from oceans and freshwater systems, crops and medicines from plants, cultural identity, and the health benefits gained from access to nature.The following categorization of ecosystem services has been used by the Millennium Ecosystem Assessment (MEA).the benefits obtained from forest and woodland ecosystem fall into the four major categories (provisioning, regulating, supporting and cultural) services.

1. **Provisioning services** – ecosystem services that combine with built, human, and social capital to produce food, timber, fiber, or other "provisioning" benefits. For example, fish delivered to people as food require fishing boats (built capital), fisher-folk (human capital), and fishing communities (social capital) to produce.

2. **Regulating services** – services that regulate different aspects of the integrated system. These are services that combine with the other three capitals to produce flood control, storm protection, water regulation, human disease regulation, water purification, air quality maintenance,

pollination, pest control, and climate control. For example, storm protection by coastal wetlands requires built infrastructure, people, and communities to be protected. These services are generally not marketed but have clear value to society.

3.**Cultural services** – ecosystem services that combine with built, human, and social capital to produce recreation, aesthetic, scientific, cultural identity, sense of place, or other "cultural" benefits. For example, to produce a recreational benefit requires a beautiful natural asset (a lake), in combination with built infrastructure (a road, trail, dock, etc.), human capital (people able to appreciate the lake experience), and social capital (family, friends and institutions that make the lake accessible and safe). Even "existence" and other "non-use" values" require people (human capital) and their cultures (social and built capital) to appreciate.

4. **Supporting "services"** – services that maintain basic ecosystem processes and functions such as soil formation, primary productivity, biogeochemistry, and provisioning of habitat. These services affect human well-being indirectly by maintaining processes necessary for provisioning, regulating, and cultural services. They also refer to the ecosystem services that have not yet, or may never be intentionally combined with built, human, and social capital to produce human benefits but that support or underlie these benefits and may sometimes be used as proxies for benefits when the benefits cannot be easily measured directly.

3.2.1. State and Trend of Flora and Fauna in Kasha Forest Ecosystem

The flora of Ethiopia is very diverse with an estimated number between 6,500 and 7,000 species of higher plants, of which about 15 per cent or more are probably endemic. Ethiopia is considered as the fifth largest floral country in tropical Africa (http://chora.virtualave.net/biodiversity.htm). Flora and fauna are the collections of all plants (flora) and animals (fauna) living in a particular region that interact in various ways to form an ecosystem. Flora and fauna have different roles in the oxygen and carbon dioxide cycles. Flora uses carbon dioxide in the air to produce oxygen, while fauna produces carbon dioxide when they respire. The benefits obtained from forest and woodland ecosystem fall into the four major categories (provisioning, regulating, supporting and cultural) services

Table 8 Flora (plant) Species are found in the study area.

R.no	Scientific name	Amharic name	Remark
1	Accaciaabyssinica	ቆንጥር	

2	Accacialbida	ግራር	
3	Accaciabrevispica	ቀንጠፋ	
4	Croton macrostachyus	ብሳና	
5	Grevillearobusta	ግራቪሊያ	
6	Carbaedulis	ጫት	
7	Celtis Africana	አምላቃ	
8	Cordia Africana	ዋንዛ	
9	Olea European	ወይራ	
10	Cyperusdigitatus	ፊላ	
11	Diospyrosabyssinica	ሰለቸኝ	
12	Croton macrostachyus	ብሳና	
13	Prunus Africana	ጥቁርእንጨት	
14	FicusVasta	ዋርካ	
15	Eucalyptus amaldulensis	ቀይባርዛፍ	

Source: - from filed observation 2024

Table 9 Faunal species are found in the area.

No	Scientific name	Amharic name	Remark
1	Columbus Monkey	ጉሬዛ	
2	Bush pig	የዱርአሳማ	
3	Common Bush buck	ድኩላ	
4	Tiger	ነብር	
5	Bush Duiker	ሚዳቋ	
6	Jackal	ቀበሮ	
7	lione	አንበሳ	
8	Vervet Monkey	ጦጣ	
9	Hayena	ጅብ	
10	**Buffalo**	**ጎሽ**	
11	**Monkey**	**ዝንጀሮ**	

Source:-from filed observation 2024

Table 10 Land uses land cover change detection 2024

LULC Class Name	Years		
	2002_ha	**2012_ha**	**2024_ha**
Grazing & grassland	1037.996	6299.354	5429.012
Degraded land	125.754	182.986	161.919
shrub land	19250.185	9067.055	10522.141
Forest	17125.661	12895.446	20775.847
Settlement	718.360	1288.095	2374.359
Cropland	5864.946	14389.965	4859.624
total	44122.902	44122.902	44122.902

Source: - 2024 land use land cover change detection.

Within 10 years from 2002 to 2012 Grazing/grass, shrub land, and Forest decreased by (5,261.358), (10,183.13), and (4,230.215) hectares respectively. During this period there was high rapid urban and cropland expansion, in other words, cropland, and settlement increased by (8,525.019), and (569.735) hectares respectively. Following this there were very high Land degradations for example from 2002 to 2012 year's (57.232) hectares of land were damaged.

3.2.2 Driver and Pressure of Deforestation and Forest Degradation

The Millennium Ecosystem Assessment highlighted the five main direct drivers of biodiversity loss: habitat change, overexploitation or unsustainable use, invasive alien species, climate change, and pollution. More recent analyses, including the Global Biodiversity Outlook 3, reported that these five drivers remain the principal causes of biodiversity loss and are either constant or increasing in intensity. An analysis of the proportion of threatened species on the IUCN Red List (mammals, birds, amphibians) affected by each driver showed that more than 80% are under threat from habitat loss, 70% from overexploitation and unsustainable use, and almost 30% from invasive alien species. Although climate change is an emerging driver, less that 20% of threatened species are affected by climate change and only 10% by pollution. The biggest driver of biodiversity loss is how people use the land and sea. This includes the conversion of land covers such as forests, wetlands and other natural habitats for agricultural and urban uses. Since 1990, around 420 million hectares of forest have been lost through conversion to other land uses. Sep 5, 2023.

Direct/Proximate driving Factors expanding agricultural activities (burning and removing of the tree, and overgrazing), fuel wood and charcoal, and resettlement expansion program leads to deforestation and forest degradation (Walle et al. 2011; Oljirra 2019) .The main direct drivers of deforestation are generally agreed to be logging and the expansion of agriculture and infrastructure. Forest fauna and flora ecosystem has long been threatened by a variety of land use pressures in Ethiopia. Deforestation and forest degradation in Ethiopia are driven by various factors including expanding agricultural activities, logging, and resettlement programs. Key drivers include logging, unsustainable exploitation of forest resources, logging, non-forestry investment, and new settlements. Forest fires, invasive species, and insect pest outbreaks also pose significant threats to the ecosystem. Demand for wood fuels is a major driver of forest degradation in Ethiopia. Though the role of firewood in forest degradation is somewhat contested, charcoal dominates cooking energy choices in urban areas and uncontrolled fires, livestock grazing in forest fauna and flora are widely recognized to contribute to forest degradation (Zerga&Gebeyehu 2016).

Figure 10Kasha Forest Ecosystem

Source – filed photo 2024

The main drivers and pressures of Kasha forest ecosystems are:

Forests are important sources of livelihood for millions of people and contribute to the national economic development of many countries. Despite their crucial importance in livelihood and climate regulation, forest resources all over the globe are subjected to enormous pressure resulting in deforestation and degradation due to the increase in human and cattle population and widespread rural poverty [FAO. *The state of the World's Land and Water Resources for Food and Agriculture (SOLAW*Nations: Rome, Italy; London, UK, 2011**1)**

According to Bradley and Yee (2015), the DPSIR model is useful for conveying complex environmental issues. As a systems-thinking framework, it considers the component parts of a system and how they relate to and interact with one another and other systems. The DPSIR model is commonly used in environmental management contexts to demonstrate the cause-and-

effect relationships between interacting components of social, economic and environmental systems (Bradley and Yee (2015).Forest losses can be caused by both human and natural phenomena. Human phenomena is more widespread than natural phenomena, through deforestation occurring when people clear forests and use the land for other purposes such as agriculture, infrastructure, human settlements and mining. Natural phenomena like disasters lead to the conversion of forests to other land uses if the forest does not regenerate naturally and there is no reforestation by peoples. Deforestation is a consequence of the interaction of environmental, societal, ethnic and political forces in a collapsed area. The respondents identified different factors as important drivers for forest flora and faunal changes in the ecosystem landscapes with population growth, fuel wood/charcoal collection, and the expansion of cultivated land as the most important drivers In addition, some of the respondents reported house construction, logging for income generation causes for the observed Land cover changes.

Forest degradation and deforestation: Forestry-related drivers of deforestation and forest degradation are usually illegal and conducted by persons who are less aware of environmental consequences of their act. The worst kinds are the illegal timber cuttings, fuel wood collection and also expansion of cultivated land in the ecosystem.

Population growth:-one of the most frequently cited underlying causes of forest decline is population pressure. That more population should translate into more deforestation and thus higher pressures to degrade forests makes intuitive sense. With an increased population, there would be more families in search of land for agriculture or looking for fuel wood or timber (Contreras-Hermosilla 2000). Population growth is a major cause of forest decline, as it leads to increased deforestation and consumption of natural resources. This leads to decreased land productivity, gully formation, groundwater loss, disease incidence, drought outbreaks, community conflicts, and rapid urbanization. The decrease in forest flora and fauna as result increases demand for land, fuel wood, building supplies, settlement sites, and infrastructure.

Fuel wood consumption's: the primary energy source for rural communities, gathering from Kasha forest ecosystem for home and market use, and for income generation by selling to cities.

The population's growth shows that in semen benche-woreda 106,490 **reached 145,932 within the last 22 years population density 371.7 and annual change 2.1%.** Many FGD and key

informant respondents indicated population growth as the main factor of change in Kasha forest ecosystems.

Illegal settlement around the Kasha forest ecosystem in search of farm land and grazing land to overtake other communal resources form forest area is increasingly each day. Grazing and forest lands were largely converted into settlement and farm lands, disrupting the normal functioning of the Kasha forest ecosystem.

Land tenure is crucial for preventing forest exploitation, as it allows local households to protect their land from outsiders. Enforcing land registration helps protect forests from deforestation and degradation. Local environmental awareness leads to better landscape care. The government is working to scale up PFM through community forest user groups and cooperatives, which manage and use forest resources according to their agreements.

Land certification issues hinder forest laws and regulations, allowing exploitation of forests. Local communities need the power to sustainably utilize and protect natural forests. The lack of clear ownership over communal lands has caused irreversible changes in forest ecosystem services, as people perceive the ecosystem as public and exploit its resources without restriction.

Land tenure system and weak land use policy: land privatization is a topic of considerable disagreement in Ethiopia. The government owns all forest and agricultural land, granting usufruct rights to citizens in the case of farmland and maintaining all management authority in the case of forestlands (Guillozet et al. 2011). Uncertain land tenure systems leading to low investment, including lack of ownership, trigger illegal logging and the so-called tragedy of the commons (Assefa& Bork 2014). Likewise, weak policy implementation on land use, low capacity of forest institutions, land use conflict, and policy discrepancies are aggravating forest cover loss in Ethiopia (Moges et al. 2010). The lack of responsibility among local populations for common forest resources leads to unenforced forest laws and regulations. To protect natural forests sustainably, communities need to gain the power to utilize and protect resources. The absence of clear ownership over wetland resources has caused irreversible changes in forest flora and fauna in Kasha ecosystems.

Institutional factors: the underlying driving factors of forest cover change in the area include: competing for jurisdictional authority over activities affecting forests; weak enforcement capacity; political superiority of forestry to quarrying site purpose, inexperience in enforcing

reforestation regulations, unclear tenure arrangements and boundaries, and unclear reporting requirements widely practiced in forest areas. Ethiopia's land privatization debate revolves around the government's ownership of forest and agricultural land, leading to low investment and illegal logging. The system is also exacerbated by weak policy implementation, low capacity of forest institutions, and policy discrepancies as a result of this Kasha forest ecosystem, which is degrading alarmingly. Forest logging, whether legal or illegal, leads to deforestation. Even if LULCC shows forest coverage shows 17,125.661 ha in 2002, 12,895.446 ha in 2012 and know it increased to 20,775.847 ha increased while the shrubs and bushes 19250.1852ha in 2002 and know it decreased to 10522.141ha in 2024 as result of the driver forest.

3.2.3. Impacts of Forest and Woodlands degradation

Impact of the degradation of forest faunal and flora in Kasha forest ecosystems

1. Habitat degradation and fragmentation: Habitat loss and degradation are the ultimate threats to biodiversity in the tropics (Haddad et al., 2015). This is caused by deforestation for wood products (especially fuel wood), fire, agricultural expansion, and overgrazing (EBI, 2014). In the Kasha forest ecosystem, intensive agriculture, firewood collection, free livestock grazing, climate change, biological invasion, land use and cover changes, infrastructure construction (road), erosion, climate change, overexploitation, and invasive species are increasingly threatening the biodiversity of forest flora and fauna and their ecosystem services to society and the environment. Ethiopia faces a significant issue of land degradation, with over 85% of land severely degraded and 75% affected by desertification (**Gebreselassie et al. 2016).** Soil erosion caused by water and wind, accounts for 56% of land degradation, followed by 28% by water and wind. This erosion leads to 75 billion tons of soil being taken annually, causing low agricultural productivity, food insecurity, and rural poverty. The UNCCD 2017 report reports that Ethiopia loses 30,000 hectares of agricultural land annually due to water erosion and over 2 million hectares of degraded land. Because of such forest ecosystem degradation, some flora and fauna species are becoming locally endangered, and many communities are economically affected (exposed to poverty). For example, buffalo, tigers, lions, and pigs, as well as the forest flora Pod carpus falcatus, Cordiaafricana, and Juniperusprocera, are highly threatened flora and faunal species in the area.

2. Land use land covers change of forest ecosystem

Direct loss of habitat at intersection locations, particularly on account of damage to the existing vegetation due to quarrying site activities and transport.

Gully formation of the area due to the quarrying and deforestation activities

Fragmentation to the forest and other important habitat areas may reduce home range and cause isolation of the forest fauna species.

Decline in the faunal population, their flow, and their movement. Due to the impacts of deforestation and quarrying activities, direct loss and fragmentation of habitat, noise, sound, and anthropogenic effects, the decline of the forest fauna is expected. Particularly for the small creatures that live in that proposed alignment and its adjacent areas.

3. Direct loss in the form of the removal of shrubs and trees: by the pressures and drivers of activities' approximately 8,728 ha of scrubs and bushes of trees removed, which might have a significant effect on the current ecosystem like:

The loss of trees will lead to a higher degree of soil erosion.

The loss of trees will reduce the ambient air quality since trees act as adsorbents of air pollutants, thereby improving the air quality.

The reduction in the number of trees, especially in or near congested market places, will enhance the weather conditions in the area.

Loss of such large numbers of trees may affect the ecosystem severely in the form of a change in the microhabitat.

Loss of diversity in agro ecosystems increases their vulnerability and thus reduces the sustainability of many production systems.

Reductions in the provision of regulating and support services can drive additional chemical use and may create harmful feedback loops (WHO and SCBD 2015). There is some evidence that farmers in homogeneous landscapes have higher incomes than farmers in heterogeneous landscapes (Watts and Williamson, 2015).

Loss and extinction of water bodies like the domaye, awoche and ure rivers

4. Increment of settlement:the urban–rural nexus Nowadays, the world is getting more urbanized than ever (Gebre and Gebremedh in 2019). Rural individuals in many countries had been migrating towards urban areas in search of a better livelihood, job opportunities, education, and well-being (Bewket and Abebe 2013). This has led to the unplanned and rapid expansion of small cities creating enormous pressure on natural resources. There has been extensive deforestation in order to construct dwellings and houses for the people. Such fast-growing urban areas are becoming more and more congested creating urban slums. Urban slums again are becoming major sources of pollution of all kinds; air, water, and noise (Kapur 2016) .the area coverage of settlement for the last 20 yrs. Shows718.36ha to 2374.359ha of land so forest ecosystem is disrupted alarmingly.

Figure 11 Partial View of Kasha Forest Ecosystem

Source: : filed photo 2024

Figure 12Dominant Tree Species in the Kasha Forest Ecosystem

source: filed photo 2024

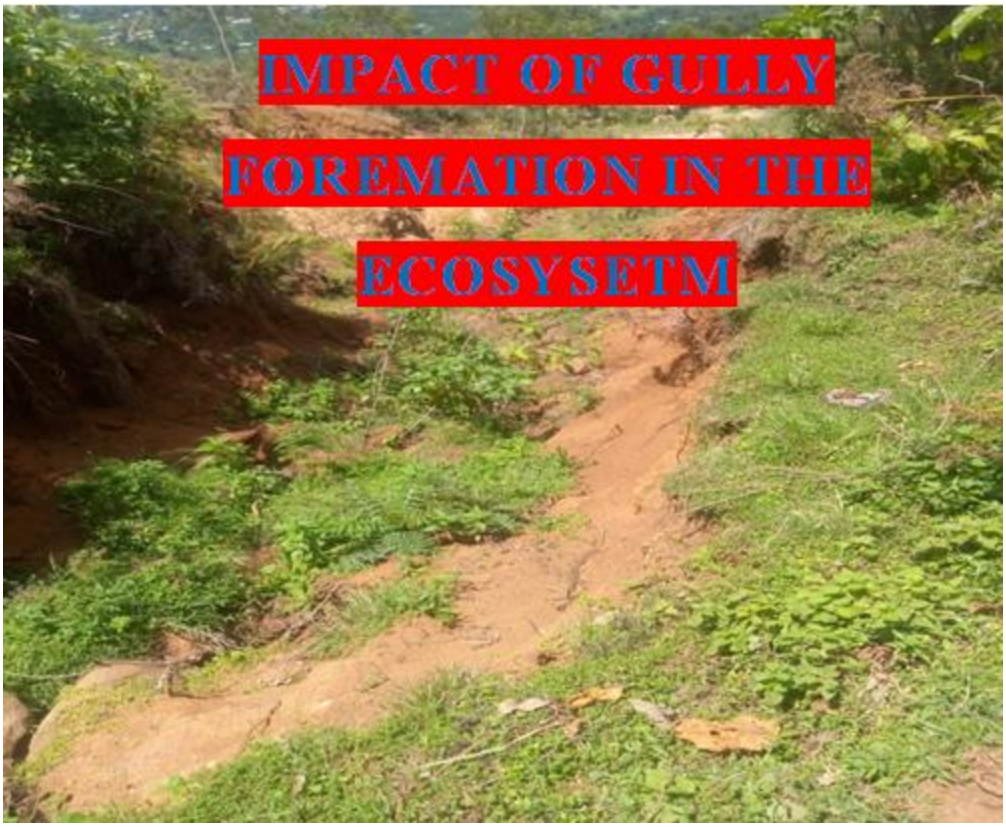


Figure 13 Gully Formation on The Kasha Ecosystem

source: filed photo 2024

Figure 14 Partial view of Kasha forest Ecosystem

Figure 15 Reforestation on The Kasha Forest Ecosystem

Figure 16 Replantation on the Kasha Forest Ecosystem

Source: filed photo 2024

3.2.4 Response for Forest Degradation

Response taken to improve the status of theKashaForest Ecosystem.

To maintain ecological balance and reverse forest flora and fauna degradation, all communities, governmental and non-governmental organizations, farmers, and private sectors must take an inclusive responsibility.

Awareness Generation: Awareness Generation: In order for human capital to function as intended, knowledge and technical skills are prerequisites. Therefore, it is recommended that local residents and other stakeholders be given access to information about the various plant and animal species found in the ecosystem, their significance to human society, the environment, and the economy, as well as the ecological processes necessary for maintaining ecological balance at the site, threats to their survival, and appropriate packages of practices for biodiversity

conservation. Local fairs and festivals may present better chances for raising awareness and enhancing comprehension.

Participating women's in conservation practices: Women's participation in conservation techniques affects rural men and women's knowledge and how they use it. This includes access to or control over resources and biodiversity, as well as education, training, information, and control over the advantages of production. In order to ensure the sustainable use of plant and genetic resources, women frequently take the lead in indigenous variety selection and development, as well as in seed exchange and management.They also have a great deal of knowledge about where to find and properties of natural food products, as they are often the main gatherers of these in woods. Women's significant contributions to forest biodiversity and agro-biodiversity conservation are often overlooked or underestimated in biodiversity programs, projects, and policies related to ecosystem management.

Habitat Management for Wildlife: both regulatory (for human actions) and habitat management practices, including work devices, need to be utilized for managing and improving habitats for forest fauna. Habitat management practices such as fencing along roadside habitats.

Strengthening government institutions and their management bodies or decision-makers concerned with forests.

Providing appropriate legal and institutional mechanisms.

Biodiversity mainstreaming is focused on embedding biodiversity considerations into the policies, strategies, and practices of key public and private actors that impact or rely on biodiversity. Mainstreaming enables biodiversity to persevere across entire landscapes.

Providing ecosystem-based adaptation includes the sustainable management, conservation, and restoration of ecosystems to provide services that help people adapt to the adverse effects of climate change.

Providing restoration of areas that have been converted to agriculture land and gulley, especially those degraded by quarrying activities or low-productivity lands

Institutional response: Local peoples are able to associate and form organizations at the local and national levels they can engage more powerfully in support to maintain their rights. The

recognition of customary or informal tenure rights provides local people with a strong motivation to perform enforcement and oversight functions.

3.2.5. Outlook

According to the data obtained from GIS land use land cover detection 2024, from primary and secondary data, forest coverage of the forest ecosystem from 2002 to 2024 increased by 0.824% in each year, or 17,125.661ha in 2002, 12895.446ha in 2014, and 20775.847 ha in 2024. The total area coverage of the forest increased by 3650.186 ha, but the coverage of bushes and shrubs decreased by 1.82%, or from 19250.185 to 10522.141ha of land. Then, if forest ecosystem management continues, usually within the next 10 years, the forest coverage will increase by 0.374%, or 7687.06ha of land. While shrubs and bushes will be decreasing by 0.831% or by 8750 ha of land, this will in turn contribute to livelihood food insecurity, climate change loss of productivity among people living in the forest ecosystem, and also have their own impacts on woreda and regional states.

3.3. State and Trend of Water on Kasha Forest Ecosystem

Water is a precious natural resource, vital for life, development and the environment. It can be a matter of life and death, depending on how it occurs and when it occurs and how it is managed. Irrespective of how it occurs, if properly managed, water can be an instrument for survival and development. It can be an instrument for poverty reduction. Access to safe water and sanitation to meet human and livestock needs is a prerequisite for sustainable development. However, when inadequate in quantity and quality, it can rather serve as a limiting factor in poverty reduction and overall national development, resulting in poor health and low productivity, food insecurity and constrained economic development. It is therefore imperative that the linkages between water development initiatives in the agriculture, food, energy, health, education and decentralized governance sectors be clearly understood and carefully managed to benefit from the inherent synergies and to minimize or avoid negative cross-sectorial impacts(MOWIE, 2015)..

It is on this basis that water is one of the most essential substances for the sustenance of life. It is generally recognized that fresh water is the most important natural resource in all socio-economic development endeavors and indispensable input for environmental management. It is an important component of every type of environment where life is found. Successful management of the environment, therefore, can never be achieved in isolation from appropriate management of water resources. Water is a product of the environment, and vice versa, as it comes as rain from the environment and goes through land, which is the major component of the human environment and ends up in the sea or in the land. Managing water is thus intimately linked with managing the environment—all terrestrial, aquatic and atmospheric resources including human welfare. Based on the bond between water resources and the environment, integrated water resources management is gaining paramount importance worldwide. In pursuit of integrated solutions, it is observed that decision-makers and planners tend to be oriented towards the management of water while preserving the environment through appropriate legal tools and sustainable actions of development. Integrated management of water resources entails co-ordinated development of water, land and related resources to maximize socio-economic benefits and preserve the sustainability of the ecosystems.

3.3.1. State and Trends of fresh Water resource in Kasha Forest Ecosystem

Ethiopia has 12 major river basins/valleys, 11 lakes, 9 saline lakes, 4 crater lakes and over 12 major swamps. The total mean annual flow from all the 12 river basins is estimated to be 123.25 billion m3. Based on this information, it is always stated and often quoted that 'Ethiopia is the water tower of East Africa'. The major rivers carry water and valuable soil and drain mainly to the arid regions of neighboring countries. The total loss of top soil in Ethiopia has been estimated at 3 billion tons per year. The Wabi Shebelle and Genale drain to the desert areas of Somalia and flow into the Indian Ocean. Abay (Blue Nile), Tekeze-Angereb (Atbara) and Baro drain to the Sudan and Egypt and join the Mediterranean Sea through the Nile. The ground water and the gross Hydro-Electric potential in the country are estimated at 2.6 billion cubic metres and 139,250 Gigawatt hours (GWh) per year respectively. Based on available information the potential irrigable land in the country is about 3.7 million ha. There are also eleven major lakes with a total area of 750,000 ha. The biggest is Lake Tana found in the Northwestern part of the country while the rest of the lakes are found in the Rift Valley. Although Ethiopia's water resource is large, very little of it has been developed for agriculture, hydropower, industry, water

supply and other purposes. To date only about 160, 000 ha (about 4%) of the potential irrigable land has been developed. National coverage of potable water supply stood at 26% by 1992 while coverage of sanitation services is only 7%, which is low by even the Sub-Sahran standards (MoWR, 2001).

The country can only be a water tower in terms of receiving ample water and donating it to neighboring countries but not in terms of ample water resources that is readily available for use. This is because, most of the major rivers have created deep gorge in the country and the water they contain passes to neighboring countries, thus constraining development and utilization of the water resources in the country. In addition, uneven spatial and temporal distribution of the available water resources either demand huge investment to develop and extend to the water scarce areas or constrained the utility at required time and place.

Water is an essential life-supporting medium for fish and other aquatic organisms. It essentially provides all fish needs, such as food, oxygen, and other helpful environments for breathing, feeding, reproduction, and growth of fishes The water quality parameters such as water temperature, turbidity, watercolor, dissolved oxygen, BOD, CO_2, pH, alkalinity, .hardness, calcium, ammonia, nitrite, nitrate, phosphorus, H_2S, primary productivity, and plankton are essential factors to be considered when planning for high fish production.

The Southern Nations Nationalities and Peoples Region (SNNPR). The regional investment plan for irrigation envisages the following targets: ♣ construction of 54 new schemes to irrigate 6,215 ha ♣ construction of 105 pond schemes to irrigate 3,150 ha ♣ rehabilitation of 60 irrigation schemes for an area of 3,000 ha ♣ engineering design of 240 projects covering an area of 34,615 ha ♣ feasibility studies of 249 schemes to irrigate a total area of 38,085 ha, including 82 small-scale schemes (9,430 ha), 25 medium-scale schemes (21,250 ha), 105 ponds (3,150 ha), and 37 old schemes for rehabilitation (4,255 ha) ♣ short- and long-term training for 62,930 beneficiary farmers, 106 development workers, 125 professionals, and 196 mechanics, drivers, and equipment operators ♣ procurement of Birr 59,339,200 worth of construction machinery, vehicles, surveying and drafting equipment, soils lab equipment, and camping equipment. The SNNPR program will benefit 49,260 farm families. The planned budget amounts to Birr 282,081,825 (US$ 33,985,762). Skilled manpower requirements call for an additional 318 personnel, comprising 93 for study and design, 118 for construction, and 107 for support. IFAD

and AFD programs will support 13 additional schemes to irrigate 1,320 ha. The AFD program will support 5 schemes (650 ha for an investment of Birr 7,552,351 (US$ 909,922). Based on SNNPR's investment cost for the short-term SSIDP, IFAD's program of 8 schemes (670 ha) is estimated at Birr 15,485,710 or US$ 1,865,482.

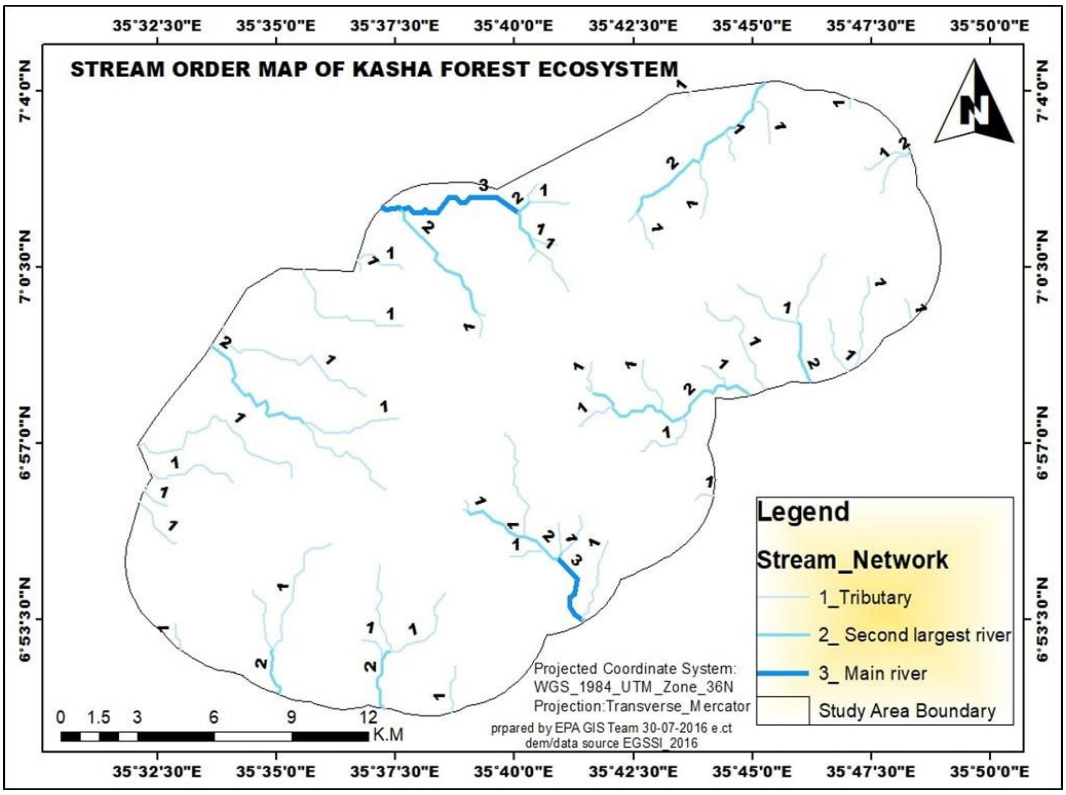


Figure 17 Stream Network in Kasha forest Ecosystem

Water Supply and Coverage around Kasha forest ecosystem

Safe domestic water supply is an essential component of primary health care and plays a vital role in poverty alleviation. Inadequate water supply and sanitation services impact upon the lives of billions of poor people in the developing world (World Bank, 2004). Two in every ten persons lack access to safe water supply, five have inadequate sanitation, and nine do not have their wastewater treated. Yet, these estimates are believed to underestimate the extent of the drinking water supply problem. In many countries where water supply systems have been installed, the quality of the services provided is poor. Many consumers who are connected face unreliable water supply and when available, it is often not safe to drink (World Bank, 2004).

Water supply services in Ethiopia are among the lowest in Africa, with an average consumption of only 15 liter per day in urban areas, which is far below the World Health Organization (WHO) standard of 45 liters per person per day. Safe domestic water supply is estimated to be available to 36 percent of the population in rural areas and 80 percent in urban areas. According to the WHO, Ethiopia had the lowest level of water supply coverage in Sub-Saharan Africa in 2000 (39% compared to an average of 56% in Sub-Saharan Africa) and the second-lowest level of sanitation coverage. Unprotected water supply sources are one of the most important problems related to water supply quality. Consequently, a majority of the Ethiopians use unsafe and polluted water and are, as a result, exposed to a large variety of water-borne diseases. This is especially the case for the rapidly growing urban population. Besides limited protection of water supply sources, financial constraints also play an important role in the current state of water supply in Ethiopia. Investment and operation costs of domestic water supply facilities are only partly covered by the consumers (15%). The central government contributes more or less the same as the consumers, but the majority of the costs (70%) are funded by financial sources from outside Ethiopia, primarily through international aid (Teshome, 2007). There exists a huge gap between the finance required to maintain and operate the existing water supply system.

The main water source in North bechi woreda is both ground and surface water (North Benchi woreda Water & Mining office, 2016). According to FGD participants the water source of the local community is dominantly use boreholes for their drinking as well as household water consumption.TheFGD participant in Muya and Wala kebele also explained that water sources like Debaye river, Kayach River and Yori River are totally dried but water sources like Qachi,Keja kome and Chuka rivers are available know. According to North Benchi woreda Water & Mining office, 2016) the total demand of water in the woreda is 5,000 cubic meter and also the percentage of population with access to safe drinking water was 37%.

The FGD and key informant interview explained that the decline in the coverage of water in North Benchi woreda prawn to water shortage and also females' travel long distance (40 minute) to fetch water.

3.3.2. Driver and Pressure of Deterioration of Water Bodies in North Benchi Woreda Around Kash Forest Ecosystem

The main drivers for the deterioration of water bodies in North Benchi woreda are listed below

- **Plantation of Eucalyptus Tree around Water Bodies**

Eucalyptus is a well-known forest species of high water uptake ranging from 50 Lt/d/plant to even 90 Lt/d/plant, depending upon the adequacy of supply (Joshi and Palanisami, 2011). But, it is also reported that, in stress situation, its roots can grow even up to 20-30 feet and extract more water. The leaf area of the Eucalyptus plants is also another important factor affecting the rate of water consumption .Eucalyptus trees also take up a great amount of water from the soil and as a result can affect water availability, competing with crops and other vegetation for water and depleting the water table.

Eucalyptus plantations around agricultural land and water sources significantly affect the flow rate of springs and reduced crop production. Some have witnessed that springs have disappeared due to Eucalyptus plantation. Consequently, the community banned any further plantation around water sources such as ponds and springs (Daba, 2016).

- **Population Growth**

Population growth leading to increased needs of food, water and energy determines the development of natural resources in a given area. This is because the majority of the social services and development agendas designed by a government are based on this information. Ethiopia is the second most populous country in Africa. According to North Benchi woreda Finance & Economy office, 2016) the number of population in urban and rural areas was increase highly and also the growth rate of the population was increased by 2.9%.So,increase in number of population cause scrambling of Natural resource.

- **Climate Change**

3.3.3. Impact of the Decline of Water Bodies on the Local Community

Deterioration of water bodies are many impacts on the local community as well as the country as a whole. According to the FGD and Key informant interview declining of water bodies' cause varies impacts on their living environment.

- Children must fetch water instead of going to school.
- Schools without WASH infrastructure (Water, Sanitation and Hygiene) can become a high-risk place for infections.
- People (especially women) have spent their time to fetch water instead of working.
- Some productive activities (especially agriculture) cannot function without access to water.

3.3.4. Response

REDD+ project implement afforestation activity to reduce forest degradation and also improve water bodies

3.3.5 Outlook

Great increase in water demand has been noted in water scarce basins due to rapid increase in population. The increase in domestic and industrial water demands will intensify the pressure on the available limited freshwater resources. Unless Ethiopia's water resources management policy gives priority to meeting domestic and industrial water demands, human and animals prawn to shortage of drinking water. The water share of the agricultural sector, however, will decrease with time to meet the competing domestic and industrial demands.

3.4. Baseline State and Trends of Climate of Southwest Region (1960-1990)

Baseline Climate

The world's climate has already changed and will change dramatically. Under the no emission scenario, the average global surface temperature is predicted to increase by 2.8ºC during this century (IPCC, 2007). Such global warming would alter the natural climate, leading to increased frequency of extreme weather events (such as droughts, storms, and flooding), rising sea levels, reversal of ocean currents, and changes in precipitation patterns.

The Ethiopia climate patterns mainly rainfall and temperature are modulated by altitude and latitudinal differences For this baseline study the state of the climate is considering the 30-year climate trend before 1990

A. Temperature variability and trend

In Ethiopia the year-to-year variation of annual maximum and minimum temperatures expressed in terms of normalized temperature anomalies averaged over 40 stations the country has experienced both warm and cool years over the last 50 years. Years like 1957, 1958, 1973, 1987 and 1995 were very warm while 1964, 1967, 1968, 1975, 1977 and 1989 were very cool years. also reveal that there has been a warming trend in temperature over the past 50 years. The average annual minimum temperature over the country has been increasing by about 0.25^0C every ten years while average annual maximum temperature has been increasing by about 0.1^0C every decade. It is interesting to note that the average annual minimum temperature is increasing faster than the average annual maximum temperature. For the past four decades, the average annual temperature has been increasing by 0.37ºC every ten years, which is slightly lower than the ***average global temperature rise***.

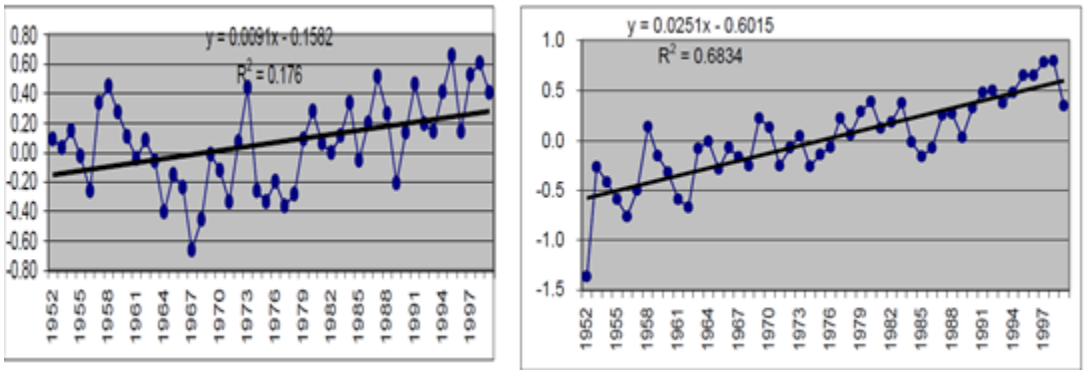


Figure 18Year to Year Annual Mean Maximum(left) and Minimum(Right) Temperature Variability and Trend over Ethiopia

Source:NMI

At country level the temperature rise was more pronounced in the dry and hot spots located in the northern, northeastern, and eastern parts. The mean annual temperature varies from less than 10ºc over the central high lands to more than 35º c over Northeastern and Southeastern low lands. In South West Region the temperature increment was the lowest as compared to other part of the coutry. See Fig map of atmospheric temperature for the past 10 years.

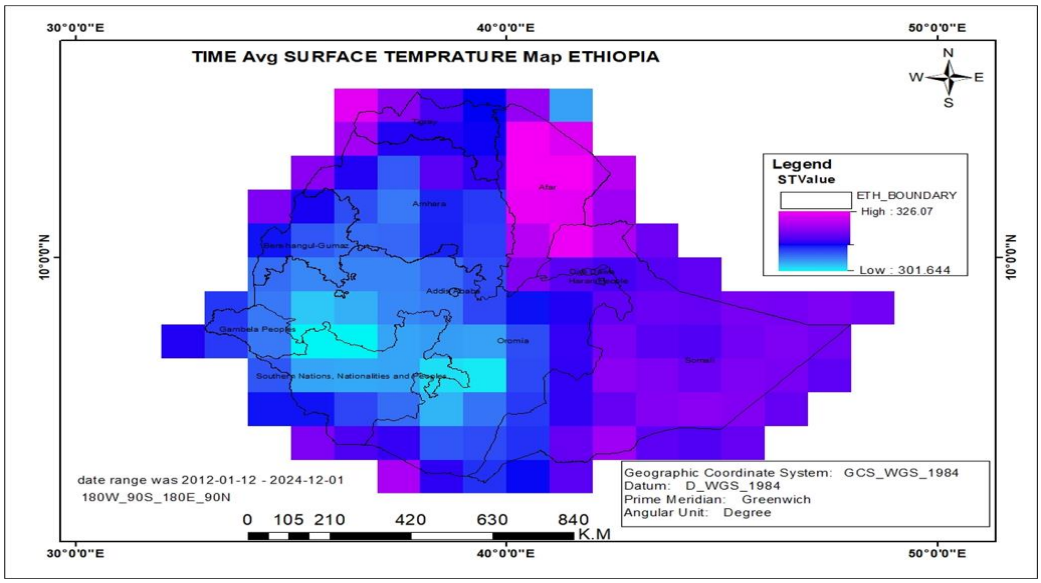


Figure 19 Time Average Surface Temperature Map of Ethiopia

B. ***Rainfall variability and trend****:*

Baseline Climate was developed using historical data of temperature and precipitation from 1961- 1990 for selected stations. Mean annual rainfall shows large spatial and temporal variation. It is characterized by large spatial variation and ranges from about 2000 mm over some pocket areas in Southwest to about less than 100 mm over the Afar lowlands in the Northeast.(source national metrology agency 2001)

Ethiopian Meteorological data shows the mean annual rainfall produced based on 567 stations and 30 years (1981- 2010) the southeastern mean annual rainfall was 1500 mm, where the maximum in excess of 2000 mm mainly on the highlands. This is due to topographic barriers trigger orographic rainfall on their windward slopes.

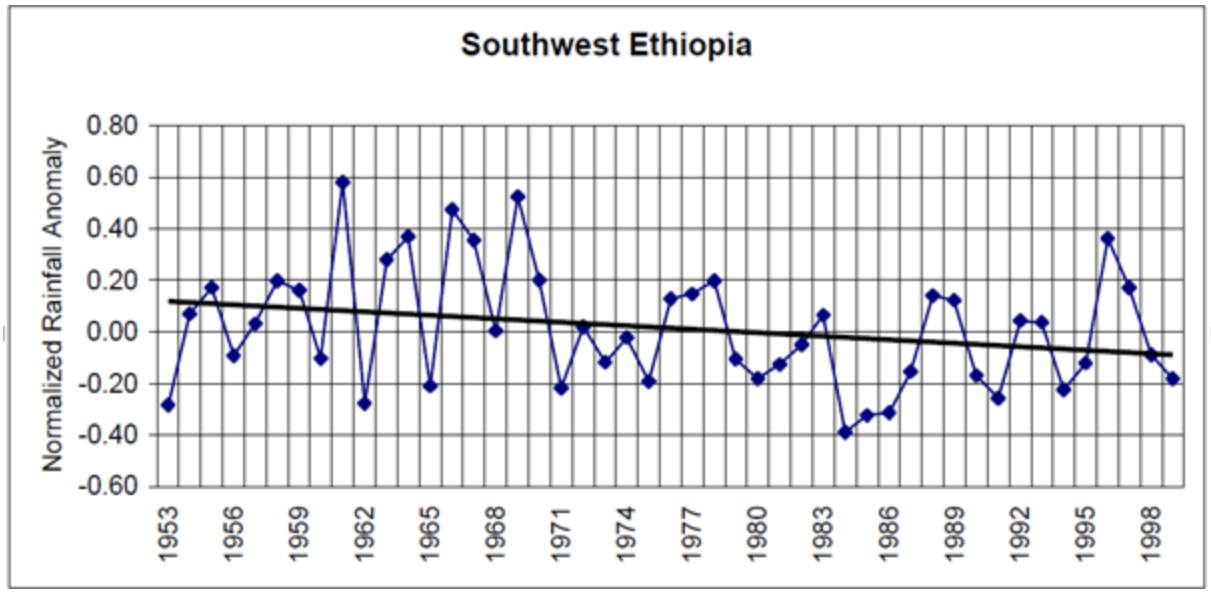


Figure 20 Year to Year Variablity of Annual Rainfall over Southwestern Ethiopia Expressed in Normalized Deviation

Source: NMI

Trend analysis of annual rainfall shows that rainfall remained more or less constant when averaged over the whole country while a declining trend has been observed over the Northern half of the country and Southwestern Ethiopia. Though the Southwest decline is less than the Southwest and the major decline was observed in the lowland areas o contrary the highland moutons areas have increased,

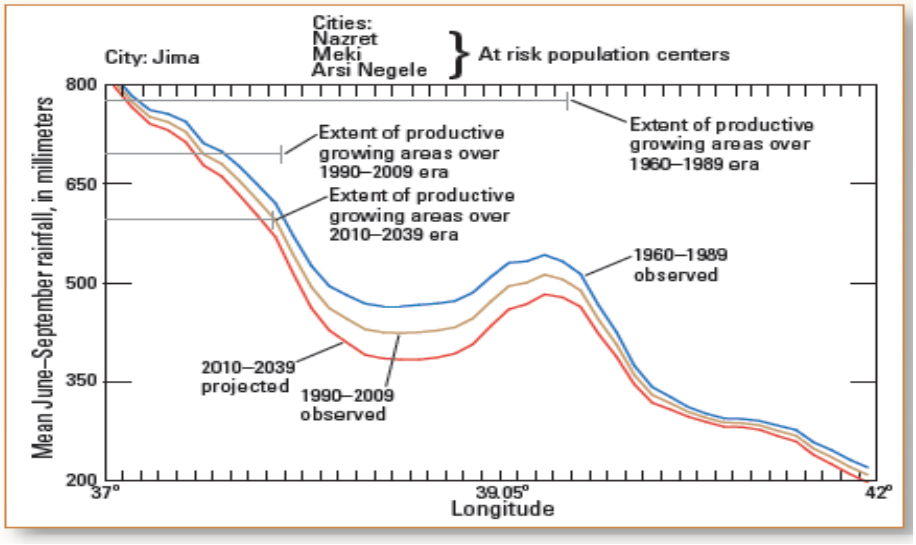


Figure 21 Transects of Mean 1960-1989 and 1990-2009 June-September rainfall, Along with 2010-2039 projected rainfall (transects taken along 8^0 N)

Source: USAID- Famine Early Warring Systems Network- Informing Climate Change Adaptaition Series

See map Interaction of Altitude and Climate Change: Observed June-September rainfall means at 8°N for 1960–1989 and 1990–2009, and projected 2010–2039 the graph shows the 'local velocity' of climate change can interact with ***terrain***. rainfall tends to increase generally to the South**west** ***higher elevations mountainous.***

As the result of periodic and unprecedented over-precipitation in the South West Highlands cause over-floods and landslides damaging the human as well as physical capital of the downstream. During our visit to the Forrest Ecosystem nearby we have observed a landslide. See Map location of the land slide nearby

3.4.1. State and Trends of Climate Variables for Kasha Forest Ecosystem (1990 – 2020)

a. State and Trend of Rainfall on Kasha Forest Ecosystem

Rainfall

Kasha forest ecosystem have has been experienced a bio-modal rainfall pattern classified as the long rainy season (June –October) and short rains (March-May) locally referred as *Kiiremt* and *Belg* rains respectively.

Table 11 Kasha **Average Monthly** rainfall from 1990-2020

Month	RF Avr
January	36.82903
February	32.79145
March	114.6378
April	130.707
May	232.6054
June	230.9299
July	239.1192
August	204.6616
September	185.2403
October	162.3376
November	90.16545

December	67.09287
Sum	**1727.118**

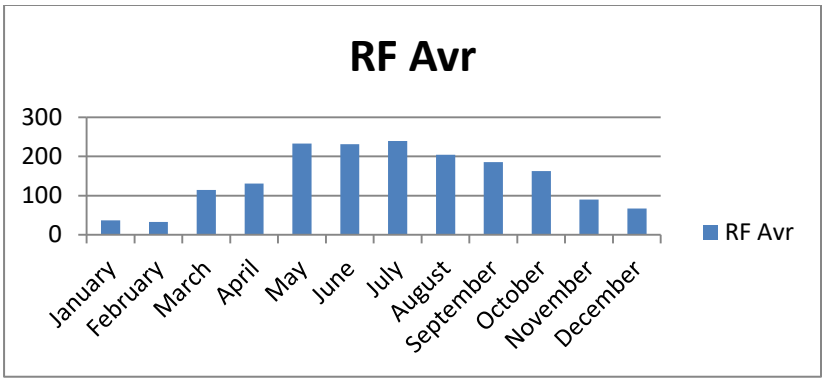


Figure 22 Kasha **Average Monthly** rainfall from 1990-2020

One can observe that the peak average monthly sum of rainfall was recorded during July, it reached around 239 mm. The positive rainfall anomaly was recorded in May up to October months. The positive sign was an implication that the monthly averages were higher than the 30-year normal. On the other hand, all the other six months have a negative anomaly which means the monthly average rainfall was recorded lower than the 30-year average normal.

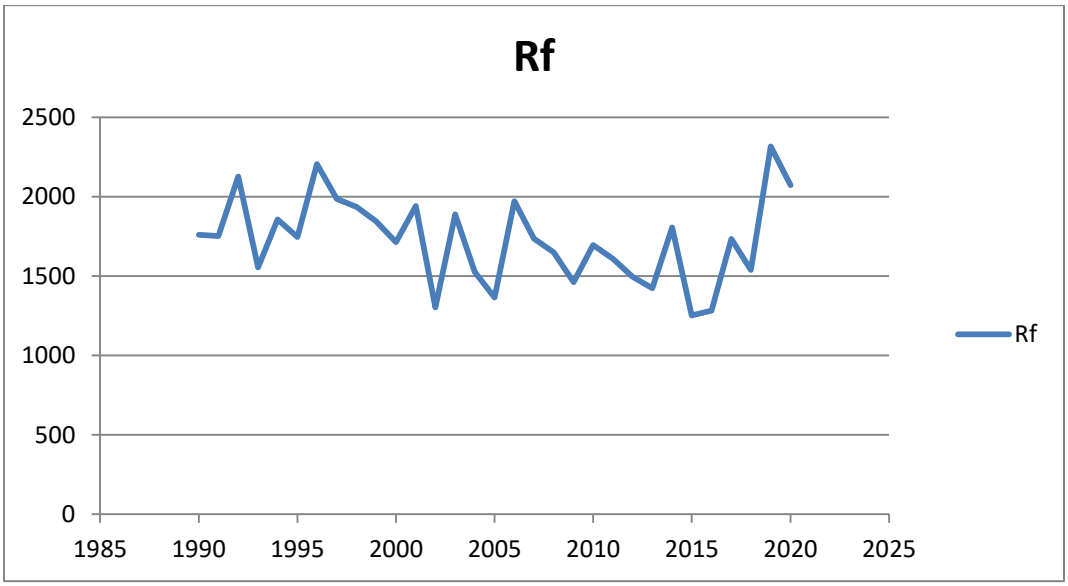


Figure 23 Kasha **annual** Rainfall from 1990- 2020

The amount of annual sum of rainfall was highly variable from year to year. The highest Rainfall was recorded around 2315 mm in 2019 and the lowest rainfall was recorded in 2015

which was 1253 mm. From the available data annual average rainfall was 1727 mm rainfall were recorded.

The highest negative anomaly was **-474** mm in **2015** which indicate that in these years the average rainfall received was far below the reference normal. On the other hand, the highest positive rainfall anomaly was recorded in **2019** which is **+588** mm above the reference normal as illustrated above.

Temperature

Kasha forest ecosystem have has been experienced a warm pattern classified as the long rainy season (June –September) and cool (February-May) locally referred as Meher and Bega respectively.

Table 12 Kasha **Average Maximum Temperature**

Month	Avr T Max
January	31.96593
February	32.86659
March	31.77259
April	30.97034
May	30.33876
June	29.3351
July	28.47828
August	29.41555
September	30.1701
October	30.25141
November	30.59017
December	31.46386
Avr T Max	**30.63489**

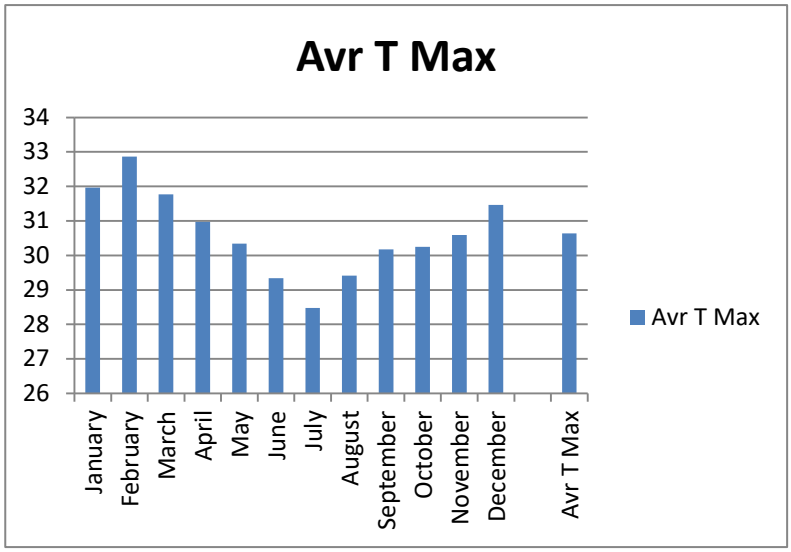


Figure 24 Kasha **Average Maximum Temperature**

Table 13 Kasha **Average Minimum Temperature**

Month	Avr T Min
January	16.226
February	17.43262
March	16.87624

April	17.25576
May	17.18072
June	17.04048
July	16.66472
August	16.96297
September	16.90069
October	17.25048
November	17.00214
December	16.93917
Avr T Min	**16.97767**

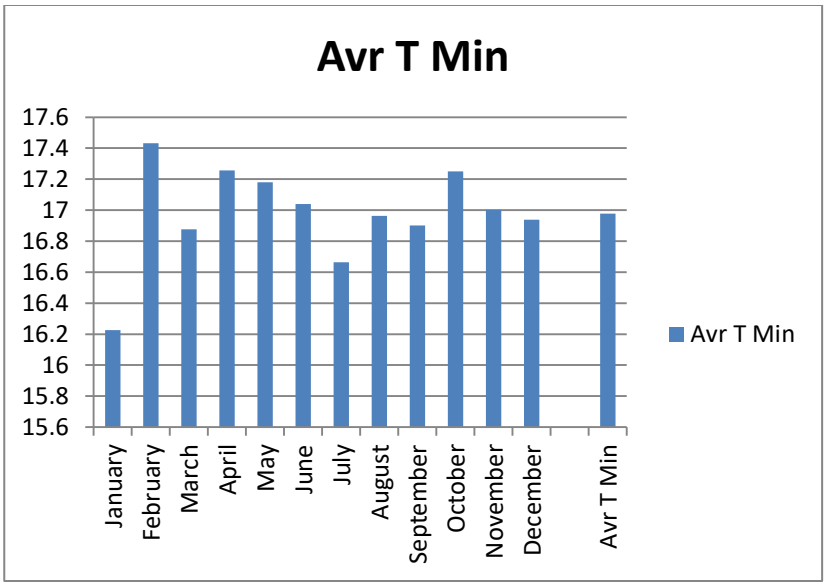


Figure 25 Kasha **Average Minimum Temperature**

The hottest month for the 1990 - 2020 period was the months of February with an average maximum temperature of 32.9 °C against the normal reference of 30.6°C an increase of 2.3°C while the coldest month was the months of July with a maximum average of 28.5 °C against the normal reference of 30.6 °C decreases of - 2.1 °C as well. The overall total average anomaly for the 1990 - 2020 periods was 4.4 °C.{ variability }

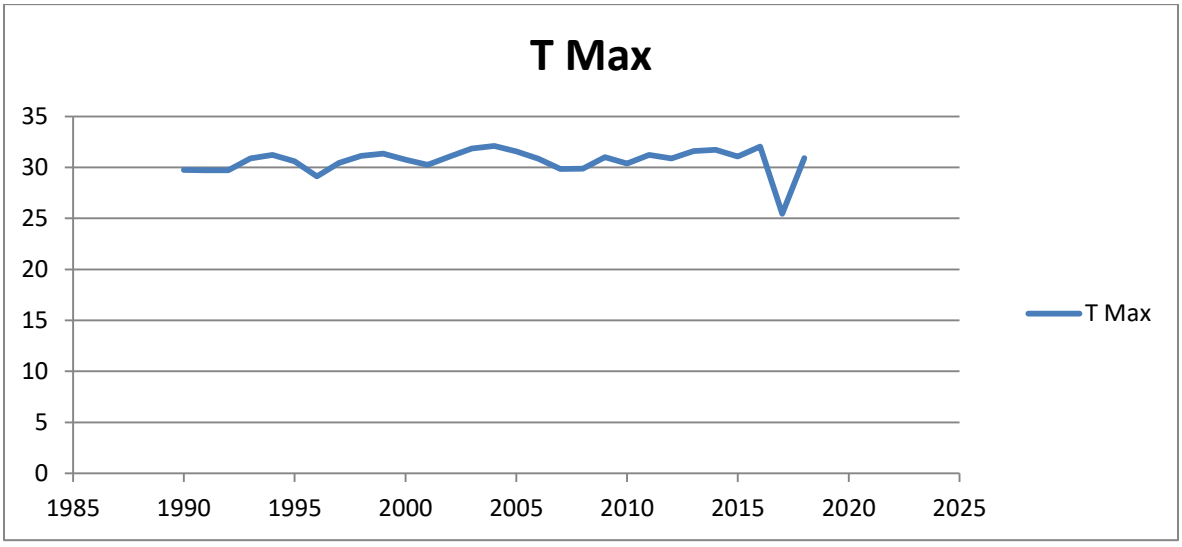


Figure 26 Kasha Average Annual **Minimum Temperature**

Within the period of between 1990 - 2020, the considering the reference normal of 30.63 °C average annual **maximum** temperature recorded

- Highest recorded was 32.03 °C in 2016 with the highest anomaly +1.4 °C of. While
- Lowest average annual maximum temperature was 25.45 °C in 2017 with an anomaly of - 5. 18°C

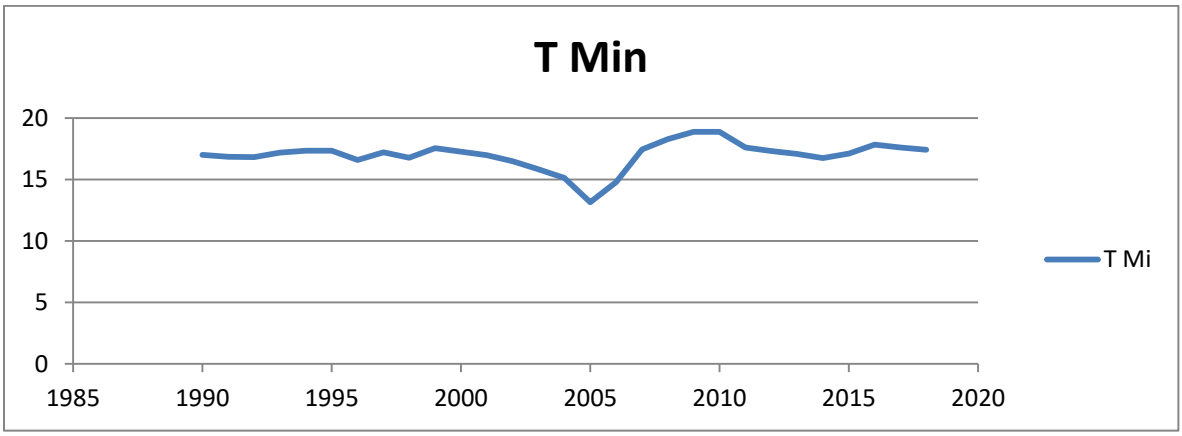


Figure 27 Kasha Average Annual **Minimum Temperature**

Within the period of between 1990 - 2020, the considering the reference normal of 16.98 °C average annual **minimum** recorded

- Highest recorded was 18.88 °C in 2009 with the highest anomaly +1.9 °C of. While
- Lowest recorded was 13.15 °C in 2017 with an anomaly of - 3. 83 °C

b. Climate variability and anomalies observation from FGD

The focus group discussion was carried with selected indigenous elder peoples having well known the forest ecosystem ad the climate for the 3-5 decades. Acourdi g to Thier life experiences of sensationalizing the climate change and it's adverse impacts on the forest and livelihoods the participants explanation is summarized as follow:-

Over precipitation effects

- Southwest get more water than any region and its highland get the highest. Qusha Forest Ecosystem high mountain and vicinity areas get the highest rain fall than any. As a result of this over precipitation the forest area and nearby mountains they are exposed to landslide and flooding downslopes,
- **Leaching effect**:-Characterized by high rainfall (majority above 1400 mm) associated with inherently acidic soils such as Nitisols, Alisols, and Fluvisols (soil acidity is a critical bottleneck of agricultural production as it is expanding in coverage and magnitude and severely limiting crop production and productivity. As a result of leaching the topsoil, the shallow rooted cereals productivity was reduced to 3-5 qnt/ha and maize to 7-10 qnt/ha
- erratic and Rainfall is highly typically falls in the form of intensive convective storms such variability cause shifting of crops seasons for instance in the past Maize were cultivated in January up to February but now shifting to April

Warm temperature effects

- Species have shifted their geographic range Yellow shrub and Red flower tree are envisage the area
- Location (i.e. elevation and altitude)
    - certain crops like teff, burley, wheat were produced in the locality by now their yield was reduced and the farmers shifted to grow deep rooted crops like potatoes, beat root, Enset, etc
- Animal disease Aba Senga spread recorded since the last 10 -15 years ago In the nearby Kebelles, and also at Wereda level animal disease Trips, Anthrax, Blackleg, New Castle, Gumbroo Lumpy skin, pasterollosis, etc were occurred ,
- Currently temperature flactuation was very high and exposed to diseases Cold/Beerd.

3.4.2. Driver and Pressure for Climate Change

Driver for Climate change

a. Globally driver

As far as we know, our planet is the only place in the universe that supports life. The earth is the only hospitable for human and other forms of life. The living earth was abused when traditional societies and their ecological wisdom they possess are being lost rapidly as the:-

- Domination to the biblical injunction to “Be fruitful, and multiply, and replenish the earth, and subdue it; and domination over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth. (Genesis 1: 28)
- Tool revolution followed by agriculture, industrial and information-electronic revolutions make to advance science and technology give humankinds a power to understand and change the world
- Western materialist culture sweeps around the globe i.e. the spread of the white men over the sphere of the earth.

b.National &Local Drivers

- **The huge number of animal population:**

Under the business as usual scenario farming of livestock-cattle, sheep, goat, and chickens contribute around 140 million tons of greenhouse gases (carbon dioxide, methane and nitrous oxide) to the atmosphere by 2030. This could represent up to 60% of the national emissions..

- **Overpopulation;**

Mainly rural population continues to grow, accordingly the need to provide housing, agricultural land expansion and fuel wood consumption. Community use the forest in unsustainable way, As a result of these exerts pressure on forest ecosystem.

- **Land tenure**

As long as there is no real responsibility among the local population for the common forest resources and forest laws and regulations are not enforced, it is impossible to stop another person from exploiting forests. The worst kinds are the illegal timber cuttings in the last remaining high forests which one can blame a number of wood traders.

- **Investment policy**

As we have seen in the field observation, the study area is potentially coffee farming activities, the export oriented investment policy favorably encourage both local and foreign investors engaged in coffee farming and plantation. They are weeding and removing the biodiversity within the forest which they think compete with the interested coffee crop.

- **Livelihood income**

The local community to satisfy their economic demands and compensate the agricultural crises caused due climate change and harvest economically and market valuable timber and lumber trees.

- **Social security**

Due to the scarce of the natural resources and the consequence cooption larger families have better competitive advantage. Over the past 50 years poor rural families have not got sufficient social security support and turned therefore to various other kinds of social security net surrogates. These surrogates have been, for instance, large families, which provided sufficient household labor for family livelihood. Secondly, the families in villages and town communities have to support each other during the difficult times. The third social security net surrogate has been exploitable forests, which could provide many goods and services free of charge such as wood energy, construction wood, food and fodder, new farm and housing land and drinking water.

Pressure for Climate Change

a. Global Pressures

The unprecedented increase in global energy uses of fossil fuels and deforestation of the carbon sink forests has given rise greenhouse gas emission. The main natural GHGs are carbon dioxide (CO_2) , methane (CH_4) , nitrous oxide (N_2O) , water vapor (H_2O) , and ozone (O_3).

On the whole if the rise of GHG's takes place in the current rate the overall rise GHG effect will be higher with doubling point sometimes in 2030. Thus the corresponding temperature changes from 1850 to 2050 at the magnitude of 0.250C to 3.50C. Most scientists agree that if the pollution continues at present rates, the result will be irreversible damage to the ecological cycles

which all life depends. They warn that fundamental, and perhaps drastic, changes in human behavior are required to avert the ecological crisis and assure sustainable development.

b. National and Local Pressures

Ethiopia's current contribution to the global increase in GHG emissions since the industrial revolution has been practically negligible. Even after years of rapid economic expansion, today's per capita emissions of less than 2 t CO2e are modest compared with the more than 10 t per capita on average in the EU and more than 20 t per capita in the US and Australia. Overall, Ethiopia's total emissions of around 150 Mt CO2e represent less than 0.3% of global emissions. Of the 150 Mt CO2e in 2010, more than 85% of GHG emissions came from the **agricultural** and **forestry** sectors. They are followed by power, transport, industry and buildings, which contributed 3% each.

The mainly pressures of GHG emission are:-

- **Land use changes**

The population continues to grow, accordingly the need to provide housing, agricultural land expansion and fuel wood consumption also increases. And these exerts pressure on Land use changes of forest ecosystem to agricultural, grazing and residences.

- Agricultural farming emission contribution is great
    - Land use change (CH_4 from deforestation)
    - Crop production (N_2O emission from organic and mineral N imputes. Burning of crop residues, N_2O and CH_4 from manure handling (storage, etc.) and the application of mineral fertilizer is a significant material for agricultural products and productivity improvement.

- **Resettlement programs**

According to FGD community's resettlement program is implemented by the government however it was one of responsible factors for the local climate variability that makes great stress on the forest through cutting the trees for agricultural purpose, wood consumption, household material, timber preparation and sells those cutting trees by making charcoals in order to satisfy their economic interests

- **Forest fire**:

Intentionally combustion of the forest for different purpose. Expansion of agricultural activity mainly the local communities practice what is called shifting or slash and burn farming, better grass for grazing, charcoal making, to collect honey, were the main responsible factors for the expansion of the wild fire.

- **Charcoal and fuel wood production:**

Charcoal and fuel wood production is cause of forest degradation as a result it hinders the carbon sequestration potential of the forest ecosystem. Deforestation and forest degradation as well as biomass energy emits carbon due to backward three stone stove which is not energy saving and wasteful.

- **Animal farm**

Animal populations were degrading the area and produced methane which is great contribution to greenhouse gas emission next to carbon dioxide with roughly 28 times the warming potential of CO2 over a 100-year time frame.

Livestock generates greenhouse gases mainly in the form of methane emissions arising from digestion processes (mostly attributable to ruminant animals like a goat) and nitrous oxide emissions arising from excretions.

Livestock emissions are estimated to amount to 65 MtCO2e-35% of Ethiopia's total emissions today (Ethiopian CRGE, 2011). In Ethiopia livestock emitted **methane** and **nitrous oxide** total of **65 Mt CO_2e**, which cover 42% of the total.

3.4.3. Impacts of Climate Change

a. Global Impact

The WMO Greenhouse Gas Bulletin showed that globally averaged concentrations of carbon dioxide (CO2) reached 407. 8 parts per million in 2018, up from 405. 5 parts per million (ppm) in 2017. Globally increasing GHG that causes global warming effects of:-

- Forest distraction,
- loss of habitat and biodiversity,
- Soil erosion,

- Air and water pollution,
- Shrinking fossil fuel supplies,
- Accommodation of toxic wastes and
- Spread of tropical diseases
    - Malaria (vector Mosquito) ,
    - Schistomiasis (vector Water snail),
    - Filariasis (vector Mosquito),
    - Onchocerciasis/river blindness (vector Black fly),
    - African trpanosomiasis / sleeping sickness (vector Tsetse fly),
    - Dengue Fever (vector Mosquito), and
    - Yellow Fever (vector Mosquito).

b. National and Local Impact

- **Deforestation and Forest degradation**

It is well known that deforestation and forest degradation must be reversed if the country is to meet following economic and ecological advantages of:-

- Wood fuel accounts for more than 80% of household energy supply in Ethiopia and is particularly important in rural areas. Beyond wood fuel, forests provide other timber products and a host of valuable non-timber products, including livestock fodder, coffee and honey. Forests are also the source of essential ecosystem services, including carbon sequestration, crop pollination, conservation of agricultural soils and control of water discharge to streams and rivers.

- **Leaching effect**

The Kasha Forest Ecosystem area gets higher rainfall and the top soil which is rich in macro and micro nutrients are leached and stored beyond reach of the shallow root crops. These important nutrients for the growth of the plant are stored deeper.

- **Landslide**

Due to the high rain fall amount and nature of the high intensity rainfall we have observed landslides in nearby the forest ecosystem.

- **Flooding**

Due to the erratic character of the rainfall flooding frequency occurrence is very serious especially in downstream areas.

- **Biodiversity loss**

For the cultivation of the economic and market valuable coffee & spices most of the biodiversity competing shrub & herbs are removed. This loss the biodiversity. **Coffee** management is widely practiced under a canopy of forest trees is a great economic resource for local farmers and the government. As a result, there is more interest in expanding forests with coffee plantations the forest ecosystem is increasing area coverage though there is loss of the biodiversity.

See from Fig 5 the Kasha Forest Ecosystem map increasing the forest coverage

3.4.4. Response to Climate Change Impacts

a. Global Response

Efforts of COP 1 -28

The **United Nations Framework Convention on Climate Change** (**UNFCCC**) is the UN process for negotiating an agreement to limit dangerous climate change. It is an international treaty among countries to combat "dangerous human interference with the climate system. The main way to do this is limiting the increase in greenhouse gases in the atmosphere. It was signed in 1992 by 154 states known as the Summit. The convention's main objective is the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system and to allow ecosystems to adapt to climate change.

The **United Nations Climate Change Conferences** are yearly conferences held in the framework of the United Nations Framework Convention on Climate Change (UNFCCC). They serve as the formal meeting of the UNFCCC parties – the Conference of the Parties (COP) – to assess progress in dealing with climate change, and establish legally binding obligations for developed countries to reduce their greenhouse gas emissions.

b. National Response Climate Change

Ethiopia's green economy offers GHG abatement potential of 250 Mt to the global community:-

Ethiopia is the pioneer and frontline country presenting the continent Africa in the global climate change negotiations in UNEP Conference of Parties (COP). Ethiopia is playing a leading role and submitted a 25 year green strategic plan "Climate Resilience Green Economy (CRGE)" in **COP 16** in Johannesburg, South Africa, as a model to the world.

The priority initiatives that form the foundation of the green economy concept could help to curb the increase in the global emissions projected in the business as usual scenario. While contributing to reaching economic and social development targets, we have the domestic potential to contribute to the global effort by abating around 250 Mt CO2e in 2030 as compared to conventional development practices – this equals a decrease in GHG emissions of up to 64% compared to BAU in 2030.

The impacts of human activities on forests contribute significantly to Ethiopia's emissions. Forest-related emissions amounted to almost 55 megatonnes CO_2 equivalent in 2010, driven by deforestation for agricultural land (50% of all forestry-related emissions) and forest degradation due to firewood consumption (46%) as well as formal and informal logging (4%). These are among the main direct drivers of deforestation and forest degradation.

To avoid these negative consequences, the CRGE Strategy prioritizes several initiatives to develop more sustainable forestry and agricultural practices.

- Improving crop and livestock production practices for higher food security and farmer income while reducing emissions
    - Intensification of agriculture through use of improved inputs and better management of crop and animal residues, resulting in a decreased requirement for additional agricultural land that would be taken primarily from forests.
    - Expand agricultural activities on degraded lands through increased irrigation.
- Protecting and re-establishing forests for their economic and ecosystem services, including as carbon stocks
    - Reduce demand for wood fuel through dissemination of more efficient wood and/or alternative-fuel stoves.

- Promote afforestation, reforestation and improved forest management activities to increase carbon sequestration in forests and woodlands.

- Expanding electricity generation from renewable sources of energy for domestic and regional markets
- Leapfrogging to modern and **energy-efficient technologies** in **transport**, industrial sectors, and buildings.

c. Localities Response to Climate Change for Kasha Forest Ecosystem

The Past response measures of NGO

Kasha Forest Ecosystem was declared as protected area during the settlement program in 1977 E.C. where some of the residences within the forest areas were resettled. In 2004 E.C. an NGO {action aid Ethiopia} has initiated to reduce the deforestation & forest degradation programs and enhance enrichment plantation programs.

The current response measures or practices of State

Greenhouse gas emissions from deforestation and forest degradation have come to the forefront of the international discussions on climate change Redd+ intervention was one of the programs. The national REDD+ program through the Participatory Forest Management try to address the problems of Kasha Forest Ecosystem deforestation and forest degradation through: -

- enrichment plantation,
- providing energy saving cook stoves
- providing wood and non-wood demands of the forest community

This is good initiation to assure sustainable forest development among forest ecosystem and livelihoods of the community

Response measures or practices by family/community to impacts of climate Change

Over the past 50 years poor rural families have not got sufficient social security support and turned therefore to various other kinds of social security net surrogates. These surrogates have been, for instance, ***large families***, which provided sufficient household labor for family

livelihood. Secondly, the families in villages and town communities have to support each other during the difficult times. The third social security net surrogate has been exploitable forests, which could provide many goods and services free of charge such as wood energy, construction wood, food and fodder, new farm and housing land and drinking water.

3.4.5. Outlook

National Rainfall Projection

According to EEA (2008), the IPCC forecast on the level of precipitation shows a long-term increase in rainfall in Ethiopia despite the short- and medium-term observation of frequent dry periods with extreme rainfall levels. The average change in rainfall is projected to be in the range of 1.4 to 4.5 percent, 3.1 to 8.4 percent, and 5.1 to 13.8 percent over 20, 30, and 50 years, respectively, compared to the 1961 to 1990 normal (EEA, 2008).

National Temperature Projection

Future temperature projections of the IPCC mid-range scenario show that the mean annual temperature will increase in the range of 0.9 to 1.1ºC by 2030, in the range of 1.7 to 2.1ºC by 2050, and in the range of 2.7 to 3.4ºC by 2080 in Ethiopia compared to the 1961 to 1990 normal (EEA, 2008), posing a sustained threat to the economy

National GHG Emission

Business as usual scenario

Ethiopia's greenhouse gas emissions were about 150 megatonnes CO_2 equivalent in 2010. Under a business-as-usual development strategy, these emissions are projected to more than double to 400 mega tonnes CO_2 equivalent by 2030.

CRGE scenario

The Climate-Resilient Green Economy (CRGE) offers GHG abatement potential of 250 Mt to the global community in 2030 and (zero net emission to 2010) using four CRGE pillars agriculture, forest, industry & energy uses.

Localities of Kasha Forest Ecosystem

Accordingly based on the available meteorological data in Kasha forest area temperature was increased. If this condition continuous without any strong mitigation, and adaptation measures in the coming 30 years temperature will increased, The optimum temperature required for coffee farming may changed and the fate of the forest will be changed to other economical valuable land uses. And also climate-related hazards on the society will be savior.

The four Kebels neighboring the Kasha Forest Ecosystem loss the income eared from the rain-fed agriculture and their less adaptive to climate change will make a great pressure on the Forest Ecosystem deforestation ad degradation as compensating the loss income. Therefore the forest ecosystem will face more challenges in accelerating sustainable growth in the face of future climate for three reasons

- **First**, agriculture is by far the dominant producer, employer, and main source of income
- **Second**, the agriculture is highly susceptible to the causalities of climate change.
- **Third**, the agricultural population constitutes the significant majority are poor and highly vulnerable people.

All these factors will create great pressure and impact on the Qusha Forest Ecosystem.

3.4.6. Recommendation

To assure sustainable development and rehabilitate Kasha Forest Ecosystem it needs to ***break*** the **vicious circle** and establish friend interlink between climate, forest and livelihoods.

The vicious triangle of climate, livelihood and Forest Ecosystem linkage should be broken through the climate change mitigation & adaptation, livelihood improvement; and reduce deforestation and degradation by enhancing current efforts of the REED+ program

- using alternative cooking stoves technology,
- rehabilitee of forests through afforestation, reforestation,
- generating incomes of wood and non-wood economical valuable crops to Kasha community through the participatory forest management

In the coming 30 years climate state and trend of forest ecosystem can be conserved the existing status and develop the quality and quantity forest ecosystem ad ensure sustainable development that benefiting the ecosystem and livelihoods

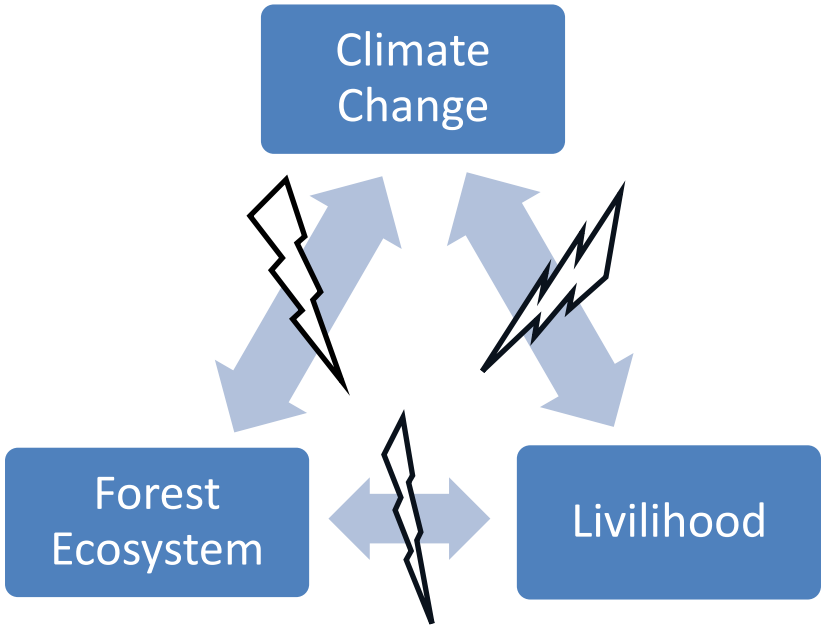


Figure 28 The vicious triangle of climate, livelihood and Forest Ecosystem

Therefore the following measures have to be taken in assuring suitability among the climate, livelihood & the Forest Ecosystem. The following recommendation that to be addressed in assuring sustainable development among climate, forest & livelihoods are:-

- **Climate Change**
  - Reduce carbon emission from deforestation ad forest degradation
  - Promote climate change mitigation efforts
- **Forest Ecosystem**
  - Promote adaptation strategies of PFM
  - Improved land tenure, conservation and restoration are all valuable strategies.
  - Enhance area enclosures to protect ecological degradation and loss of biodiversity.
  - Rehabilitee Kasha forest ecosystem through afforestation, reforestation,
  - Strengthening participatory forest management practices in coloration with the government, the society and by NGO.
  - Developing forest ownership/tenure law which is fair, stable and unambiguous with clear rights and duties (state, common, private).

- Legalising or recognising customary rights of communities over forests and woodlands and enhance the capacity of informal institutions to the extent possible.
- Developing perceptive legal instruments (policy, law and regulation) that consider Participatory Forest Management as the main "pull" of forest management in the country and to develop or amend the forest law.

- **Livelihoods**
  - Promote adaptation strategies of wood and non-wood products utilization
  - Substitute house construction material by others instead use forest for construction.
  - Use alternative cooking stoves technology and improve electricity accessibility and bio-full gas instead use forest for fuel wood.
  - Enhance drought and extreme event of RF ad T resistance improved crop.
  - The factors that drive the local people to overexploit the forest should be identified and appropriate mitigation measures should be taken to halt the problem
  - Provide land for private and community woodlots and local households, while closing the natural forests from humans and livestock. The organized land tenure situation has impacted favorably on deforestation and degradation
  - With land registration individual households get their rights overland and they can defend them from other households and outsiders coming to an area to cut trees
  - Campaign and awareness on the need of sustainable development assurance through advocacy, law enforcement ad establish system
  - Livelihood comprises capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from the stress and shocks and maintain or enhance its capacities and assets both now and in the future without undermining the natural resource base.

Reference

(Stagl, 1999; Smulders, 2000). the connection between economic development and the environment

Alemu, B., Garedew, E., Eshetu, Z., Kassa, H., 2015. Land use and land cover changes and associated driving forces in north Western lowlands of Ethiopia. Int. Res. J. Agric. Sci.Soil Sci. 5 (1), 28–44.

Apergis and Payne, 2010a the constant economic growth

Ayalew, G. (2013). An Assessment of Performance Appraisal Practices in the Ministry Of Finance and Economic Development (MOFED) In Addis Ababa.

Contreras-Hermosilla, A. (2000). The underlying causes of forest decline**.**

Coondoo and Dinda, 2008 the connection between economic development and the environment

Daba Fenet Belay (2016) Determinants of Household Participation in Water Source Management in Ethiopia

De Souza, R. J., Mente, A., Maroleanu, A., Cozma, A. I., Ha, V., Kishibe, T., ... & Anand, S. S. (2015). Intake of saturated and trans unsaturated fatty acids and risk of all cause mortality, cardiovascular disease, and type 2 diabetes: systematic review and meta-analysis of observational studies. Bmj,

Demisse, A. G., Alemu, F., Gizaw, M. A., & Tigabu, Z. (2017). Patterns of admission and factors associated with neonatal mortality among neonates admitted to the neonatal intensive care unit of University of Gondar Hospital, Northwest Ethiopia. Pediatric health, medicine and therapeutics,

Economic development is probably compatible with environmental recovery (Kijima et al., 2010).

Esayas, Y., 2010. Evaluating the Impact of Land Use/Land Cover Change on Soil Erosion Runoff Using SWAT Model at TikurWuhaWatershed.Unpublished M. Sc Thesis Addis AbabaUniversity, Ethiopia http://etd.aau. edu. et/dspace/bitstream/123456789/2272/1/Yacob% 20Esayas. pdf].

FAO (*2015*).Forests of Ethiopia ... (*LULCC*) is an important indictor and early warning of ecological changes. However, few

Gebreselassie, S., Kirui, O. K., & Mirzabaev, A. (2016). Economics of land degradation and improvement in Ethiopia. Economics of land degradation and improvement–a global assessment for sustainable development,

Grossman and Krueger (1991) U-shaped linkage of economic growth

Guillozet, K., & Bliss, J. C. (2011). Household livelihoods and increasing foreign investment pressure in Ethiopia's natural forests.

Henok, K., Dondeyne, S., Poesen, J., Frankl, A., Nyssen, J., 2017. Transition from Forestbased to Cereal-based Agricultural Systems: A Review of the Drivers of Land use Change and Degradation in Southwest Ethiopia. Land Degradation and Development 28, 431–449.ation.

Heywood, V.H., Watson, R.T., 1995. Global Biodiversity Assessment, vol. 1140. Cambridge University Press, Cambridge

Hirpha, H. H., Mpandeli, S., Bantider Dagnew, A., Chibsa, T., & Abebe, C. (2021). Assessing the integration of climate change adaptation and mitigation into national development planning of Ethiopia. *International Journal of Climate Change Strategies and Management*,

Jemal, s. effects of climate change on potential productivity of afromontane forest: implication on schefflera abyssinica (common bee tree), a case in southwest ethiopian highlands.

Kayet, N., Pathak, K., Chakrabarty, A., Sahoo, S., 2016. Spatial impact of land use/land cover change on surface temperature distribution in Saranda Forest, Jharkhand.Modell. Earth Sys. Environ. 2 (127), 1–10.

Loha, A., Tigabu, M., Teketay, D., Lundkvist, K., & Fries, A. (2006). Provenance variation in seed morphometric traits, germination, and seedling growth of Cordia africana Lam. New forests,

Loha, A., Tigabu, M., Teketay, D., Lundkvist, K., & Fries, A. (2006). Provenance variation in seed morphometric traits, germination, and seedling growth of Cordia africana Lam. New forests,

Marohn,C and Cadish,G(2016). Assessment of land use and land cover change in South Central Ethiopia during four decades based on integrated analysis of multi-temporal images and geospatial vector data

Marques, S., Zeisel, A., Codeluppi, S., Van Bruggen, D., Mendanha Falcão, A., Xiao, L., ... & Castelo-Branco, G. (2016). Oligodendrocyte heterogeneity in the mouse juvenile and adult central nervous system.

Mganga, K.Z., Nyariki, D., Musimba, N.K.R., Amwata, D.A., 2018. Determinants and Rates of Land Degradation: Application of Stationary Time-Series Model to Data from a Semi-arid Environment in Kenya.

Ministry of Urban Development and Construction (MUDCo) Addis Ababa; 2012. Structure Plan Manual (Revised Version

MOWE (2001) Water Sector Development Program Main Report Volume I

MOWIE,(2015).Second Growth and Transformation National Plan for the Water Supply and Sanitation SubSector (2015

Roy P.S., R.S. Dwivedi, D. Vijayan(2010). Remote Sensing Applications

Teshome Adugna.(2007).Impacts of Water Supply and Sanitation on Poverty in Ethiopia to Meet MDGs Poverty Reduction Goal.

The Millennium ecosystem services (2005)

The world development report 1992

Toman, 2003 . The term "by-products management

Unep, A., & ASSESSMENT, I. R. R. (2016). The rise of environmental crime. Nairobi: UNEP.

World Bank (2004). Water and Development

World Commission on Environment and Development, 1987; Pearce and Warford, 1993).

World Economic Outlook (2020), the United Nations Conference on Environment and Development

Yee, S. H., Carriger, J. F., Bradley, P., Fisher, W. S., & Dyson, B. (2015). Developing scientific information to support decisions for sustainable coral reef ecosystem services. *Ecological Economics*, *115*, 39-50.

Yirdaw E., Tigabu M., Monge A. (2017). Rehabilitation of degraded dryland ecosystems – review. Silva Fennica vol. 51 no. 1B article id 1673. https://doi.org/10.14214/sf.1673

Zerga, B., & Gebeyehu, G.(2016). Climate Change in Ethiopia Variability. *Impact, Mitigation, and Adaptation*, *2*

Writers

	POSITION
• Mr. Gedamu Yewnesew	Senior GIS Expert
• Mrs. Banchaymolu Terefe	State of Land and Water Change Study Report Preparation Higher Expert
• Mr. Washun Yemer	State of Biodiversity Change Study and Report Preparation
• Mr. Elshadaye Arega	Social and Economic Change Study Higher Expert
• Mr. Bhirhane Bezabe	State of Climate change and air pollution Study and Report Preparation

Facilitator

- Mr. Tilahun Alemu — Lead Executive officer State of Environment and Natural Resource Report and Data preparation
- Mrs. Kidist Yewalashet — Head, State of Environment Data Study and Report Report Preparation Desk