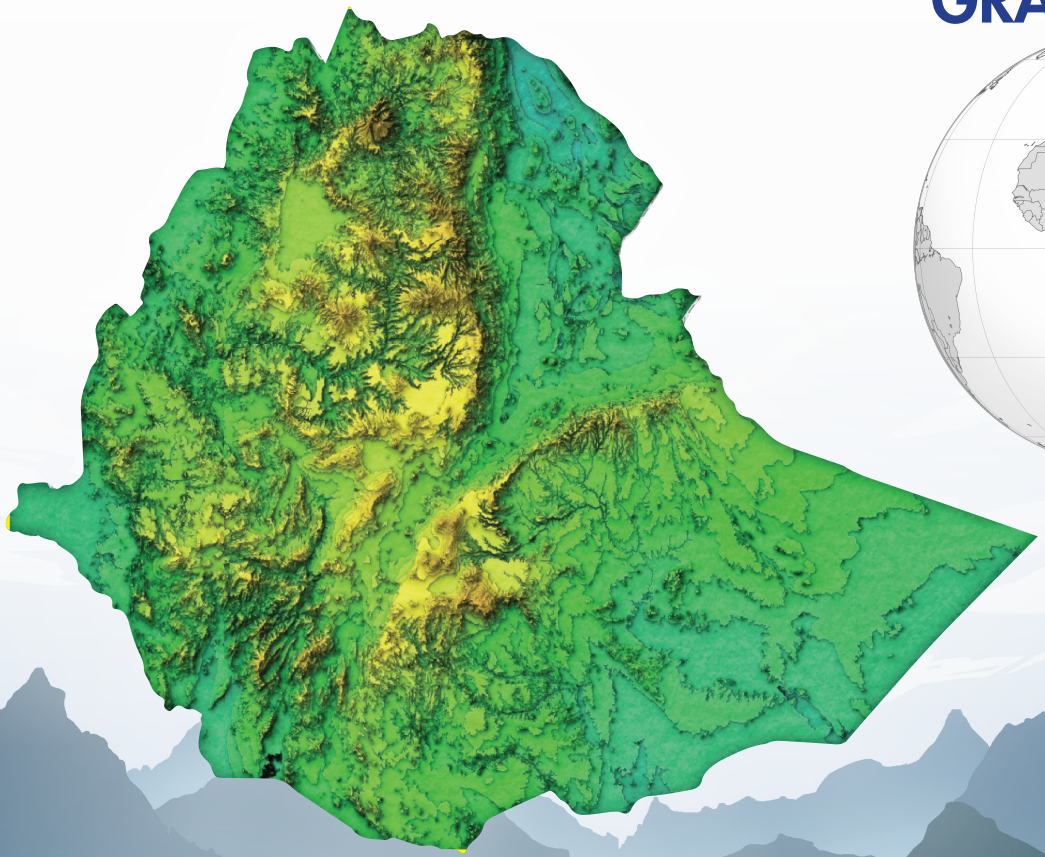
GEOGRAPHY

DISTANCE LEARNING MATERIAL GRADE 9



MODULE ONE

FDRE Ministry of Education
2023

GEOGRAPHY

DISTANCE LEARNING MATERIAL

GRADE 9

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Geography Grade 9 Distance Learning Material

Introduction

Hello, dear distance learner! How have you been doing? We hope you have enjoyed learning about the physical characteristics of the Earth, people and socioeconomic activities, natural resources and socioeconomic development, modern Ethiopian history, and contemporary global issues in the eighth grade geography module that you studied through distance learning.

This is grade 9 Geography distance material. It has been developed by MOE in collaboration with Hawassa University and center of excellence of education (Addis Ababa University, Bahir Dar University, Jimma University and Samara University).

During the preparation of this distance materials all contenporary Geographic thematic areas have been included. It adresses Physical Geography, Human Geography, Human-environment interaction, geographic issues and public concerns, and geographic inquiry, skills and techniques.

This distance material contains two modules which consist of four units each. The first module consists of physical geography and population studies. The second module also consists ectonomic activities, human environmental interaction, comtemporary issues and map reading and geo-spatial data inquiries.

Dear learner! As you are learning independently, this learning material will be covered by 88 hours. The firrst Module will be covered within 44 hours and the second one will be covered within 44 hours.

We anticipate that you have experiences and skills on how to use this type of geography distane material to advance learning. However, we would like to introduce the following methods to ensure that you study this material efficiently. New topics and sub-topics with detailed explanations are provided for you. Besides, some brainstorming activities are given following the topics. Furthermore, reflective activities are given following the descriptions of each topic. These brainstorming and reflective activities should be done by you. Of course, the answers for each activity are given at the end of each unit. At the end of each section, there is a checklist that helps you assess the extent of your understanding of the section.

And then, if you are successful in responding positively, that is good! Now, proceed to do the self-test exercises whose answers are available at the end of the unit. If not, you have to go back and read the section again. Moreover, a summary of each unit and the required reference materials for the unit are given at the end of the unit.

Finally, the module also includes assignments that need to be submitted. Therefore, you are expected to do the assignments carefully and submit them to your tutor. We wish you all the best in your studies.

General Objective

At the end of this Geography distance learning material, you will be able to:

1. To develop an understanding and acquire knowledge of:

- *concept, scope and branches of geography;*
- *geological processes and landforms of Ethiopia;*
- *concepts of weather and climate;*
- *elements and controls of climate and climatic regions;*
- *drainage pattern and water resources of Ethiopia;*
- *factors responsible for the difference in types of natural vegetation in Ethiopia;*
- *the types of wildlife in Ethiopia and factors that affect their distribution;*
- *the types of soils in Ethiopia and factors that affect their distribution;*
- *spatiotemporal distribution of minerals in Ethiopia;*
- *theories, growth, characteristics, structure and distribution, population, and settlement patterns in Ethiopia;*
- *spatial distribution of health and diseases in the highlands and lowlands of Ethiopia; and*
- *the diversity of language and religion in Ethiopia.*

2. To develop skills and abilities of:

- *constructing the absolute and relative location of Ethiopia;*
- *computing the size and shape of Ethiopia;*
- *illustrating the distribution of soil types, major water resources, natural vegetation, and wild life in Ethiopia;*
- *demonstrating the spatiotemporal variation of minerals in Ethiopia;*
- *demonstrating the population distribution and settlement patterns of Ethiopia; and*
- *demonstrating the spatial distribution of health and diseases in the highlands and lowlands of Ethiopia.*

3. To develop the habits and attitudes of:

- *appreciating the diversity of language and religion in Ethiopia;*
- *showing interest in the realization of plan for accelerated sustained development to end poverty;*
- *aspiring to natural resource management in Ethiopia;*
- *showing interest in the implementation of Ethiopia's vision to achieve development without undermining the potential of the natural environment;*
- *conforming to participate in conservation programs; and*
- *generalizing the present features of Ethiopian socio-economic development.*

Main Contents

Unit 1: Geological History and Topography Of Ethiopia
Unit 2: Climate of Ethiopia
Unit 3: Natural Resource Base of Ethiopia
Unit 4: Population and Demographic Characteristics of Ethiopia
Unit 5: Major Economic and Cultural Activities in Ethiopia
Unit 6: Human – Natural Environment Interactions in Ethiopia
Unit 7: Contemporary Geographic Issues and Public Concerns in Ethiopia
Unit 8: Geographic Inquiry Skills and Techniques

Assessments

Formative assessment

- Open-ended questions
- Worksheets
- Rubrics
- Portfolios
- Essays
- Self-test exercises
- Diagnostic test at the beginning of the class term
- Feedback on learning-in-process
- Peer and self-evaluation

Summative assessment

- Mid-term examination
- Assignments
- Portfolios
- Final examination

MODULE I

Module Introduction

Dear distant learner! This is module one for a grade nine distance learner. In this module, you are going to study about the geography of Ethiopia. This module comprises of the physical and human environment of the country. Subsequently, you will learn about the country's location, size, shape, geological history, topography, drainage, climate, vegetation, wildlife, soil, mineral resources, and population and demographic characteristics.

We anticipate that you have experience and skills on how to use this type of module to advance learning. However, we would like to introduce the following methods to ensure that you study this material efficiently. New topics and sub-topics with detailed explanations are provided for you. Besides, some brainstorming activities are given following the topics, and reflective activities are given following the descriptions of each topic. These brainstorming and reflective activities should be done by you. Of course, the answers for each activity are given at the end of each unit. At the end of each section, there is a checklist that helps you assess the extent of your understanding of the section.

And then, if you are successful in responding positively that is good; just proceed to do the self-test exercises whose answers are available at the end of the unit. If not, you have to go back and read the section again. Moreover, a summary of each unit and the required reference materials for the unit are given at the end of the unit.

Finally, the module also includes assignments that need to be submitted. Therefore, you are expected to do the assignments carefully and submit them to your tutor. We wish you all the best in your studies.

Module Objectives

At the end of this module, you will be able to:

- *understand the notion, scope and branches of geography,*
- *know basic features of the physical environment,*
- *understand the concept of a map and its basic components*
- *acquire the knowledge of geological processes and landform of Ethiopia,*
- *identify elements and controls of climate, and climatic regions,*
- *know drainage pattern and water resources of Ethiopia,*
- *describe factors responsible for the distribution of the major water resources in Ethiopia*
- *recognize impacts of rapid population growth on natural environment, socio - economic development and urbanization in Ethiopia,*
- *distinguish spatial distribution of diseases in the highlands and lowlands of Ethiopia,*
- *construct the absolute and relative location of Ethiopia,*
- *compute the size and shape of Ethiopia,*
- *illustrate the distribution of soils types, major water resources, natural vegetation and wild life in Ethiopia,*
- *demonstrate the population distribution and settlement patterns of Ethiopia,*
- *demonstrate spatial distribution of health and diseases in the highlands and lowlands of Ethiopia,*
- *adhere to the realization of the Ethiopian population policy, and*
- *appreciate the diversity of language and religion in Ethiopia.*

Module Contents

Unit One: Geological History and Topography of Ethiopia
Unit Two: Climate of Ethiopia
Unit Three: Natural Resource Base of Ethiopia
Unit Four: Population and Demographic Characteristics of Ethiopia

Module Assessment Methods

Formative assessment

- Open-ended questions
- Worksheets
- Rubrics
- Portfolios
- Essays
- Self-test exercises
- Diagnostic test at the beginning of the class term
- Feedback on learning-in-process
- Peer and self-evaluation

Summative assessment

- Mid-term examination
- Assignments
- Portfolios
- Final examination

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UNIT ONE

GEOLOGICAL HISTORY AND TOPOGRAPHY OF ETHIOPIA

Unit Introduction

Dear distance learner! In this unit, you will learn the geological history and topography of Ethiopia, which deal with the location, size, shape, geological processes, and landforms of Ethiopia. The unit is also intended to get you familiar with the meaning, scope, and branches of geography. Since, this unit is the introductory part of the course, understanding it enhances understanding of the proceeding units.

Unit learning outcomes

At the end of this unit, you will be able to:

- *recognize the concept, scope and branches of geography;*
- *express the basic land features of the physical environment;*
- *describe the absolute and relative location of Ethiopia;*
- *analyze the effects of shape and size of Ethiopia on its sociocultural, political and economic condition;*
- *explain geologic processes that shaped the land surface of Ethiopia; and*
- *describe the different landforms of Ethiopia.*

Key Terms

- *Absolute location*
- *Era*
- *Exogenic force*
- *Geography*
- *Geology*
- *Human geography*
- *Orogenic*
- *Physical geography*
- *Relative location*
- *Relief*
- *Vicinal location*

Unit contents

1.1. Geography: Meaning, Scope, and Branch
1.2. Location, Size, and Shape of Ethiopia
1.3. Geological History of Ethiopia

The Required Study Time: 11 Hours.

Learning Strategies of Unit One

Suggested learning strategies are:

- *written brainstorming questions;*
- *case study;*
- *field visit;*
- *Problem-solving method;*
- *individual project;*
- *report writing;*
- *observation;*
- *written activities;*
- *practical activities;*
- *self-test assessments;*
- *online dialog (if possible); and*
- *electronic portfolios (if possible).*

Section 1 Geography: Meaning, Scope and Branches

Section Overview

Dear learner! In this section, you will learn about the meaning, scope and branches of geography. First, you will be acquainted with some basic concepts related to the science of geography. Then, you are going to learn about the two fundamental branches of geography: Physical and Human Geography.

Section Learning Outcomes

At the end of this section, you will be able to:

- *define geography as a subject;*
- *describe the scope of geography; and*
- *identify the branches of geography.*

Required study time:4 Hours

1.1.1. Meaning of Geography

Dear learner! *Do you recall the notion of 'geography' from social studies distance learning module for grade 8? Well. Let you try to define the word 'geography' in your own words below.* _____

_____

_____

Have you tried? That is great. The term "Geography" first appeared in history at the time when the Greek civilization reached its peak. They defined geography for the first time by combining two words of Greek origin namely: Geo and Graphos.

- Geo – which means earth
- Graphos – which means writing

Eratosthenes, a famous Greek Philosopher (276-194 B.C) coined the term Geography and defined it as "the field of study that deals with the description of the earth". Now, this definition seems very general when we compare it to the scope of current geography.

A number of definitions have been given by different scholars of the nineteenth and twentieth centuries. These definitions relate to geography's current concerns, interests, and focus.

Here are some of the most important definitions that scholars have proposed:

- **Eratosthenes (276-196):** "Geography is the description of the earth."
- **Alexander Von Humboldt (1769-1859):** "Geography is a synthesizing discipline to connect the general with the particular through measurement, mapping, and a regional emphasis."
- **Concise Oxford Dictionary (1964):** "Geography is the science of the earth's surfaces."
- **Hartshorne, R. (1899-1992):** "Geography is a branch of knowledge that is concerned with the provision of an accurate, orderly and rational description of distributions on the surface of the earth."
- **Yeates, M. (1968):** "Geography is a science that is concerned with the rational development and testing of theories that explain and predict the spatial distribution and locations of things and phenomena on the surface of the earth."

Dear learner! *How do you view the definitions? What similarities and differences exist among them? Try to answer it below.* _____

_____

_____

Yes, as you have read above, each of these definitions includes the idea that geography studies the earth. Most of them specify the surface of the earth.

It is difficult to forward a definition acceptable to all geographers at all times and places because of the dynamic nature of the discipline and the changes in its scope and method of study. However, the following may be widely accepted definitions by most scholars:

Geography is the scientific study of the Earth that describes and analyses spatial and temporal variations of physical, biological and human phenomena, and their interrelationships and dynamism over the surface of the Earth.

1.1.2. The Scope of Geography

Dear learner! *What do we mean by the word scope? Do you know the extent of geography's scope? Please try to answer each question. Use the space given for your answers.* _____

_____

_____

We hope you have got them all right. If not, you can answer them after reviewing the note given below. Scope refers to the content (how broad or narrow) of the field of study of a given discipline, in this case geography. The scope of geography is very wide. As the scope is dynamic, it often changes as discoveries and ideas enter the field.

Geography studies a great many physical and human features of the world. Its focus includes their causes, effects, and interactions. As a result, the subjects that geography examines include features in the hydrosphere, atmosphere, lithosphere, biosphere, and anthroposphere.

Geography as a field of study is also concerned with the economic, social, political and ecological problems that you hear every day. It is also concerned with modern technology, such as computers, the Global Positioning System (GPS) and the Geographic Information System (GIS), to analyze information and draw accurate conclusions.

- **Hydrosphere:** – it includes all the bodies of water, i.e., oceans, rivers, lakes, and others.
- **Biosphere:** – refers to all living organisms in and on the earth's surface.
- **Atmosphere:** – it includes all aspects of the air composition surrounding our planet.
- **Lithosphere:** – it is the solid layer of rocks that covers the entire surface of the planet.
- **Anthroposphere:** – it is the part of the environment that is made or modified by humans.

Dear learner! Did you notice how wide the scope of geography is? Do you understand the extent of its scope? That is right, it is true that geography has a very wide scope. However, this does not mean its scope is unlimited. The major areas that geography focuses on are:

- the earth, its position in the universe and its movements;
- the different physical features that constitute the earth's surface, the forces that cause them, their variations from place to place, and their changes over time;
- the different relationships between human beings and their natural environment. Also, the interdependence and the impact that each has on the other;
- the conditions of the lower part of the atmosphere and the subsequent weather and climatic conditions, together with their spatial distribution and variation;
- the materials that make up the earth and its diverse landforms; and
- the major economic activities of humans and their impacts on the environment.

Therefore, geography deals with an enormous range of phenomena ranging from the physical and biotic to the human environment. From this, it is possible to conclude that although wide in its scope, geography has certain areas on which it focuses. Hence, geography is a holistic discipline of knowledge and research (academics).

1.1.3. Branches of Geography

We hope you have studied the definition of geography, and you have considered its scope. Next, you will learn about the main parts of geography and its sub-branches. Well. Geography has two major branches. They are:

- physical geography; and
- human geography

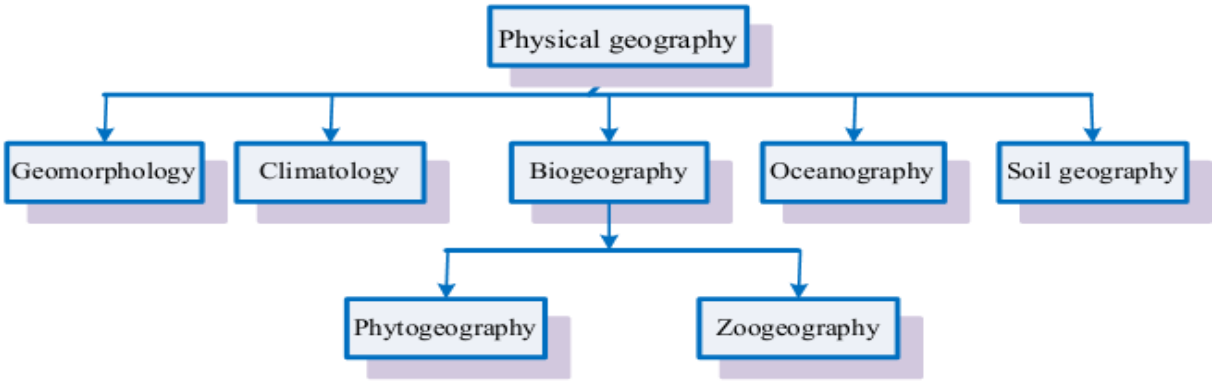
Dear learner! *Have you ever read the descriptions of the phrases "physical geography" and "human geography,"? If not, write down your definitions of physical geography and human geography in the space provided and compare your answer against what you are going to read in the subsequent paragraphs.* _____

_____

A. Physical Geography

Physical geography studies the distribution of the natural features of the world, such as climate, landforms, soil, vegetation, surface drainage systems, water resources and animals. This branch of geography also considers the causes, effects and interactions of these features.

Dear learner! *Do you know the sub-branches of physical geography? Did you try to recall them? That is great. Physical geography is sub-divided into more specialized fields of study as follows:*



- **Geomorphology:** it is the study of landforms, their distribution, origin and the force that change them.
- **Climatology:** it studies factors that create the climate and examines the variation and distribution of climate and related causes and effects.
- **Biogeography:** generally speaking, it deals with the distribution of plants and animals. One part of biogeography deals with patterns of vegetation growth in relation to climate, soil and human activities and it is known as phytogeography. There is also another part of biogeography that studies why certain animals live in one region and not in other. In addition, it investigates the migration of animals and the factors that affect their movements. This area of study is called zoogeography.
- **Oceanography:** it studies the location, causes and effects of ocean currents, waves and tides. It also investigates the ocean floor.
- **Soil geography:** it studies the distribution of various types of soils throughout the world. Soil geography studies how different kinds of soil influence the type and amount of crops produced in an area. It also examines how soils are affected by the agricultural activities practiced in an area.

B. Human Geography

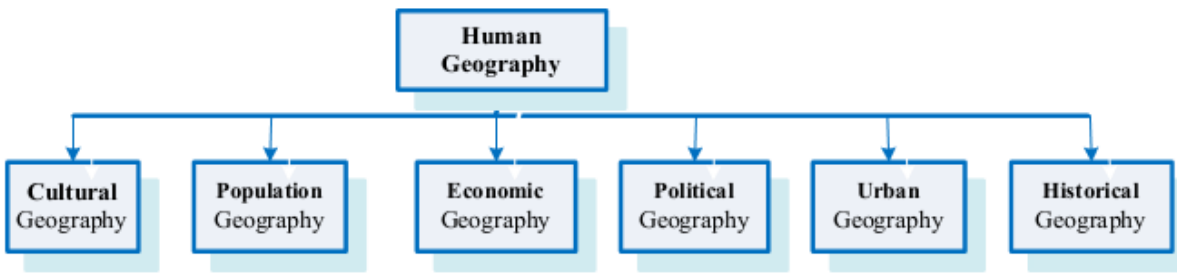
Dear learner! *What are the sub-branches of human geography? List down your answer in the space provided below and compare against what you are going to read in the following paragraphs.* _____

_____

_____

_____

Have you tried it? If so, that is fantastic. Human geography studies the distribution and influence of human aspects of our world, including cultures, population settlement, economic activities, and political systems. This branch of geography is subdivided into the following specialized fields of study.



- **Cultural geography:** it examines the distribution and interactions of cultures, including peoples' beliefs and customs. It also examines the movement, expansion and interaction of cultures on the surface of the earth.
- **Population geography:** it is concerned with population distribution and the factors affecting it. It also deals with birth and death rates, population structure, population movements, household size, and other related statistical data.
- **Economic geography:** it studies production, consumption, exchange, the spatial distribution of goods, services and the factors affecting them.
- **Political geography:** it deals with the distribution of political systems and the ways people use them to exercise power and make decisions. It also studies topics such as changes in political boundaries, problems of political instability and patterns of voting.
- **Urban geography:** it studies the development and characteristics of towns, cities and other urban centers. It also investigates where different groups live within a city; why and where slums develop.
- **Historical geography:** it is the study of the geography of the past and how places, regions and patterns of human activity have changed over time.

Resources

Adams, Willia M. et.al (eds) (1996). The Physical Geography of Africa. New York: Oxford University Press.

Arthur, H. (1957). Elements of Geography. London: McGraw Book Company, Inc.

Small, John, et al, (2001): A Modern Dictionary of Geography. Fourth Edition. Hodder Education Publishers.

Geography student textbook for grades 9 – 12

Activity One

Dear learner! Now you are going to do an exercise. Answer the following questions in the space provided.

1. Who defined the term geography for the first time in history?

2. Mention the major issues that encompass the scope of geography.

3. What are the two branches of geography?

4. What are the six branches of human geography?

Checklist

Dear learner! Now it is time to check your understanding of the meaning, scope, and branches of geography. Read each of the following questions and answer them by putting a tick (√) mark in one of the boxes under the alternatives 'Yes' or 'No'.

S.N	Items	Yes	No
1	Can you define geography as a subject?		
2	Can you describe the scope of geography?		
3	Can you recognize the branches of geography?		
4	Can you identify the sub-branches of physical geography?		
5	Can you list down the sub-branches of human geography?		

Is there any box that you mark 'No' under it? If yes, please go back to your text and read about it before you go to the following exercise.

SELF-TEST EXERCISES FOR SECTION ONE

Part I. Write 'True' if the statement is correct and 'False' if it is wrong.

1. The two major branches of geography are climatology and economic geography.
2. The first scholar who coined the term 'Geography' was Eratosthenes.
3. The scope of geography is the extent of geography as a field of study.
4. Cultural geography is concerned with population distribution and factors affecting it.
5. Anthroposphere is the part of the environment that is made or modified by humans.

Part II. For the following questions, choose the correct answer from the given alternatives.

1. The branch of geography that studies landforms, their distribution, origin and the force that change them is called_____.

   A. Soil geography
   B. Geomorphology
   C. Biogeography
   D. Phytogeography

2. One of the following is not a branch of human geography.

   A. Urban geography
   B. Population geography
   C. Political geography
   D. Oceanography

3. It is the solid layer of rocks which covers the entire surface of the planet.

   A. Lithosphere
   B. Hydrosphere
   C. Biosphere
   D. Atmosphere

4. Population geography is a branch of _____.

A. Settlement geography
B. Cultural geography
C. Human geography
D. Physical geography

5. The word geography comes from Greek word 'Geographos' which literally means

A. Animals and planets
B. Water
C. Living habits
D. To write about the Earth

Section 2 Location, Size and Shape of Ethiopia

Section Overview

Dear learner! In previous section we looked in detail at the meaning, scope and branches of geography. In this section, we will try to have a brief look at the location, size and shape of Ethiopia. The location of Ethiopia can be expressed absolutely and relatively. With a total area of 1,106,000 km^2, Ethiopia is one of the ten largest countries in Africa.

Section Learning Outcomes

At the end of this section, you will be able to:

- *describe the absolute and relative location of Ethiopia; and*
- *discuss the effects of size and shape of Ethiopia on its sociocultural, political and economic condition.*

Required study time:4 Hours

1.2.1. Location of Ethiopia

Dear learner! *Why is the location of things important in geography? What locational significance does Ethiopia have as a country that is in the Horn and near the Red Sea route? Write down your answer in the space provided and compare it against what you will read in the subsequent paragraphs.* __

_____

_____

_____

Have you tried? Yes, a location is a place where a particular point or object exists. In spatial distribution, every place has its own particular location in relation to its surroundings. In geography, the term 'location' is a much more abstract concept than what an ordinary person knows. This important term is usually expressed in two ways: relative location and absolute location.

Dear learner! *Can you identify the relative location of your workplace or home? Try to answer it below. If not, please read the details below or ask any geography teacher near you.* _____

_____

_____

A. Relative Location of Ethiopia

Dear learner! *Look at the map in Figure 1.1 and try to write down the vicinal location of Ethiopia in the space provided and compare it against what you will read in succeeding paragraphs.* _____

_____

_____

Have you got them right? If not, no problem. Relative location refers to the position of a place in relation to the location of other geographic features. Relative location can be expressed in the following two ways; namely; vicinal location and geological location. The vicinal location shows the location of a country in relation to neighboring countries (Table. 1.1), while the strategic location, also known as the natural location describes a country's location in reference to water bodies and landmasses.

i. Vicinal Location of Ethiopia

Ethiopia is a landlocked country that is surrounded by six neighboring countries (see Fig. 1.1). Each country shares different lengths of Ethiopia's borderlines. The total length of Ethiopia's boundary line is 5,260 km.

Table 1.1: Ethiopia's Boundary Line length as Shared with Neighboring Countries

SN	Bordering Countries	Shared Boundary Length in Km	Ethiopia is found;
1	Djibouti	310	West of Djibouti
2	Eritrea	840	South of Eritrea
3	Kenya	760	North of Kenya
4	Somalia	1,600	West and Northwest of Somalia
5	Sudan	744	East and Southeast of Sudan
6	South Sudan	1,006	Northeast of South Sudan
Total		5,260	

Table 1.1 indicates that Ethiopia shares the longest length of boundary line with Somalia while the Republic of Djibouti shares the shortest boundary line length.

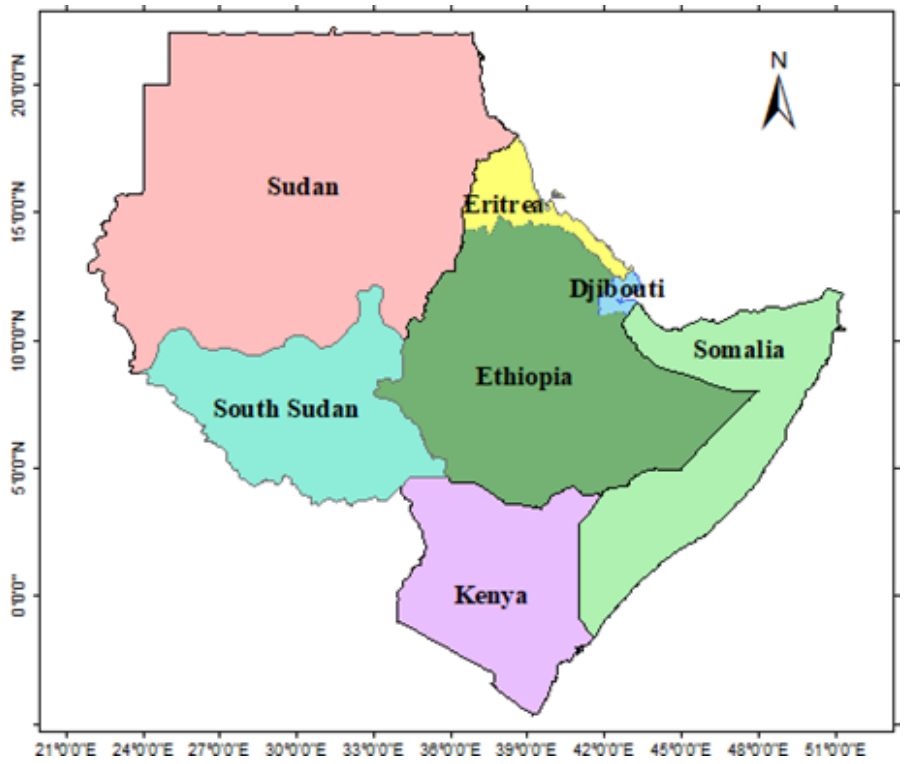


Figure 1.1: Relative Location of Ethiopia

ii. Strategic Location of Ethiopia

Strategic location is also called natural or global location. Consequently, Ethiopia's strategic location can be described in the following ways. It is found:

- in northeastern (Horn) Africa;
- to the southwest of the Asian continent;
- in the Nile Basin;
- to the south of Europe;
- to the northwest of the Indian Ocean;
- to the southwest of the Red Sea; and
- to the south of the Mediterranean Sea.

B. Absolute or Astronomical Location of Ethiopia

Dear learner! *Have you ever described the absolute location of a given place? Using figure 1.2, please try to describe the absolute location of Ethiopia in the space provided.* _____

_____

_____

Have you written? Yes, absolute location is expressed as a geographical extent, in terms of latitudes and longitudes. The absolute location of Ethiopia is expressed as follows.

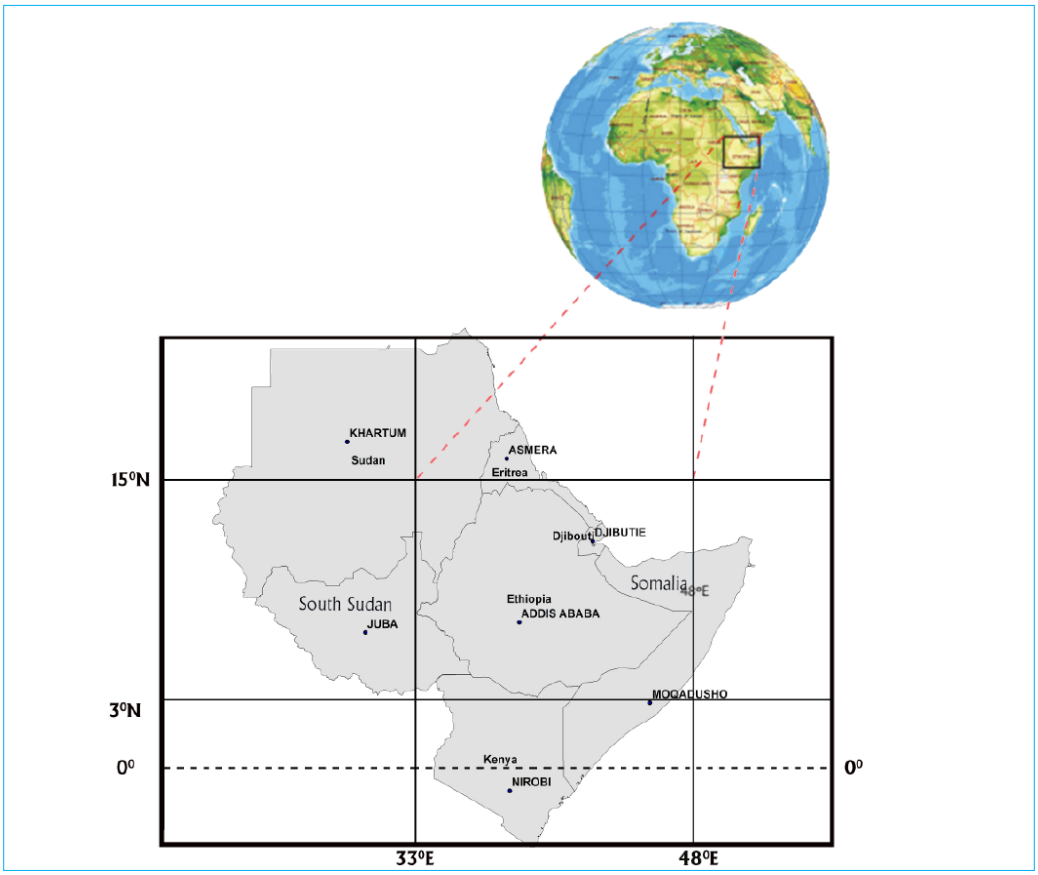


Figure 1.2: Absolute Location of Ethiopia

As a result, Ethiopia's extreme points lie at:

- the Northern tip of Tigray in the north;
- Moyalle in the south (Borena);
- Akobo in the west (Gambella) and
- the tip of Ogaden in the east (Ogaden) (see Fig.1.2).

1.2.2. Size of Ethiopia

Dear learner! *Do you assume the advantages and disadvantages Ethiopia's large size offers the country? Try to answer it below and compare it against what you will read in the subsequent paragraphs.* _____

_____

_____

Did you answer? Good. Ethiopia is the tenth largest country in Africa with a total area of 1,106,000 square kilometers. When we compare its area with that of its neighbors, Ethiopia stands second, next to Sudan, and it is almost five times bigger than Djibouti. It contains about 0.7 percent of the world's land area and about 3.6 percent of Africa's land mass.

Table 1.2: Comparison of Ethiopia's Areal Size with its Neighbors

Country	Total area (in sq.kms)	Rank	Size in comparison to Ethiopia
Ethiopia	1,106,000	2	-
Sudan	1,849,233	1	1.01 times bigger
Somalia	637,661	3	1.73 times smaller
Kenya	580,000	5	1.91 times smaller
Eritrea	118,000	6	9.42 times smaller
Djibouti	23,200	7	Almost 50 times smaller
South Sudan	631,928	4	1.75 times smaller

Source: CSA, 2012

Dear learner! Before we are going to look at advantages and disadvantages let us note the following important fact.

The Horn of Africa takes its name from the horn-shaped land formation that forms the easternmost point of the African continent, projecting into the Indian Ocean south of the Arabian Peninsula. Ethiopia is the largest country in the Horn. This status in size, in combination with its status of having a large population, confers many advantages to Ethiopia in the Horn area.

Advantages : Ethiopia's large size lets it:

- enjoy diverse agro-ecological zones, resulting in a wide variety of fauna and flora;
- possess a large amount of arable land;
- have a great variety of mineral resources; and
- be the home of diverse ethnic groups.

Disadvantages: Its large size forces Ethiopia to:

- require expensive administrative expenditures;
- have a large army to protect its sovereignty;
- require great financial power to construct infrastructural facilities; and
- face challenges for effective administration and socio-economic integration.

1.2.3. Shape of Ethiopia

Dear learner! *Use a world map or atlas to describe the shape of Ethiopia in the space provided and compare it against what you will read in the following paragraphs.* _____

_____

_____

Did you answer? Does Ethiopia have a similar shape to its neighboring countries? Sure, remember countries of Africa and the world at large vary not only in location and size but also in shape. Some countries have nearly circular (compact) shapes, others have elongated (linear)

shapes, and still, others have truncated (shortened) shapes. These shapes have implications for administrative, defense, and economic integration, both within the country and with respect to outside areas.

When you compare the shape of Ethiopia with the other countries, you find that Ethiopia has a more or less compact (circular) shape. Its shape is considered to be compact or essentially circular because the extreme north-south and east-west spans of the country cover comparable distances. You can easily see this approximate circularity in atlases and wall maps.

Dear learner, now let's briefly look at some theoretical indicators of the compactness of an area. There are three theoretical indicators of the compactness of an area:

- the boundary - circumference ratio (B/C);
- the area - boundary ratio (A/B); and
- the actual area – an area of the inscribing circle (A/A').

Each of these theoretical assumptions is based on a value of 1 indicating a perfectly compact shape except for the A/B ratio. They consider 0.5 –1.5 values as deviating only slightly from circular/compact and therefore indicating approximate compactness. In contrast, smaller values indicate greater divergence from compactness, especially as they approach zero (0). These small values reflect tendencies to elongation or truncation. On the other hand, A/B ratio compares the total area of a country under consideration with the total boundary length of the same country. The larger the areal size per unit boundary length is, the more compact the country is.

For example, let's use the boundary-circumference ratio to measure Ethiopia's degree of compactness or index of compactness. In the ratio, circumference is based on the assumption of a circle having equal area with the country under consideration.

$$\text{Index of compactness using } \frac{B}{C} \text{ ratio} = \frac{\text{Boundary length of the country}}{\text{Circumference of the circle}}$$

The formula to find the circumference of a circle having equal areal size as the country under consideration is $2\varpi r$ (ϖ=3.14). The value of radius (r) is not given, and it should be computed. It is going to be calculated by taking an area of a circle that is assumed to have equal areal size as the country under consideration. Thus, the area of the circle is calculated taking the following formula (i.e. $A=\varpi r^2$).

Dear learner! To understand more about the compactness of Ethiopia, look at the following example carefully.

Example

The B/C ratio of Ethiopia can be calculated as follows:

Given

The total boundary length of Ethiopia: = 5260Kms

Circumference of a circle having an area similar to area of Ethiopia (=1,106,000Km^2).

Solution:

$C=2\varpi r$, The value of ϖ is 3.14, while the value of "r" is derived from the circle whose area is equal to Ethiopia's area (i.e., 1,106,000Km^2).

πr^2 = 1,106,000Km r^2= 352,229.3

Hence, r= 593.5 Kms

Therefore, $C= 2\pi r$

Circumference of area of Ethiopia (if it were circle)

=2 x 3.14 x 593.5 = 3727.18

B/C ratio of Ethiopia = 5260/3727.18 = 1.411

This value implies that the shape of Ethiopia has a deviation of 41% from the assumed theoretical circular shape it ought to have.

The compact shape has militaristic advantage as stated earlier. This can be well explained by considering an area and borderline length ratio. The index of compactness using A/B ratio for Ethiopia is indicated hereunder.

$$\frac{\text{Area (A)}}{\text{Borderline (B)}} = \frac{1{,}106{,}000\ \text{km}^2}{5{,}260\ \text{km}} = 210\ \text{km}^2$$

Dear learner! What does this ratio imply? It implies that if 1 km borderline is safeguarded by the national army, 210 km^2 of the hinterland will become free from the assault of an enemy.

Another way of estimating the compactness of the shape of any country is by considering the ratio of the area of the country to the area of the smallest inscribing circle. In the ratio, the area of the circle is based on the assumption of the smallest inscribing circle that touches the north, south, east and west boundaries of Ethiopia described earlier in the "Absolute Location" section.

The ratio of the actual area to the area of the smallest inscribing circle (A/A') for Ethiopia can be calculated using the following formula:

$$\frac{\text{Actual area of the country}}{\text{Area of the inscribing circle}}$$

N.B. Lower value near 0 indicates elongation and a higher value near 1 suggests more compactness.

Resources

Adams, Willia M. et.al (eds) (1996). The Physical Geography of Africa. New York: Oxford University Press.
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Small, John, et al, (2001). A Modern Dictionary of Geography. Fourth Editio Hodder Education Publishers.
Geography student textbook for grades 9 – 12

Activity Two

Dear learner! ***Now you are going to do an exercise. Answer the following questions in the space provided.***

1. Using the political map of Africa determine the relative location of Ethiopia.
2. Use a world map or atlas and identify places that are in the following positions: 3°N – 15°N & 33°E– 48°E _____
3. What are the merits and demerits of Ethiopia's large size? _____
   _____
4. What are the three theoretical indicators of the compactness of an area? _____
   _____

Checklist

Dear learner! Now it is time to check your understanding of the size, shape, and location of Ethiopia. Read each of the following questions and answer them by putting a tick (√) mark in one of the boxes under alternatives 'Yes' or 'No'.

S.N	Items	YES	NO
1	Can you describe the relative location of Ethiopia?		
2	Can you describe the absolute location of Ethiopia?		
3	Can you compute the size of Ethiopia?		
4	Can you compute the shape of Ethiopia?		
5	Can you recognize the effects of the size and shape of Ethiopia on its sociocultural, political and economic condition?		

Is there any box that you mark 'No' under it? If there is please go back to your text and read about it before you are going to do the following exercise.

SELF-TEST EXERCISES FOR SECTION TWO

Part I. Write 'True' if the statement is correct and 'False' if it is wrong.

1. The relative location of a place is expressed in terms of latitudes and longitudes.
2. Ethiopia's location has more strategic advantages than disadvantages.
3. Ethiopia is the tenth biggest country in Africa.
4. The shape of Ethiopia is considered elongated.
5. The absolute location is expressed in relation to the location of other geographic features

Part II. For the following questions choose the correct answer from the given alternatives.

1. Which one of the following neighboring countries shares the longest boundary line with Ethiopia?

   A. Somalia
   B. Sudan
   C. Eritrea
   D. Djibouti

2. Which of the following is a disadvantage of Ethiopia's large size?

   A. Variety of natural resources
   B. Home for diverse cultures
   C. Difficult for effective administration
   D. Extensive arable land

3. Ethiopia is located at 3^0N to 15^0N latitudes and 33^0E to 48^0E longitudes in the Eastern part of Africa. This describes:

   A. Vicinal Location of Ethiopia
   B. Absolute location of Ethiopia
   C. Relative Location of Ethiopia
   D. Strategic Location of Ethiopia

4. Which one of the following neighboring countries borders Ethiopia in the north and northeast?

   A. Sudan
   B. Djibouti
   C. Somalia
   D. Eritrea

5. Ethiopia is the tenth largest country in Africa, with a total area of _____. square kilometers.

   A. 2,106,000
   B. 1,900,000
   C. 1,106,000
   D. 3,106,000

Section 3 Geological History of Ethiopia

Section Overview

Dear learner! In this section, you will study in detail the major geological events in Ethiopia that have happened within the four eras and their respective periods. In addition, you will learn about the major landforms of Ethiopia, which are the results of the geological processes and changes that have happened since the formation of the landform regions.

Section Learning Outcomes

At the end of this section, you will be able to:

- *explain the geological history of Ethiopia;*
- *distinguish the geological processes that result in the current landform of Ethiopia; and*
- *describe major landforms of Ethiopia.*

Required study time:3 Hours

1.3.1. The Geological Processes in Ethiopia

Dear learner! *Have you ever read the definition of "geological process"? Did you read it? Well. Please try to describe the term "geological processes" in your own words in the space provided and then compare that definition to what you will read in the succeeding paragraphs.* _____

_____

_____

_____

Have you tried? Yes, the term "geological processes" describes the natural forces that shape the physical makeup of a planet.

The geological history of Ethiopia is part of the geological processes that acted within and upon the earth's surface for many millions of years in the past. To describe the geology and history of life on Earth, scientists have developed the geological time scale. The geological time scale measures time on a scale involving four major geological eras. Each era is divided into periods, the periods into epochs, epochs into years, and years into major occurrences.

Each geological era is distinguished from the others based on grounds of the following three characteristics:

- the relative positions of the continents;
- the character of the prevailing climate; and
- the predominant lifeform (plants and animals).

Summary of Major Geological Events in the Horn

Dear learner! Which geological era is significant regarding the formation of the various landforms in Ethiopia? Please try to guess it. Well. Let's begin by considering the different geological eras and then study the events that took place in those eras. Here are the geological eras, in chronological order.

- The Precambrian Era – the oldest era (from 4.5 billion years to 600 million years ago.
- The Paleozoic Era (from 600 million years to 250 million years ago).
- The Mesozoic Era (from 250 million years to 70 million years ago).
- The Cenozoic era (from 70 million years to the recent time).

I. The Precambria Era (from 4.5 Billion to 600 Million years ago).

What do you understand by the term Precambrian? Let you try to describe it in your own words below. _____

_____

The Precambrian Era is the oldest and longest geological era, covering about 5/6 of the earth's geological time.

The following geological events occurred in the Horn during this era.

- Frequent orogenic movements (mountain building process by volcanic eruptions);
- Intensive volcanic activities;
- Denudation during the later periods (reduction or wearing down of the mountains); and
- Formation of folded mountain.

During the Precambrian era:

- The first forms of life (one-celled) emerged, such as amoeba, jellyfish, and
- The oldest rock formed – the old crystalline basement/ basement complex rock. This rock is found beneath all other rocks.

Today, in a few areas of Ethiopia, outcrops of old crystalline basement complex rocks are found on the surface, due to continuous denudation.

Example:

- In central and northern Tigray;
- In Mettekel, Assossa, Illubabor and the Abbay Gorge;
- In central Sidama, southern Omo, southern Bale and Borena, and
- In central, western and northern Eritrea.

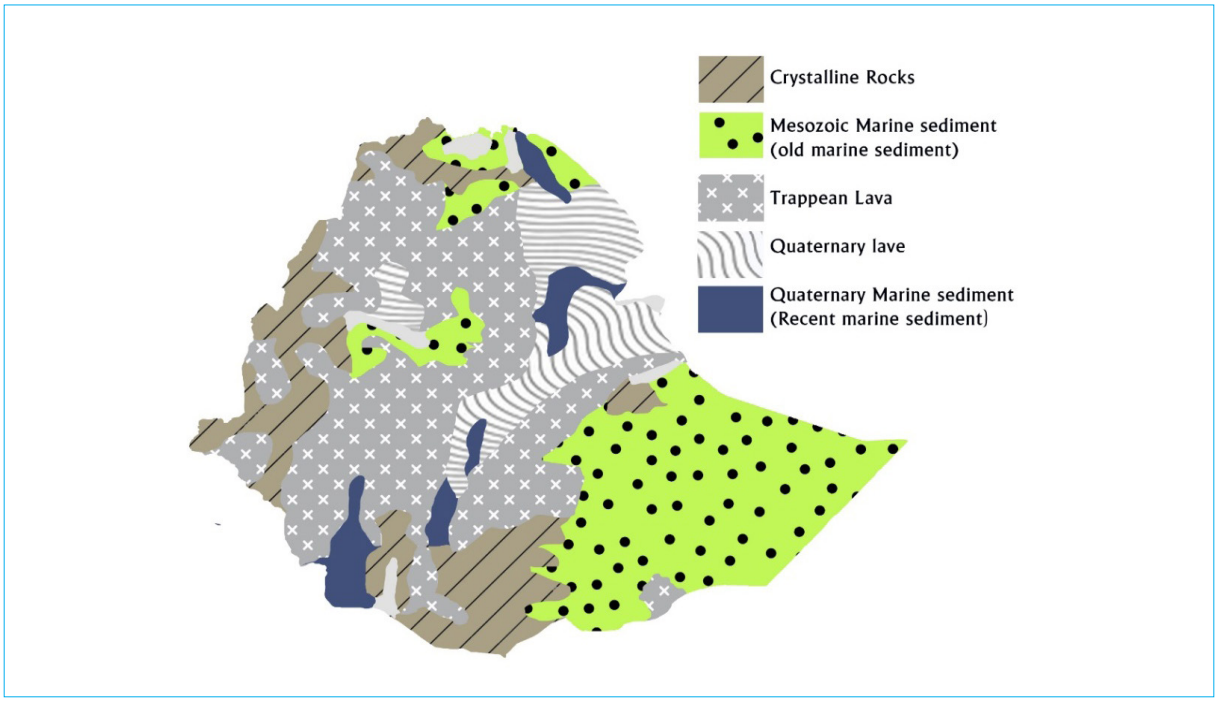


Figure 1.3: Geological Map of Ethiopia

II. The Paleozoic Era (from 600 million years to 250 million years ago)

Dear learner! *Which life form was dominant in the Paleozoic era?* _____

_____

During this era, in Ethiopia, the major geologic (geomorphic) process was denudation followed by peneplanation. No significant structural formation took place. Hence, the Paleozoic is the only era that left a gap in a rock formation in Ethiopia. The massive denudational activity resulted in the formation of inselbergs (residual features) in some parts of Ethiopia.

The Paleozoic era is known for the predominance of invertebrates.

III. The Mesozoic Era (from 250 million years to 70 million years ago)

Dear learner! *Which life form was dominant in the Mesozoic era?* _____

_____

Did you try it? Good. Please try to look at the following paragraphs to understand what happened during this era.

This era was marked by alternate slow sinking and uplifting of the landmass (Epeirogenesis) of the Horn of Africa. The Mesozoic Era was an era of sedimentary rock formation in Ethiopia. The Mesozoic era has three distinct periods as indicated hereunder.

Table 1.3.The Three Periods of Mesozoic Era

Periods	Geological time scale
Triassic	250 - 180 millions
Jurassic	180 - 135 millions
Cretaceous	135 - 70 millions

Triassic Period

During this Period, the landmass sank due to internal forces. This event was followed by the transgression of a nearby sea into the mainland of today's Somalia and southeastern Ethiopia. During the Triassic Period, the oldest sedimentary rock known as Adigrat sandstone was formed. The Adigrat sandstone is the oldest in the southeast and progressively decreases in age to the northwest.

Jurassic Period

In this Period, the transgression of the sea continued into the mainland in the northwest direction. This event deposited another sedimentary rock known as Hintalo limestone. The Hintalo limestone in the northwest is younger while it is older in the southeast.

Cretaceous Period

During this period, the landmass bega n to rise and the sea started to regress towards the southeast, depositing sedimentary rock known as Upper Sandstone. The Upper Sandstone is the youngest sedimentary rock and therefore overlies the rest.

Because of the direction of the regression and deposition, Upper Sandstone is the youngest in the southeast, and it is the oldest in the northwest.

The transgression of the sea extended up to northwestern Ethiopia, as far as central Tigray and the western slopes of the western highlands. The sedimentary rocks formed in the Mesozoic Era were later buried by overlying Cenozoic igneous rocks. However, the sedimentary rocks have been exposed at the surface in some areas of Ethiopia. They are thinnest (because they are the youngest) in the southeast and thickest (because they are the oldest) in the northwest.

One can see them exposed at the surface mostly in the southeastern lowlands of Ethiopia, central Tigray, and in the Abbay and Wabishebelle gorges. (For more information, look at the geological map of Ethiopia.)

The Mesozoic is also known for the predominance of reptiles. Huge reptiles, such as dinosaurs, were dominant. However, at the end of this era, two other significant biological events occurred:

- one was the disappearance of the dinosaurs, and
- the other was the emergence of mammals, birds and flowering plants.

IV. The Cenozoic Era (from 70 million years to the recent time)

Dear learner! *Have you ever heard about the era in which the Great East African Rift Valley was formed? Let you try to answer it below.* _____

_____

Cenozoic era is the most recent geological era. During this era, very significant structural, climatic and biological events occurred in Ethiopia. Thus, geologic events of the Cenozoic era have greatly resulted in the development of very recent landforms in the Horn of Africa in general and Ethiopia in particular.

The Cenozoic Era is divided into two periods namely, Tertiary and Quaternary. To make this lesson simple and comprehendible, we shall discuss only the geological events of this era into events of each of the Periods.

a. Geologic Events of the Tertiary Period - (70 million - 2 million years ago)

In the Tertiary Period, the uplifting that began in the Cretaceous Period of the Mesozoic Era continued and reached its maximum height. In Ethiopia and the Horn, it formed huge blocks of dome over the greater part of the region. As the uplifting continued through time, great cracks opened in the crust and resulted in the pouring out of extensive basaltic lava (known as the Trappean lava series).

The lava resulted in the formation of:

- the Northwestern Highlands,
- the Southeastern Highlands, and
- the Somali plateaus.

As the cracking and faulting continued during the period, it formed the Great East African Rift Valley System – of which the Ethiopian Rift Valley System is part. The Great East African Rift system extends from Palestine-Jordan in the north to Malawi-Mozambique in the south, for a distance of about 7,200 kilometers. Of these, 5,600 kilometers are in Africa, and 1,700 kilometers are in Eritrea and Ethiopia.

b. Geologic Events of the Quaternary Period (2 million - recent years)

This period is known for its recent volcanic activities that took place after the formation of the Rift Valley.

In the Quaternary Period, the structures that were formed in Ethiopia and the Horn are:

- the Afar Horst that extends into Djibouti,
- the active volcano of Erta Ale in Afar,
- the dormant volcanic mountain of Fentalle in Eastern Oromia,
- the extensive lava field and sheets of Metahara,
- thermal springs and fumeroles of the rift valley, and

- the Pluvial rainfall in Africa and the resultant deposition that took place in the lowlands of Ethiopia including the Rift Valley.

The Cenozoic Era in its Quaternary Period is assumed to be the period in which modern man evolved.

1.3.2. Landforms of Ethiopia

Dear learner! *Have you had opportunities to travel to the different regions of Ethiopia? If you have, what did you notice along your routes? Please try to briefly note in the space provided.* _____

_____

_____

Landform refers to individual earth surface features. As mentioned in an earlier sub-section, the landforms of Ethiopia are largely the result of the Cenozoic era's tectonic and volcanic activities. Consequently, they are characterized by a great diversity of highlands, plateaus, ambas, rugged mountains, deep river gorges and lowlands. Altitude varies from about 116 meters below the mean sea level at the Dallol depression (Kobar sink) to 4620 m above the mean sea level (m.a.m.s.l.) at Ras Dashen in the Semein mountain system. Between these extreme points lie a number of mountains. If 1000 meters is chosen as a demarcating contour line between highlands and lowlands, 56 percent of Ethiopia's land is highland. This fact has given Ethiopia the name "Roof of Eastern Africa." It is the only country in the region with such a high proportion of elevated surface. This elevated surface is bisected diagonally by the Rift Valley, which extends from Syria to Mozambique across the East African lakes.

Figure 1.4: Topography of Ethiopia

These landforms are the results of two opposite forces:

- the endogenic force that originates from inside the earth. For example, volcanic activity and tectonic forces, and
- the exogenic force that originates at the surface (denudation and penepalantion).

It is a combination of these two forces that created the existing landforms of Ethiopia.

In terms of the geological and structural features that resulted from the two types of forces, the relief of Ethiopia can be divided into three main physiographic divisions (see Fig 1.4):

I. The Western Highlands and Associated Lowlands
II. The Southeastern Highlands and Associated Lowlands
III. The Rift Valley

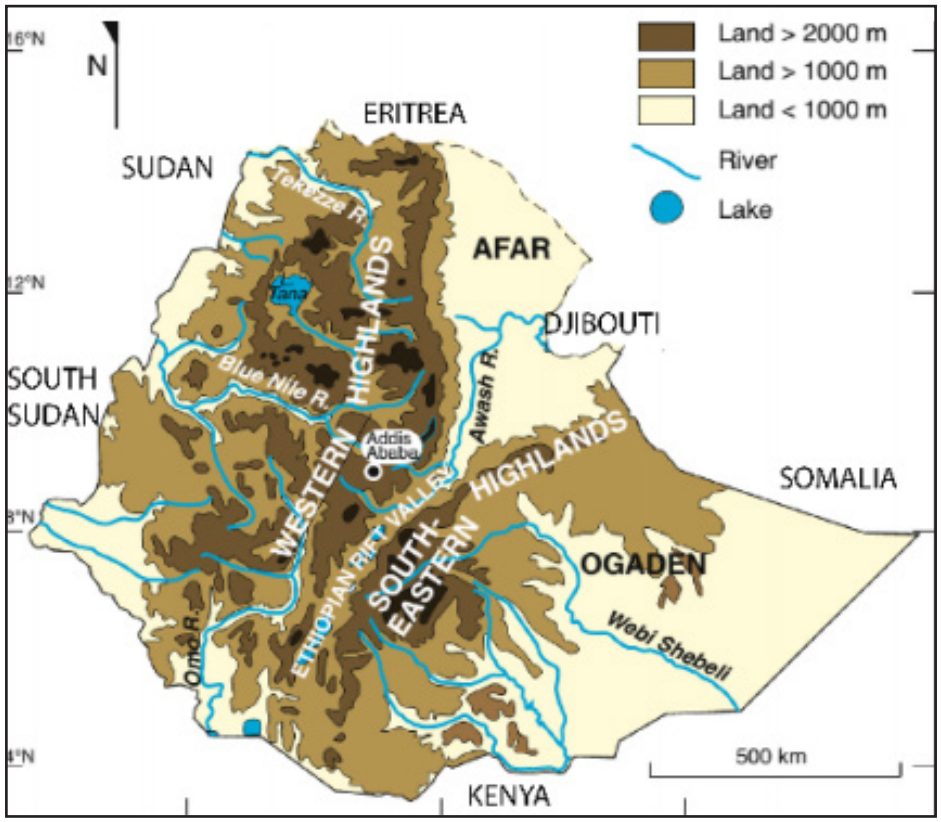


Figure 1.5: Ethiopia's Main Topographic Regions

I. The western Highlands and Associated Lowlands

A. The Western Highlands

Dear learner! *Have you ever had a chance to go to Bahrdar, Gondar, Mekelle, etc.? If you have, what did you notice along your routes? Please try to briefly list in the space provided.* _____

_____

_____

Did you try? Yes, the Western Highlands stretches from Tigray in the north to the highlands of Gamo and Goffa in the southwest. They are separated from the southeastern highlands by the Rift Valley. It is the biggest physiographic region. It makes up 44% of the area of the country (see Fig. 1.5).

The Western Highlands are the source of a large number of rivers and streams. Famous rivers like Abbay, Baro, and Tweeze emerge from these highlands. As the rivers cross boundaries, they influence Ethiopia's geopolitics role in northeastern Africa and the Middle East.

Based on the internal altitudinal variability, the region is further subdivided into four groups of highlands.

a) The Plateau of Tigray
b) The North Central Massif
c) The Plateau of Shewa
d) The Southwestern Highlands

a. The Plateau of Tigray

Dear learner! *Can you mention known mountain peaks in the plateau of Tigray? Please try, in the space provided and compare it against what you will read in the subsequent paragraphs.* _____

_____

_____

Did you answer it? If so, that is great. The Tigrean plateau is the most northerly group of plateau bounded in the north by the Mereb River and in the south by the Tekezze River. It is drained by Mereb, and the tributaries of the Tekezze.

It is an area composed largely of sandstones and limestones, as the overlying basalt has been eroded. As a result, the soils are poor and thin. The plateau has been exposed to severe erosion due to long periods of human inhabitation.

There are very high mountains on this plateau with elevations of over 3000 meters above sea level. Three of these are:

Known mountain peaks in this sub-division include:

- Mount Tsibet – 3988 m a.m.s.l.
- Mount Ambalage – 3291 m a.m.s.l.
- Mount Assimba – 3248 m a.m.s.l.

b. The North Central Massif

Dear learner! *Do you know where the North Central Massifs are found?* __

_____

__

Have you answered? Yes, the north central Massifs are found between the Abbay Gorge in the south and the Tekezze Gorge in the North. This massif contains the highlands of Gondar, Gojjam, and Wollo. River Abbay and Tekezze along with their tributaries have formed a number of gorges and steep sided river valleys.

The north central Massifs are the most rugged and dissected plateaus of Ethiopia. They are capped by basalts of the tertiary period and surrounded by deep gorges. Within each of the plateaus are small arable lands known as ambas. The ambas are isolated from one another by gorges.

The Mountain systems in Gondar and Gojjam are separated from the eastern group of mountains in Wollo by impenetrable and deep gorges. At one point though, they are connected by Yeju-Wadla Delanta land bridge (ridge). The western Massif makes up the Massif of South Gondar (Semein), while the eastern ones make up the Lasta and Wollo Massif. South of these is found the Gojjam Massif.

The Gojjam Massif is the most extended tableland and is comparatively less dissected. It is formed on the core of the Amedamit-Choke Mountains. It is carved by the Abbay river that effectively separated it from the Shewa plateau in the south and the Amhara Saynt Massif in the northeast. The North-Central Massifs are known for the production of cereals, such as teff, pulses and oil seeds.

Known mountain peaks in this Massif are:

- Mount Ras Dashen – 4620 m a.m.s.l.,
- Mount Legeda – 4532 m a.m.s.l.,
- Mount Analu – 4480 m a.m.s.l.,
- Mount Tefaw Lezer – 4456 m a.m.s.l.,
- Mount Kolo – 4300 m a.m.s.l.,
- Mount Guna – 4231 m a.m.s.l.,
- Mount Abuna Yoseph – 4190 m a.m.s.l., and
- Mount Hey – 4154 m a.m.s.l.

C. The Plateau of Shewa (Central Plateau)

Dear learner! *Have you ever had the opportunity to travel from your locality to a nearby plateau? If yes, list out in the space provided what you appreciate all the way through until you reach any gorge.* _____

_____

The Shewan Plateau is the smallest subdivision of the western highlands. It is a dome-shaped plateau that serves as a watershed between the Awash, Omo- Gibe and Abbay River basins. It extends westwards into western Wollega through Horo Guduru and forms a crescent shape which causes the Abbay to swerve and drain northwards.

The Shewan plateau is separated from:

- the plateau of Gojjam by the Abbay gorge in the north,
- the southeastern highlands by the Awash River and the Rift Valley, and
- the Highlands of Kafa by the Gibe River.

The Plateau of Shewa is drained by the tributaries of the Abbay River in the west and the Awash River in the east. Its high mountains are found on its northeastern and south eastern margins; they are:

- Mount Abbuye Meda – 4000 m a.m.s.l., and
- Mount Guraghe – 3721 m a.m.s.l.

d. The Southwestern Highlands

Dear Learner! *Which regional zones are found in the southwestern highlands of the Horn?* _____

_____

The southwestern highlands lie south of the Abbay trough which is greatly eroded due to torrential rain that pours down in the area for almost all of the year. It is the wettest region of the country with a total average annual rainfall of above 1500 mm. They include the highland areas of Wollega, Illubabor, Jimma, Kafa, Gamo, and Goffa. The region is drained:

- Northwards, by the Dabus and Didesa tributaries of the Abbay River;
- Westwards, by the headstreams of the Baro-Akobo River;
- Southwards, by the Omo-Gibe River, which ends in Lake Turkana; and
- Eastwards, by the right-bank tributaries of the Omo-Gibe (the Gojeb- Gibe River of Jimma Zone and Yem Special Woreda).

The general elevation of these highlands is relatively low when compared to that of the Northern and Eastern Highlands. Only a few areas are above 2500 meters.

The highest points in the region are the:

- Gamo-Konso Highlands,
- Maji-Korma Highlands,
- Dawuro-Konta Highlands,
- Tullu Wallel, and
- Benishangul mountain.

Mount Gughe has the highest altitude: 4200 m a.m.s.l. It is found in the Gamo plateau.

These highlands are well-known for the production of coffee, inset, spice production, timbering, rubber tree production, cattle, honey, maize and a high percentage of forest cover.

B. The Western Lowlands

The Western Lowlands extend from western Tigray in the north up to the southern Gamo and Goffa in the south, bordering Sudan and South Sudan with a general elevation of 500-1000 m a.m.s.l. They are characterized by arid and semi-arid climates.

The Baro-Akobo lowland is the wettest lowland compared to other lowlands of this physiographic division. That is why the rivers draining the region (particularly the Baro River) have almost a regular flow of water for much of the year.

The lowlands of this physiographic region are sub-divided into:

- the Tekezze and Angereb Lowlands,
- the Abbay Dinder Lowlands,
- the Baro-Akobo Lowlands, and
- the Omo-Gibe Lowlands.

The Tekezze and Angereb Lowlands are the most northerly lowlands, drained by Tekezze and Angereb. The Abbay Dinder Lowlands extend from south of Metema town up to the southern part of the Abbay River. Because of climatic hardship in most parts of these lowlands, the communities practice pastoralist and semi-pastoralist ways of life. However, there are notable towns, such as Humera, Kurmuk, Omedla and Metema that serve as business centers for the communities living along the Ethio-Sudanese border.

II. The Southeastern Highlands and Associated Lowlands

Dear learner! *Can you propose what feature separates these highlands from the northwestern highlands? Which highlands are said to be the components of the southeastern highlands of Ethiopia? Let you try to answer them below.*

_____

_____

This physiographic region is found to the southeast of the rift valley. This region is further divided into highland and lowland units.

A. The Southeastern Highlands

The Southeastern Highlands of Ethiopia include:

a) the Hararghe plateaus,
b) the Arsi plateau,
c) the Bale Massif, and
d) the Sidama highlands.

Their formation is similar to that of the North and Southwestern Highlands and they are capped by basaltic rock. They are the main sources of the Wabe Shebelle and Genale rivers.

They are bounded:

- in the west, by the fault line of the Rift Valley;
- in the east, by the Ogaden Lowlands; and
- in the south by the Elkerie and Borena Lowlands.

a. The Hararghe Plateaus

The Plateau of Hararghe rises sharply from the fault line of the Rift Valley and extends gently to the east up to Jigjiga. After Jigjiga, a fall in elevation takes place, giving way to the Ogaden

Lowlands. The Plateau is drained by the left-bank tributaries of the Wabe Shebelle River. The basaltic rocks have been worn away, exposing limestones and earlier sedimentary rocks.

The Hararge Plateau area and its foothills are significant producers of coffee, chat, sorghum, and millet.

The prominent mountain peaks include:

- Mount Gara Muletta (3381 m a.m.s.l.), and
- Mount Jebel Tita (3122 m a.m.s.l.).

b. The Arsi Plateau

This plateau area consists of the Gugu and Chillalo Massif. It is an extendingly rolling plateau; it is a very suitable plateau for farming. These features have been comparatively low because of the erosion on the Arsi plateau. The Arsi plateau is known for its wheat production.

The highest points on the Arsi plateau are:

- Mount Chillallo (4136 m a.m.s.l.),
- Mount Bada (4139 m a.m.s.l.), and
- Mount Kaka (4180 m a.m.s.l.).

c. The Bale Massif

The Bale Massif is next to the Arsi Plateau but is separated from it by the headstreams of the Wabe Shebelle, popularly known as the Wabe River. In the north, the massif consists of a flat form that is similar to basaltic plateaus. The Bale massif is known for its barely. In its southern part, the massif consists of huge mountains.

The highest points of the Bale Mountains are:

- Mount Tulu Dimtu (4377 m a.m.s.l.), and
- Mount Batu (4307 m a.m.s.l.).

d. The Sidama Highlands

The Genale river valley separates the Sidama Highlands from the Bale Highlands. The area constitutes the southwest extension of the southeastern highlands. The plateau slopes away gently to the south and southeast and is drained by the Genale River and its tributaries.

B. The Southeastern Lowlands

These lowlands extend from the foothills of the southeastern highlands along the Ethio-Somalian and Ethio-Kenyan borders. Their general elevations lie between 500 and 1000 m a.s.l.

They consist of:

- the Ogaden plains,
- the Elkeri plains,
- the Borena plains, and
- the Genale plains.

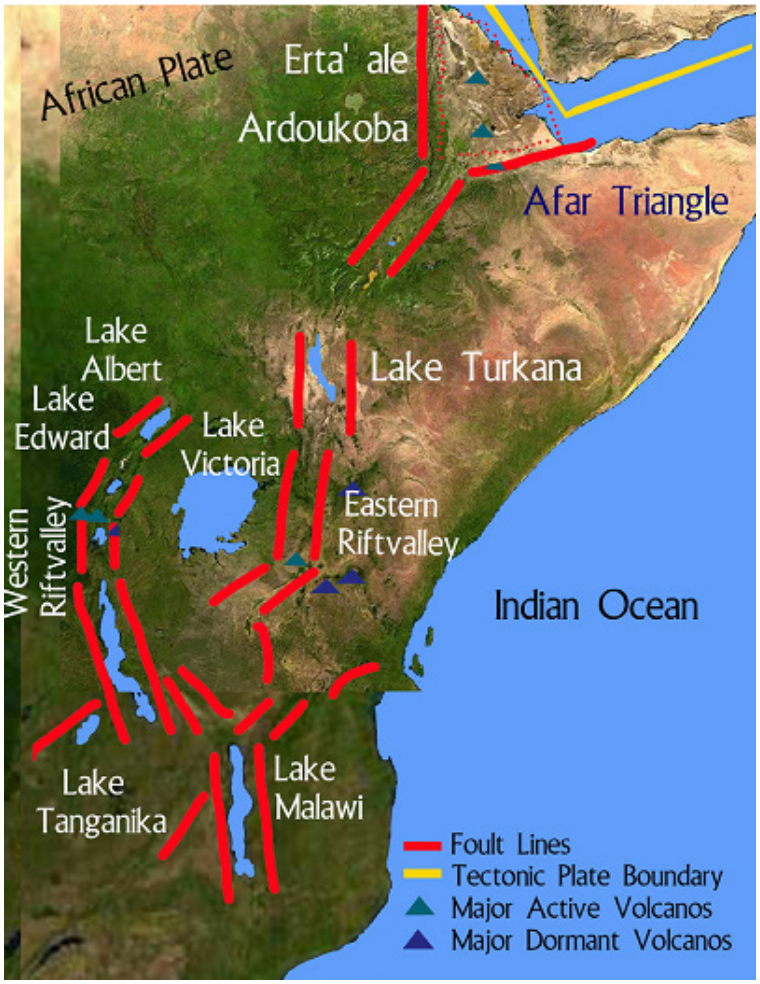
These landforms are highly extensive lowlands. They are characterized by extreme climatic conditions with low annual rainfall-often below 500 mm. Most of these lowlands are covered by sandstones and recent marine deposits. The people practice a pastoralist way of life because of the harsh climate.

III. The Rift Valley

Dear learner! *How do you explain the difference between a river valley system and a rift valley system? Can you give examples in the space provided?*

_____

_____



The Ethiopian Rift Valley System is a narrow strip of land, which stretches from the Afar Depression in the north, through the Rift Valley Lakes' region up to Lake Turkana and Chew Bhair.

The Ethiopian Rift Valley System is part of the Great East African Rift Valley, which covers a distance of 5600 kms in Africa. The Great East African Rift System is a set of fractures in the earth's crust that extend from the Jordan River valley in the north, through the Red Sea, and then across East and Central Africa to Mozambique in the south (Fig 1.6).

Figure 1.6: The Rift Valley System of Ethiopia and the Horn

As indicated earlier, the rift valley was formed at the end of the Tertiary Period as a result of tectonic epeirogenic activity. The presence of active volcanoes, minor faulting, hot springs, cinder cones, fumaroles, and geysers could be good evidence for the unstable nature of the region geologically.

As you can see in fig. 1.6, the Ethiopian Rift Valley System runs diagonally from northeast to southwest and divides the Ethiopia's Highlands into two. It covers a total length of 1700 kilometers in Ethiopia and Eritrea.

With a length of 1700 kms, the Ethiopian Rift Valley System comprises 18 percent of the country's total area. It is subdivided into three main parts:

a) The Afar Triangle (northern),
b) The Main Ethiopian Rift or the Lakes' Region (central), and
c) The Chew-Bahir Rift (southern).

a) The Afar Triangle (Northern Part)

The Afar Triangle is the largest and widest part of the system, extending 200-300 kilometers. Its altitude is generally low, ranging from 116 meters below mean sea level at the Kobar Sink to about 900 meters above sea level at Awash. Much of the area here lies below sea level.

This part of the Ethiopian Rift System is characterized by:

- faulted depressions (the Dallol Depression) and grabens (also called troughs), and
- cinder cones and volcanic mountains

Also, a large part of the area is covered by extensive salt plains and lakes (for instance, Lake Assale and Lake Afrera). The Afar triangle is bounded by parallel fault lines on the east and west. Its floor is made up of:

- grabens such as the Tendaho Graben;
- volcanic ash and lava deposits;
- lacustrian and fluvial deposits; and
- volcanic mountains such as Mount Fentalle.

What is more, the Afar Triangle has special characteristics that do not exist in other regions of Ethiopia. It consists of:

- fossil rich sediments, and
- rich archeological sites have shown us that the area was the home of the ancient ancestors of primates and hominids.

b) The Main Ethiopian Rift or the Lakes Region (Central Part)

The central subdivision of the Ethiopian Rift system, i.e., the main Ethiopian Rift, covers the area from the lower Awash basin up to Lake Chamo. This subdivisionis the most elevated and narrowest part of the Ethiopian Rift Valley. It is also the wettest, most densely vegetated, and most densely populated area.

Unlike others, sedentary farming is practiced here. The area also includes numerous lakes of enormous economic and aesthetic value.

c) The Chew-Bahir Rift (Southern Part)

The southern subdivision of the Ethiopian Rift System, the Chew-Bahir Rift, is also known as the Omo- Gibe trough. It is the smallest section of the Ethiopian Rift System separated from the Lakes' Region to the north by the Konso Highlands and its surroundings. It consists of an extensive shallow marshy area covered by tall grasses into which the Sagan and Woito streams end.

In the vicinity of Arba Minch, this part of the Ethiopia's Rift Valley System is split into the Ganjuli and the Galena Valleys by the Amaro mountain range. At large, the Chew-Bahir Rift region is occupied by a pastoralist population.

Resources

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Activity Three

Dear learner! Now you are going to do an exercise. Answer the following questions in the space provided.

1. List the most important sedimentary rocks ever formed in Ethiopia during the Mesozoic era. _____

   _____

2. Using the geological map of Ethiopia, identify the areas where these rocks are found on the surface as outcrops:
   a) Metamorphic rocks
   b) Sedimentary rocks
   c) Quaternary lava deposits
3. What was the most noticeable geological event of the Precambrian era in Ethiopia? ____

   _____
4. List the four sub-divisions of the western highlands. _____

   _____

   _____
5. Sketch a map of Ethiopia showing the major physiographic divisions.
6. Draw a map of the Rift Valley System in Ethiopia and demarcate its subdivisions.

Checklist

Dear learner! Now it is time to check your understanding of geological processes in Ethiopia and the landform of Ethiopia. Read each of the following questions and answer them by putting a tick (√) mark in one of the boxes under the alternatives 'Yes' or 'No'.

S.N	Items	YES	NO
1	Can you explain the major geological events in Ethiopia and the Horn?		
2	Can you distinguish the geological processes that result in the current landform of Ethiopia?		
3	Can you describe the Western Highlands and Associated Lowlands?		
4	Can you describe the Southeastern Highlands and Associated Low-lands?		
5	Can you describe the Great East African Rift Valley system?		

Is there any box that you mark 'No' under it? If yes, please go back to your text and read about it before you go to the following exercise.

SELF-TEST EXERCISES FOR SECTION THREE.

Part I. The following items focus on major geological events. Match items under column 'A' with their era under column 'B'.

A	B
1. An era of denudation and peneplanation	A. Cenozoic Era
2. An era of Great East African Rift Valley formation	B. Precambrian Era
3. An Era of sedimentary rock formation in Ethiopia	C. Paleozoic Era
4. The oldest and longest geological era.	D. Mesozoic Era

Part II. For the following questions choose the best answer among the given alternatives.

5. Which one of the following alternatives is not grouped under the Western Highlands?

A. The Plateau of Tigray
B. The Hararghe plateaus
C. The Plateau of Shewa
D. The Southwestern Highlands

6. As Hintalo sandstone is to Jurassic, Upper sandstone is to

A. Permian
B. Cambrian
C. Cretaceous
D. Triassic

7. The Afar Horst that extends into Djibouti was formed during

A. Quaternary Period
B. Tertiary Period
C. Triassic Period
D. Jurassic Period

8. The North Central Massifs are separated from the plateau of Tigray by the

A. Mereb River
B. The Danakil Lowlands
C. Tekezze River
D. Abbay River

9. The smallest sub-division of the western highlands is

A. Shewan plateau
B. Tigrean plateau
C. North central massif
D. Semein mountain

10. Which landform in East Africa was formed as a result of tectonic epeirogenic activity?

A. The Abbay River Gorge
B. Mount Tulu Dimtu
C. Mount Ras Dashen
D. The Great Rift Valley

UNIT SUMMARY

- Ethiopia is located in Eastern Africa within the 3°N-15°N latitudes and 33°E-48°E longitudes. Regarding shape, Ethiopia has a more or less compact shape.
- In terms of size, Ethiopia is the tenth largest country in Africa. It has an area of 1,106,000 square kilometers. Because of its large size, Ethiopia enjoys a diverse climate, a great variety of fauna and flora, diversified ethnic groups, and a large potential of arable land as well.
- The geological time scale measures time on a scale involving four major geological eras. The geological structure of Ethiopia is the result of the geological events that occurred during these eras. For example, crystalline basement complex rocks were formed during the Precambrian era; peneplanation took place during the Paleozoic era; land mass sinking and uplifting were dominant during the Mesozoic era; and the Ethiopian Rift Valley System was formed during the Cenozoic era respectively.
- The landforms of Ethiopia are largely the results of the Cenozoic era tectonic and volcanic activities. Consequently, Ethiopia has rugged mountains, plateaus, ambas, river gorges, a rift valley, and lowlands. The altitudinal variation in Ethiopia ranges from the highest peak, Ras Dashen (4620 meters above sea level) to the lowest point, Kobar Sink (116 meters below mean sea level).

GLOSSARY

Absolute location - the particular location of a point on Earth's surface that can be expressed by a grid reference such as latitude and longitude.

Altitude - Height above sea level.

Elongated shape countries - they are geographically long and relatively narrow like Chile.

Endogenic force - is the pressure that originates inside the earth. These internal forces lead to vertical and horizontal movements and result in subsidence, land uplift, volcanism, faulting, folding, earthquakes, etc.

Epeirogenic - is the uplifting or sinking of the surface. It is the vertical movement of the surface.

Epoch - is a subdivision of geological period

Era - is the second largest division of geological time characterized by differences in life forms (Example: Paleozoic era - an era of amphibians, Mesozoic era - an era of reptiles).

Exogenic force- is a force which derives its strength from the earth's exterior or originate within the earth's atmosphere.

Fragmented shape countries- they are divided from their other parts by either water, land or other countries.

Geological location - is a variant of relative location that considers global or semi global areal extents (Example: the location of Ethiopia with reference to the middle East, etc).

Igneous rock - a rock formed when molten material, magma, solid if is, either withinthe Earth's crust or at the surface

Metamorphic rock - a rock which has been changed by intensive heat or pressure

Orogenic- mountain building associated with Fold Mountain. Unlike the epeirogenic, it is a horizontal movement of the earth's crust (surface).

Peneplanation - is a low-relief plain formed by protracted erosion.

Period - is a subdivision of geological era.

Physiographic region - a portion of the Earth's surface with a common topography and morphology

Plateau - a large area of relatively flat terrain that is significantly higher in elevation than the surrounding landscape, often with one or more sides with steep slopes.

Regression- is a geological process occurring when areas of submerged seafloor are exposed above the sea level.

Relief - involves the vertical and horizontal dimensions of land surface.

Rift valley- is a valley formed by the sinking a portion of land between two parallel faults.

Sedimentary rock - a rock, which is composed of the fragments and particles of older rocks that have been eroded and the debris deposited by wind or water, often as distinct strata. Their origin can be organic or inorganic.

Transgression- is a geologic event during which sea level rises relative to the land and the shoreline moves toward higher ground, resulting in flooding.

Topography - the physical features of a place, or the study and depiction of physical features, both natural and man-made, including terrain relief

Vicinal location - unlike geological location, it is a type of relative location that considers very nearby areas (i.e., neighboring countries)

Volcano - vent (opening) in the Earth's surface through which magma erupts, or the landform that is constructed by eruptive material.

SELF-ASSESSMENT CORRECTED BY THE STUDENT

Give short answers to each of the following questions.

- Who was Eratosthenes? What did he contribute to geography?
- List down the major branches of geography.
- Enumerate and then explain the advantages of compact shape.
- Explain the main difference between a relative location and an absolute location.
- Draw a map of Ethiopia showing the major physiographic divisions.
- Draw a map of the Rift Valley System in Ethiopia and demarcate its subdivisions.
- Describe the geological era which was significant regarding the formation of the various landforms in Ethiopia.

SELF-ASSESSMENT CORRECTED BY TUTOR

- List the noticeable geological event of the Paleozoic era in Ethiopia.
- Write down the peculiarities of the western and southeastern lowlands.
- List the four sub-divisions of western highlands.
- Describe the major geological events that occurred during the Cenozoic era of the Tertiary Period in Ethiopia.
- When was the Ethiopian rift valley formed?
- What is the distinction between a vicinal location and a geological location?
- List the most important sedimentary rocks ever formed in Ethiopia during the Mesozoic era.

ANSWER FOR SECTION LEVEL ACTIVITY

Answer for Section Level Activity One

1. Eratosthenes.
2. Hydrosphere, biosphere, atmosphere, and lithosphere.
3. Physical and human geography
4. The six sub-branches of human geography are cultural geography, population geography, economic geography, political geography, Urban geography, and historical geography

Answer for Section Level Activity Two

1. Ethiopia is found to the South of Eritrea, North of Kenya, East of Djibouti, Northwest of Somalia, Northwest of the Indian Ocean, Southeast of the Red Sea, etc.
2. Ethiopia.
3. Some of the advantages of Ethiopia's large size are:
   a) High probability of the presence of varieties of natural resources.
   b) High probability of having different climates.
   c) Large space for population settlement.

   Some of the disadvantages of large size are:
   a) High cost of infrastructural development.
   b) Difficulty of political administration and unity.
   c) High cost of defense to protect every corner of the country.
4. The three theoretical indicators of the compactness of an area are:
   a) the boundary - circumference ratio (B/C);
   b) the area - boundary ratio (A/B); and
   c) the actual area - area of the inscribing circle (A/A').

Answer for Section Level Activity Three

1. Adigrat sandstone, Hintalo limestone, and Upper Sandstone
2. Metamorphic rocks- Abay Gorge, Assossa, Western and Central Eritrea and many other locations; Sedimentary rocks- located in nearly all the south-eastern parts of Ethiopia, as well as in the Somali lowlands and Quaternary lava deposits- can be found in the Afar region and Djibouti.
3. The noticeable geological events of the Precambrian era occurred in Ethiopia were:
   a) Frequent orogenic movement,

b) Intensive volcanic activities, and
c) Denudation during the later periods.

4. The four sub-divisions of western highlands are:
   a) The Plateau of Tigray,
   b) The North Central Massif,
   c) The Plateau of Shewa, and
   d) The Southwestern Highlands.

5. Since it is an individual-based activity, the answers are expected to vary from learner to learner. Therefore, let the distance learner try to answer it by him/herself.

6. Since it is an individual-based activity, the answers are expected to vary from learner to learner. Therefore, let the distance learner try to answer it by him/herself.

ANSWER KEY FOR SELF-TEST EXERCISES

Self-test Exercise Answers for Section One

Part I. True/False Items

1. False 2. True 3. True 4. False 5. True

Part II. Multiple Choice Items

6. B 7. D 8. A 9. C 10. D

Self-test Exercise Answers for Section Two

Part I. True/False Items

1. False 2. True 3. True 4. False 5. False

Part II. Multiple Choice Items

6. A 7. C 8. B 9. D 10. C

Self-test Exercise Answers for Section Three

Part I. Matching Items

1. C 2. A 3. D 4. B

Part II. Multiple Choice Items

5. B 6. C 7. A 8. C 9. A 10. D

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UNIT TWO

CLIMATE OF ETHIOPIA

Unit Introduction

Dear distance learner! In the previous unit, we looked at the geological history and topography of Ethiopia. In this unit, we are going to examine the climate of Ethiopia. Climate has an important control over the distribution of flora and fauna and in consequence it largely determines the agricultural activities and the materials available for shelter and clothing. Ethiopia as a large country in the Horn of Africa, is characterized by a wide variety of altitudinal ranges and diverse climatic conditions. In addition, because of its closeness to the equator and the Indian Ocean, the country is subjected to large temporal and spatial variations in elements of weather and climate.

Unit Learning Outcomes

At the end of this unit, you will be able to:

- *recognize the meaning and concepts of weather and climate;*
- *identify elements of climate;*
- *distinguish the elements of climate from its controls;*
- *compare and contrast the spatial and temporal variations of climate; and*
- *identify factors affecting the climate of Ethiopia.*

Key Terms

- *Alpine or Afro-Alpine*
- *Altitude*
- *Anemometer*
- *Barometer*
- *Bereha*
- *Conservation*
- *Dega*
- *Distance from the sea*
- *Humus*
- *ITCZ*
- *Kolla*
- *Latitude*
- *Ocean currents*
- *Parent material*
- *Rain gauges*
- *Soil*
- *Subtropical*
- *Thermometer*
- *Wind vane*
- *Woina Dega*
- *Wurch/Kur*

Unit Contents

2.1. Meaning of 'Weather' and 'Climate'
2.2. Elements of Weather and Climate
2.3. Controls of Weather and Climate in Ethiopia
2.4. Climatic Regions and Seasonal Variations in Ethiopia
2.5. Measures of Weather and Climate

The Required Study Time: 10 hrs.

Learning Strategies of Unit

Suggested learning strategies are:

- *written brainstorming questions;*
- *case study;*
- *field visit;*
- *problem-solving method;*
- *individual project;*
- *report writing;*
- *observation;*
- *written activities;*
- *practical activities;*
- *self-test assessments;*
- *online dialog (if possible); and*
- *electronic portfolios (if possible).*

Section 1 Meaning of Weather and Climate

Section Overview

Dear learner! In this section, you will learn about the meaning and concepts of weather and climate. People often mistakenly use the terms weather and climate interchangeably as if they are similar. However, though the two terms are interrelated, they have different meanings.

Section Learning Outcomes

At the end of this section, you will be able to:

- *explain the concepts of weather and climate;*
- *define weather and climate; and*
- *identify the difference between weather and climate.*

Required study time:1 Hours

Dear learner! *What do you know about the concepts of weather and climate? Try to define the term "Weather" and "Climate" in your own words below.*

_____

_____

Have you tried? If so that is great. The word "weather" and "climate" are closely related but have quite different meanings. Weather refers to the condition of the atmosphere in terms of temperature, rainfall, pressure, wind, moisture, cloud cover, humidity, etc. observed in a certain place over a short period. It is a phenomenon that varies very much from day to day, even from hour to hour. While climate is a pattern of weather conditions experienced in an area over a long period. It considers the trends, fluctuation and vibration that may occur in a departure from the average conditions in time and space. A large area can experience only one type of climate.

Resources

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Activity One

Dear learner! Now you are going to do an exercise. Answer the following questions in the space provided.

1. Define weather and climate _____

_____

_

2. Explain the main differences between weather and climate. _____

_____

Checklist

Dear learner! Now it is time to check your understanding of the meaning of weather and climate. After reading each of the following questions answer them by putting a tick (√) mark in one of the boxes under the alternatives 'Yes' or 'No'.

S.N	Items	YesYes	N0
1	Can you explain the meaning of weather and climate?		
2	Can you define weather and climate?		
3	Can you describe the difference between weather and climate?		

Is there any box that you marked 'No'? If there is, please return to your text and read about it before beginning the next activity.

SELF-TEST EXERCISES FOR SECTION ONE

Write 'True' if the statement is correct and 'False' if it is incorrect.

1. The term "weather" and "climate" are closely related and have similar meanings.
2. Climate is the pattern of weather over a long period of time.
3. Weather can change drastically in day-to-day conditions.
4. Weather conditions include precipitation, but climate does not.
5. Climate covers larger areas and lasts longer than weather.

Section 2 Elements of Weather and Climate

Section Overview

Dear learner! We hope that you have been successful in studying in the concept of weather and climate in the previous section. Now in this lesson you will be introduced to the elements of weather and climate. You may have noticed that daily and monthly changes in the atmospheric condition occur continuously. These changes in the atmospheric state are caused by corresponding changes in the elements of weather and climate in various forms. We believe that you will find this lesson easy to understand and enjoy it.

Section Learning Outcomes

At the end of this section, you will be able to:

- *identify elements of weather and climate;*
- *define the elements of weather and climate; and*
- *differentiate the elements of weather and climate from their controls.*

Required study time:1 Hours

Dear learner! *What elements do you consider to define weather condition of your locality? Please try to give your answer below.* _____

_____

_____

_____

Have you tried? That is great. Both weather and climate are composed of the following elements.

- **Precipitation:** - It is any liquid or frozen water that forms in the atmosphere and falls back to the Earth in form of rain, sleet, hail, and snow.
- **Temperature:** - It is the degree of measurement of hotness or coldness of an object.
- **Humidity:** - is the concentration of water vapor present in the air

- **Air pressure:** - It is the force exerted on a surface by the air above it as gravity pulls it to Earth.
- **Wind:** - It is the movement of air, caused by the uneven heating of the Earth by the sun and the Earth's rotation.
- **Sunshine:** - It is a direct sunlight to which a given area is exposed.
- **Cloud:-** It is any visible mass of water droplets or ice crystals suspended in the atmosphere.

The distribution of these elements over the surface of the earth is uneven in terms of magnitude and timing. This spatial and temporal distribution of climatic elements is governed by the climate control factors described in the sections below.

Resources

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Activity Two

Dear learner! Now you are going to do an exercise. Answer the following questions in the space provided.

1. List the most important elements of weather and climate in Ethiopia. _____

_____

_____

_____

Checklist

Dear learner! Now it is time to check your understanding of the elements of weather and climate. Read each of the following questions and answer them by putting a tick (√) mark either under 'Yes' or 'No'.

S.N	Items	YES	NO
1	Can you identify elements of weather and climate?		
2	Can you define the elements of weather and climate?		
3	Can you differentiate the elements of weather and climate from their controls?		

Is there any box that you marked 'No'? If there is any, please return to your text and read about it before you go to the following exercise.

SELF-TEST EXERCISES FOR SECTION TWO

The following items focus on elements of weather and climate. Match the items under column 'A' with their elements of weather and climate under column 'B'.

A	B
1. Direct sunlight to which a given area is exposed.	A. Precipitation
2. The movement of air, caused by uneven heating of the Ear th.	B. Temperature
3. Any visible mass of water droplets or ice crystals suspended in the atmosphere.	C. Humidity
4. The degree of measurement of hotness or coldness of an object.	D. Pressure
5. The concentration of water vapor present in the air.	E. Wind
6. Any liquid or frozen water that forms in the atmosphere and falls back to the Earth.	F. Sunshine
7. The force exerted on a surface by the air above it as gravity pulls it to Earth.	G. Cloud

Section 3 Controls of Weather and Climate in Ethiopia

Section Overview

Dear learner! Hotness or coldness, rainy or cloudy, sunny, windy, or calmness, of air you are feeling on a daily base in your current location are expressions of weather. Now you may ask yourself what determines the variations in weather and climate between places and seasons. These determining factors are called controls of weather and climate, or climatic controls.

Section Learning Outcomes

At the end of this section, you will be able to:

- *distinguish elements of climate from its controls; and*
- *define the controls of weather and climate.*

Required study time:3 Hours

Dear learner! *Have you ever noticed varying lengths of days and nights by season? What do you think is the reason behind this? Write down your thoughts in the space provided and compare your answer against what you will read in the subsequent paragraphs.* _____

_____

_____

Have you written down your thoughts? That is great! As you may have guessed, there are varieties of climate in Ethiopia. The spatial and temporal distribution of the climatic elements in Ethiopia is determined by various physical factors which are generally known as controls of weather and climate. The most important are:

a) latitude;
b) altitude;
c) mountain barriers;
d) revolution of the earth and the inclination of the earth's axis;
e) distance from the sea; and
f) ocean current.

a) Latitude

Latitude, as a climate control, is the angular location of a place or point with reference to the direct rays of the sun. When we speak of the latitudinal impact on the climate of Ethiopia, we are considering the angle of the sun rays in the country. This is because the rays of the sun fall vertically on the equator and slant in the temperate and polar regions (See Figure 2.1).

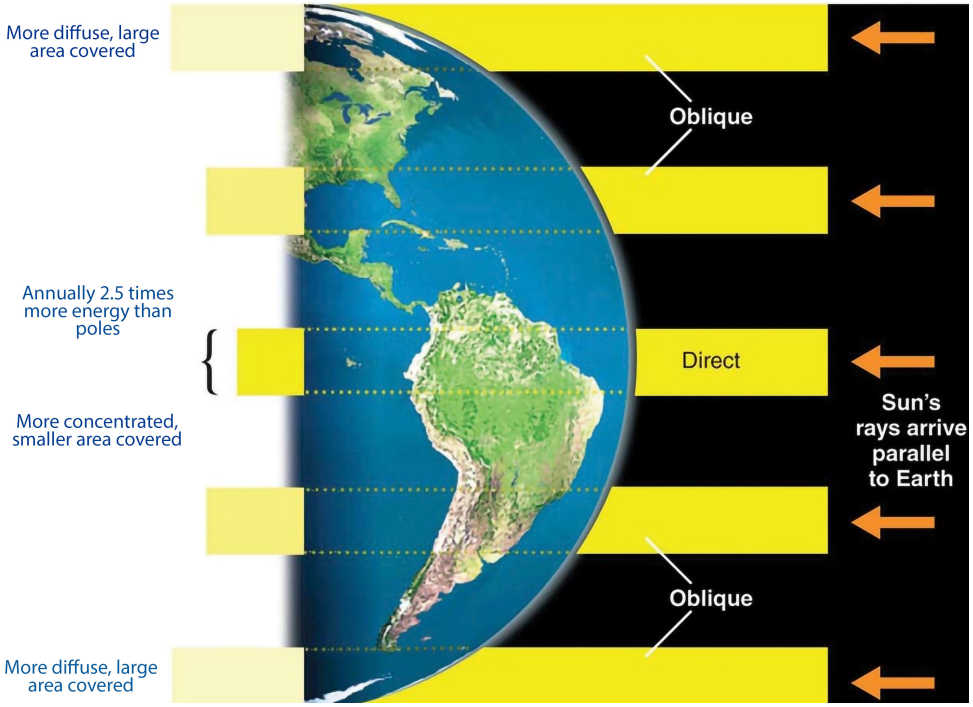

Figure 2.1: Insolation Receipt and Earth's Curved Surfaces (Source: Pearson Education Inc., (2013))

Ethiopia's location within the tropical zone results in;

- high temperatures during most of the year;
- high daily (diurnal) ranges of temperature;
- relatively small annual ranges of temperature; and
- little difference between summer and winter in the ratios of daylight to night.

b) Altitude

Dear learner! *Do you have any experience of visiting highly elevated places? What differences have you felt between the lowest and the highest elevations? Please state your reactions in the space provided.* _____

_____ *n* _____

_____

_____

Have you stated? If so, that is great. Now, compare ideas with the following points. Altitude is the main factor that determines the spatial distribution of temperature in Ethiopia. Different places that exist on the same plane or angle of the rays of the sun might be expected to experience equal temperatures. However, due to the impact of altitude, they do not. For example, three Ethiopian cities, Bako, Addis Ababa, and Awash all lie on the 9oN latitude, so they might be expected to receive equal magnitudes of direct rays from the sun and therefore equal temperatures. However, their altitudes vary, and therefore their temperatures vary, Table 2.1.

Table 2.1. The Role of Altitude in Modifying Temperatures

Towns	Latitude	Altitude	Average annual temperature
Addis Ababa	9°N	2,200 m.a.m.s.l.	16°C
Bako (West Shewa)	9°N	1,800 m.a.m.s.l.	17°C
Awash	9°N	916 m.a.m.s.l.	25°C

The table illustrates the effect of altitude on temperature, confirming the fact that temperature decreases as altitude ascends from the lowlands towards the interior highlands.

c) Mountain Barriers

Mountain barriers can affect climate in that they exert an influence on the spatial distribution of rainfall. Places located on the leeward side of mountains (also called rain shadows) receive little rain.

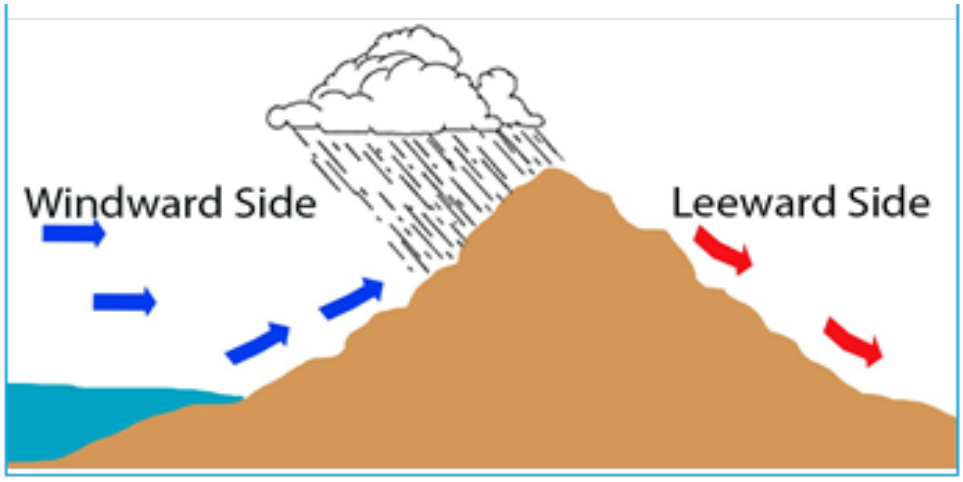

Figure 2.2.: Effects of Mountain Barriers

The side of the mountain facing the wind-laden moisture is called the windward side mountain. Leeward side is the other side of the mountain that does not face the laden moisture.

d) Revolution of the Earth and the Inclination of the Earth's Axis

The axis of the earth inclines 23½° to the normal of the elliptic. As the earth revolves around the sun, this inclination produces a change in the angle of the sun's rays, thereby affecting the length of time that the sun shines on the earth every other day (See Figure 2.3).

Changes in the length of the day and the angle (directness) of the sun's rays cause seasons. These different seasons result in the temporal variation of temperature in a year in Ethiopia.

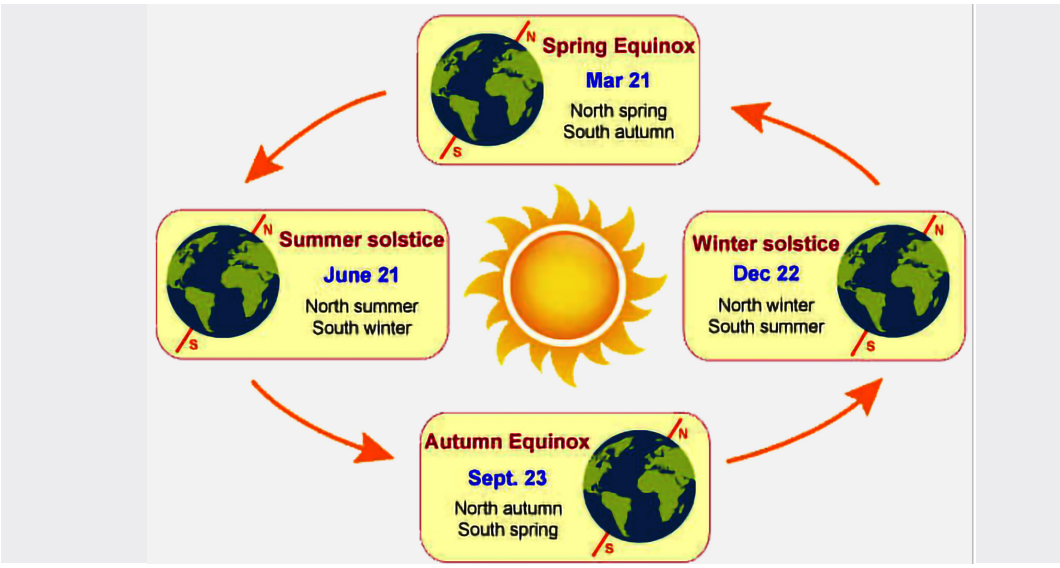

Figure 2.3: Annual March of the Seasons (Source: https://www.studyandscore.com)

e) Distance from the Sea

Water bodies and landmasses have different levels of heat absorption. Land masses absorb and release heat energy more quickly than water bodies do. Distance from the sea affects the Horn's climate only in coastal areas that are adjacent to the Red Sea and the northwestern Indian Ocean. Towards the interior, the role of distance from the sea in climate control is insignificant.

f) Ocean Current

Warm and cold ocean currents can affect the climate of coastal regions, but only when local winds blow in from the sea. Warm currents heat the air over the ocean and bring higher temperatures over land. Cold currents not only can lower air temperatures they can also bring colder temperatures over land. In Ethiopia the role of ocean currents in climate control is inconsequential.

Among the above mentioned controls of climate, the climate of Ethiopia is dominantly controlled by **altitude** and **latitude.**

Resources

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Activity Three

Dear learner! Now you are going to do an exercise. Answer the following questions in the space provided.

1. Explain how Ethiopia's latitudinal location affects the distribution of climate. _____
   _____
   _____
2. Which control of weather and climate predominantly affects Ethiopia's climate? _____
   _____
3. Identify the water bodies that have a significant impact on the spatial distribution of the elements of climate in Ethiopia. _____
   _____
4. Why does every place in Ethiopia experience the overhead sun twice a year? _____
   _____

Checklist

Dear learner! Now it is time to check your understanding of the controls of weather and climate in Ethiopia. Read each of the following questions and answer them by putting a tick (√) mark either under 'Yes' or 'No'.

S.N	Items	YES	NO
1	Can you identify controls of weather and climate?		
2	Can you define the controls of weather and climate?		
3	Can you differentiate the elements of weather and climate from their controls?		

Is there any box that you marked 'No'? If there is any, please go back to your text and read about it before you go to the following exercise.

SELF-TEST EXERCISES FOR SECTION THREE

For the following questions choose the correct answer from the given alternatives.

1. Which of the following is **not** a control of weather and climate?

   A. Latitude
   B. Humidity
   C. Altitude
   D. Ocean current

Temperature variations in Ethiopia are mainly the result of

E. Latitude
F. Ocean current
G. Distance from the Sea
H. Altitude

2. What generally happens to air temperature as we move from the lowlands to the highlands?

A. It decreases
B. It increases
C. It remains constant
D. None of the above

3. Which of the following explains why one side of a mountain usually has more precipitation than the other side?

A. The atmosphere gets denser as elevation increases
B. Temperature is higher on one side of a mountain than on the other
C. Mountain force air to rise, and the air cools and drop moisture as it rises
D. The mountain on one side is more green and lush than the other

4. Which one of the following is the cause of the change of seasons?

A. The distance of a place from the equator
B. The tilt of the Earth's axis
C. Prevailing winds bellowing across land or water
D. The rotation of the Earth

5. The side of the mountain facing the wind laden with moisture is called_____.

A. The windward side
B. The leeward side
C. The rain shadow side
D. The downslope winds side

6. _____ is known as the strongest of all the controls over the climate in Ethiopia.

A. Latitude
B. Ocean current
C. Distance from the Sea
D. Altitude

7. Which one of the following climate controls, has an insignificant effect on the climate of Ethiopia?

A. Altitude
B. Latitude
C. Ocean current
D. Mountain Barriers

8. Which one best describes the reason why latitudes closest to the equator have warmer climates?

A. They are at lower elevations
B. They receive more solar energy
C. They are nearer to ocean currents
D. They get more winds that carry energy in the form of heat

9. The climate of the coastal areas that are adjacent to the Red Sea are more influenced by_____.

A. The altitude
B. Distance from the sea
C. The latitude
D. The ocean current

Section 4 Climatic Regions and Seasonal Variations in Ethiopia

Section Overview

Dear learner! In this section, you will learn about the climatic regions and seasonal variations of temperature and rainfall in Ethiopia. The climate of Ethiopia is highly diverse, ranging from equatorial rainforest with high rainfall and humidity in the south and southwest, to Afromontane regions on the summits of the Semien and Bale Mountains to desert regions in the northeast, east and southeast of Ethiopia.

Section Learning Outcomes

At the end of this section, you will be able to:

- *identify agro-climatic zones of Ethiopia; and*
- *compare and contrast the spatial and temporal variations of climate in Ethiopia.*

Required study time:3 Hours

2.4.1. Agro-climatic Zones of Ethiopia

In Ethiopia, the impact made by altitude has resulted in the formation of five agro-climatic zones. These zones have traditionally been defined in terms of temperature (see Table 2.2 below).

Table 2.2. Agro-climatic Zones

Altitude in meters	Traditional agro- ecological name	Global equivalence	Mean annual temperature in oC
3,300 and above	*Wurch/Kur*	Alpine or Afro-Alpine	<10
2,300 – 3,300	Dega	Temperate	10 – 15
1,500 – 2,300	Woina Dega	Subtropical	15 – 20
500 – 1500	Kolla	Tropical	20 – 30
below 500	Bereha	Desert	> 30

Dear learner! *In which agro-climatic zone do you live? Do you enjoy the weather and climate of this zone? If so, why? Please write your answer in the space provided below.* _____

_____

a) *Wurch*-Zone Areas

The Wurch-zone areas have the highest altitudes and lowest temperatures. Frequently they have temperatures of less than 10°C. These areas exist in the very high mountains of South Gondar, Wollo, Shewa, Arsi, and Bale. Example:

- Mt. Ras Dashen in Semine Gondar
- Mt. Guna in South Gondar
- Mt. Megezez in North Shewa
- Mt. Batu in Bale, etc.

b) *Dega* -Zone Areas

Dear learner! *What kind of crops are grown in Dega areas? And why? Please try to write your answer in the given space below.* _____

_____

The *Dega*-zone areas are highland areas with lower altitudes and they have higher temperatures than *Wurch*-zone areas. Historically, *Dega*-zone agro-climatic areas were the home of concentrated human settlement. They were chosen because of the features below:

- secure location (from which people could defend themselves from threats);
- reliable rainfall; and
- absence of tropical diseases such as malaria, etc.

Due to the high concentration of human population, the Dega zone has been intensively cultivated and has a high rate of soil erosion, overgrazing and deforestation.

Some of the humid areas of this zone support two growing periods per year under rain-fed agriculture. Examples of humid areas in Ethiopia are:

- Dinsho in Bale
- Chillallo in Arsi
- Hulla in Sidama
- Debresina in North Shewa

C) Woina- Dega -Zone Areas

Dear learner! *What is your understanding of why the term "Woina Dega" comes after "Dega"? Does the term mean "milder Dega"? Please try to write your answer below.* _____

_____

The *Woina-Dega*-zone areas contain most of Ethiopia's agricultural land. They are the country's main areas producing:

- Surplus grain
- Inset and its derivatives

In the *Woina-Dega* zone, like in the *Dega* zone, there can be two growing seasons when rainfall reliability is high.

d) *Kolla* Zone Areas

What are the dominant crops grown in Kolla areas? Please, list them down below. _____

_____

Kolla is a (warm-to-hot semi-arid climate). *Kolla* is the climate of the hot lowlands with an altitudinal range of 500 to 1500 m a.s.l. Average annual temperatures are between 20°C and 30°C. Although the mean annual rainfall ranges between 410 mm and 820 mm, it can be as high as 1600 mm in the wet western lowlands of Gambella. Rainfall is highly variable from year to year. Example: Western lowlands.

e) *Bereha*- Zone Areas

Can we grow crops in Bereha Zone areas?

Bereha is a hot arid climate. Bereha is the climate of the desert lowlands that are found below 500 m above mean sea level where the average annual rainfall is less than 400 mm, and the average annual temperature is over 30°C. Bereha is usually characterized by a strong wind, high temperature, low relative humidity, and little cloud cover. In some places, evapotranspiration is always in excess of rainfall in some places. Example: Danakil depression in Afar lowlands.

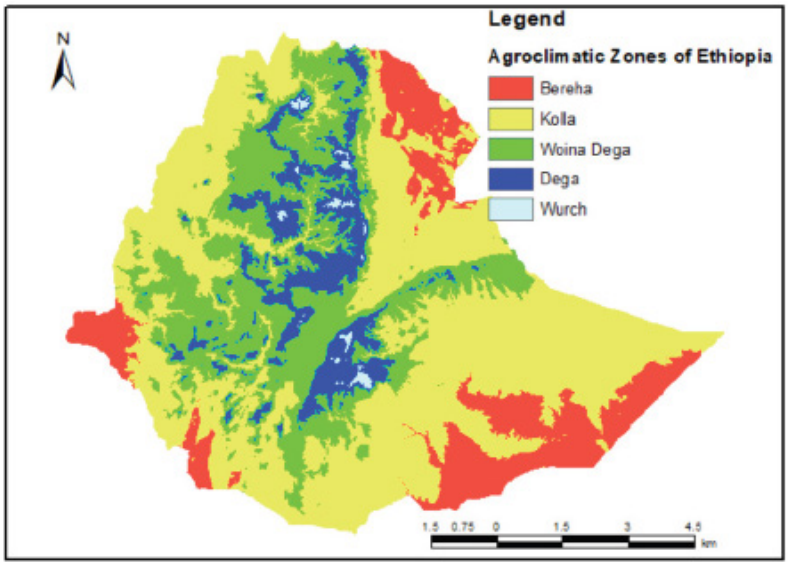

Figure 2.4: Agroclimatic Zones of Ethiopia (Source: EMA, 1994)

2.4.2. Seasonal Variation in Ethiopia

A season is a period of the year characterized by a particular set of weather conditions resulting from the inclination of the earth's axis and the revolution of the earth around the sun. The same cycle of the season is repeated year after year.

2.4.2.1 Seasonal Variation of Temperature in Ethiopia

Dear learner! *Can you categorize the temperature differences between the months of April/May, and October/November in Ethiopia? How do these differences occur? Write down your brief response in the space provided and compare your answer with what you will read in the following paragraphs.*

_____

_____

Have you tried? If so, that is great. In Ethiopia, temperatures vary from season to season. For example, in most parts of Ethiopia, high temperatures are recorded from March to June. Conversely, low temperatures are recorded from November to February. These variations occur primarily due to:

- the tilting of the earth at 23½©to the normal elliptic, and
- the distance of the overhead sun and its apparent north-south movement across the equator as the earth revolves around the sun.

During the winter season of the northern hemisphere, Ethiopia experiences the *"Bega"* season. During this season, the days have clear skies. Thus, the incoming solar rays are intense. As a result of this temperature increases in day time and abruptly decreases at night because of clear sky. Therefore, this results in high diurnal range of temperature.

- The mean maximum temperatures are experienced over the western, north eastern and south eastern lowlands while the lowest temperatures are over the *Semein* and *Arsi-Bale* mountains.
- The highest temperature i.e. over 45°C is recorded in the Danakil Depression - the hottest place in Ethiopia.

2.4.2.2 Seasonal Variation of Rainfall in Ethiopia

Dear learner! *Can you briefly explain the spatiotemporal distribution of rainfall in Ethiopia?* _____

_____

_____

Have you tried? If so, that is great. Rainfall, like temperature is a major element of climate. Ethiopia experiences marked spatial and temporal variations of rainfall.

A. Spatial Variation of Rainfall in Ethiopia

The spatial variation is the result of strength and nature of prevailing weather systems following the oscillation of the Inter Tropical Convergence Zone (ITCZ).

As described earlier, Ethiopia's weather systems is also resulted from the apparent movement of the overhead sun, prevailing winds and the presence of barrier that checks the moisture arrival into the area

Inter-Tropical Convergence Zone (ITCZ)

It is a low atmospheric pressure zone formed by the convergence of northeasterly and southeasterly trade winds. It shifts north and south of the equator following the position of the overhead sun.

In June, its position is at the Tropic of Cancer. During this time, Ethiopia comes under the influence of the Equatorial Westerlies and Easterlies. As they originate from water bodies, these winds bring moisture to the highlands, but decrease their magnitude and length of rainy periods northwards.

In December, its position shifts to the Tropic of Capricorn leaving the region for the prevalence of the Northeast Trade winds that are non-moisture-laden as they originate from the continental landmass. During this time only lowland areas in Afar region close to the coast receive some amount of rain given that these winds pick up little moisture as they blow passing over the Red Sea. In most part of Ethiopia, it becomes dry season.

In March and September, the position of the ITCZ is around the equator. Hence, the Equatorial Easterlies provide rain to the Southeastern lowlands, Central and highlands of Ethiopia.

B. Temporal Variation of Rainfall in Ethiopia

Ethiopia's rainfall is characterized by seasonal variation. There are two main rainy seasons: *Kiremt* (summer) that extends from June to August and *Belg* (spring) that covers the time from March to May. These two rainy seasons contribute more than 90% of the country's rain supply. There are two other rainy seasons namely the *Meher* (autumn) rains and the *Bega* (winter) rains. Compared to the two main rainy seasons, the duration, volume, and aerial coverage of *Meher* (autumn) rains that take place from September to November are less. The *Bega* (winter) is generally the dry season that takes place from December to February. It supplies a small amount of rain only to the Afar lowlands.

2.4.3. Rainfall Regions of Ethiopia

Dear learner! *Can you identify the rainfall regions of Ethiopia? Write your answer in the space provided below.* _____

_____

As you may have thought, based on rainfall distribution, both in space and time, five types of rainfall regions can be identified in Ethiopia. These are:

a) Year-round rainfall region (wet in most months)
b) Summer rainfall region
c) Autumn-and-spring rainfall region
d) Winter rainfall region
e) e Merged spring, summer, and autumn rainfall region

Each region is discussed in turn as follows

a. Year-round Rainfall Region (wet in most months)

In Ethiopia, the area of year-round rainfall includes the southwestern plateau, which comprises the highlands of Wollega, Kafa, Illubabor and Gamo and Goffa. The reason for the high rainfall and exceptionally long wet season is the dominance of the equatorial Westerlies wind system. They pick up moisture from the Atlantic Ocean.

This region can be represented by the following stations:

Gore, Mizan, Metu, Bonga, Gambella, etc.

The region has more rainy days than any other part of the country. The average rainfall varies from 1400 mm to 2200 mm.

The year-round rainfall region is represented by the letter **B** in Figure 2.5.

b. Summer Rainfall Region

The summer rainfall region is the largest in the country. This region consists of the Northwest Highlands and Western Lowlands, and can be represented by the following stations.

Debre Markos, Fitche,Gondar, Bahir Dar, etc.

Its moisture-bearing winds are the Equatorial Westerlies and Easterlies. The summer rainfall region is represented by the letter **A** in Figure 2.5.

c. Autumn-and-Spring Rainfall Region

The autumn-and-spring rainfall region covers the southeastern highlands and associated southeastern lowlands. They can be represented by the following stations:

Gode, Moyalle, Jigjiga, and Yabello

The region's moisture-bearing winds are the Equatorial Easterlies. They pick up moisture from the Indian Ocean, and they blow over the autumn and spring rainfall regions when the Northeasterlies and Equatorial Westerlies are weak. The region's average rainfall varies from less than 500 to 1000 mm. The autumn and spring rainfall region is represented by E in Figure 2.5.

In Ethiopia, highland rainfall is more dependable than lowland rainfall. However, highland dependability decreases from the southwestern highlands in all directions. In short, rainfall variability (deviation from the expected amount and time) decreases from areas of heavy rain to areas of low rainfall.

d. Winter Rainfall Region

The winter rainfall region consists of the eastern escarpment of the western highlands, the middle Rift Valley section, and the Afar subdivision. The winter rainfall region can be represented by the Assaita station (Afar Region). The region's moisture-bearing winds are, for the most part, the North Easterlies. The air mass is continental (dry) and has only a short sea trajectory (that is, the Red Sea).

It is represented by letter **D** in Figure 2.5. The region's total annual moisture is very low and of short duration.

e. Merged Spring, Summer, and Autumn Rainfall Region

The merged spring, summer and autumn rainfall regions are the smallest in the country. It consists mainly of the western foothills of the Southeastern Highlands. The region's total annual rainfall varies from 1500 mm to 1000 mm. It covers a corridor that stretches from the Sidama Highlands to the Hararge Plateau.

The merged spring, summer, and autumn rainfall region is represented by the letter C in Figure 2.5.

It can be represented by the following stations namely, Assaita, Awash, etc.

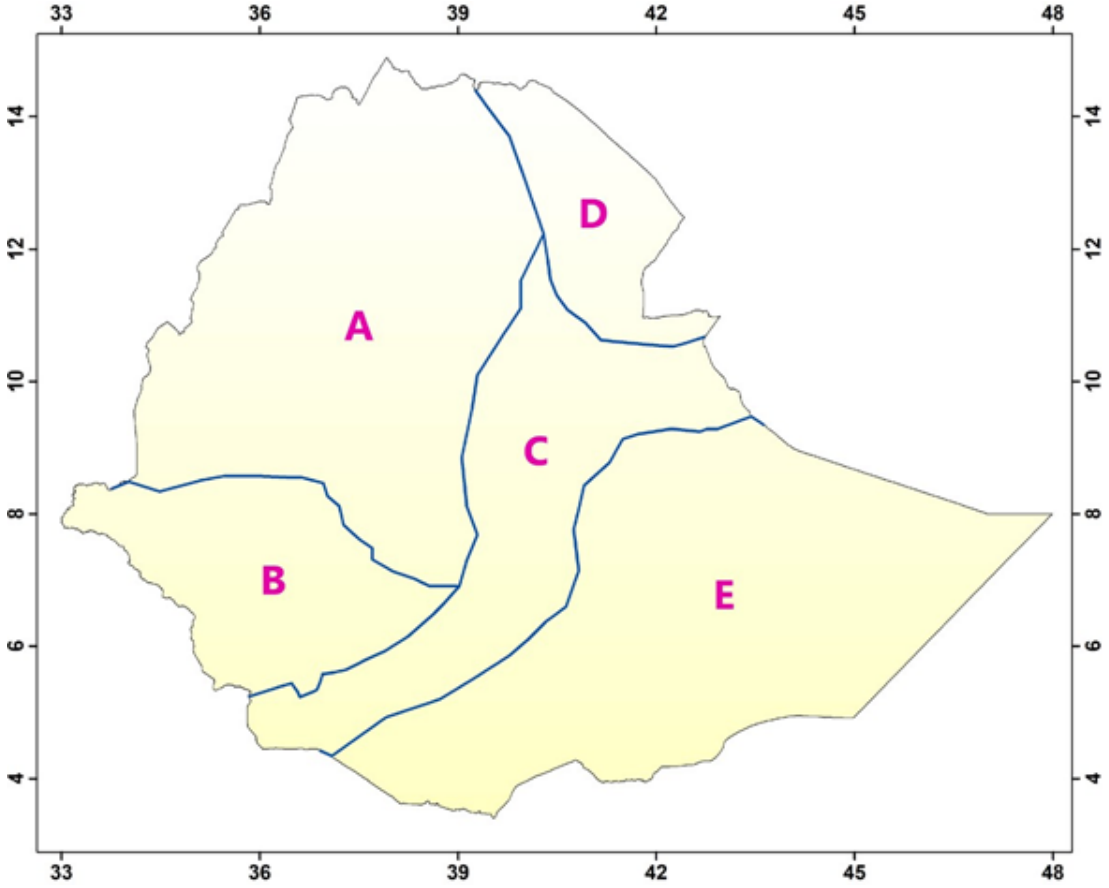

Figure 2.5: Rainfall Regions of Ethiopia

Resources

Adams, Willia M. et.al (eds) (1996). The Physical Geography of Africa. New York: Oxford University Press.

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Small, John, et al, (2001). A Modern Dictionary of Geography. Fourth Edition. Hodder Education Publishers.

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Activity Four

Dear learner! Now you are going to do an exercise. Answer the following questions in the space provided.

1. Identify your own agro-climatic zone by referring to your area's altitude. You might be able to obtain the meters above sea level value of your altitude from your area's kebele offices or from those of other agencies in your area. _____
2. Explain the pattern of rainfall distribution in your locality. _____
3. Explain the pattern of temperature distribution in your locality. _____
4. Draw the map of Ethiopia and show a) Bereha, Qolla, Woina Dega and Dega zones b) frequently drought-stricken areas, and c) the highest and lowest rainfall regions

Checklist

Dear learner! Now it is time to test your knowledge of the climatic regions and seasonal variations in Ethiopia. Read each of the following questions and answer them by putting a tick (√) mark in one of the boxes under the alternatives 'Yes' or 'No'.

S.N	Items	YES	NO
1	Can you identify the agro-climatic zones of Ethiopia?		
2	Can you explain the climatic regions and seasonal variations in Ethiopia?		
3	Can you identify the common measurements of weather and climate?		

Is there any box that you mark 'No' under it? If there is, please go back to your text and read about it before you go to the following exercise.

SELF-TEST EXERCISES FOR SECTION FOUR.

Part I. Write 'True' if the statement is correct and 'False' if it is wrong.

1. The majority of Ethiopia's agricultural land is located in the Dega agro-climatic zone.
2. Agro-climatic zones in Ethiopia are traditionally defined in terms of rainfall.
3. The Wurch-zone areas have the highest altitudes and lowest temperatures.
4. In June, the Inter-Tropical Convergence Zone (ITCZ) position is at the Tropic of Capricorn.
5. In March and September, the position of the ITCZ is around the equator.

Part II. For the following questions, choose the best answer among the given alternatives.

6. As summer rainfall is to the Northwest Highlands and Western Lowlands, _____ is to the Southeastern Highlands and Southeastern lowlands.

A. Winter Rainfall
B. Merged Spring, Summer, and Autumn Rainfall
C. Year-round Rainfall
D. Autumn and Spring Rainfall

7. With regard to the traditional temperature zones of Ethiopia, which of the following best describes the Tropical Climate?

A. Bereha
B. Qolla
C. Woina Dega
D. Wurch/Kur

8. Which of the following regions of Ethiopia receives year-round rainfall and is least likely to be affected by droughts?

A. Southwestern highlands
B. Eastern lowlands
C. Western lowlands
D. North eastern highlands

9. Most parts of Ethiopia receive rainfall during which of the following months?

A. December to February
B. March to May
C. June to September
D. October to November

10. Which of the following are high rainfall variability stations?

A. Metu and Bonga
B. Assaita and Gode
C. Gore and Mizan
D. Mizan and Metu

Section 5 Measures of Weather and Climate

Section Overview

Dear learner! The amount of temperature and rainfall, wind direction, speed and the strength of air pressure are known with the help of instruments. These instruments include the maximum and minimum thermometer, rain gauge, wind vane and anemometer and simple mercury barometer. In measuring temperature, two scales are used namely the Fahrenheit scale, and Celsius scale. These scales are interconvertible.

Section Learning Outcomes

At the end of this section, you will be able to:

- *measure the temperature variation from the thermometer;*
- *read the amount of rainfall received from a rain gauge;*
- *measure air pressure with a barometer; and*
- *detect wind direction with the help of a wind vane.*

Required study time:2 Hours

A. Measuring and Recording Air Temperature

Dear learner! *How do we know exactly how warm or cool the air is? Write down your brief response in the space provided and compare it against what you will read in the following paragraphs.* _____

_____

_____

Have you tried? If so, that is great. Now compare it with the following description. Temperature is a very important element of climate and weather. The instrument for measuring temperature is the thermometer, which is a narrow glass tube filled with mercury or alcohol. It works on the principle that mercury expands when heated and contracts when cooled. On thermo meters, temperatures are marked in one of two ways. In °F. (Fahrenheit) the freezing point is 32°F. and the boiling point is 212°F.

For most scientific purposes the Centigrade °C. scale is preferred. Its freezing-point is 0°C. and its boiling point is 100°C.

These two scales are interconvertible. Look at the following formula:

$$C=(F-32)\times\frac{100}{180}=(F-32)\times\frac{5}{9} \qquad F=\left(C\times\frac{180}{100}\right)+32=\left(C\times\frac{9}{5}\right)+32$$

Mean daily temperature: it is calculated by adding the maximum and minimum temperature of the day and dividing the sum by 2.

Daily (diurnal) range of temperature: it is the difference between the daily maximum and daily minimum temperature.

Mean monthly temperature: is determined by adding together the daily averages and dividing the number of days in a month.

Mean annual temperature: it is calculated by adding the mean monthly temperatures and dividing the sum by 12.

Annual range of temperature: it is the difference between the temperatures of the hottest and coldest months.

b. Measuring and Recording Rainfall

Dear learner! *Why is rainfall measured in millimeters? Please try to answer it below.* _____

_____

_____

Have you tried? If not, no problem. Have a look at the following description. When measuring, we don't record the volume of water that falls. It's the height to which the rainwater would stand if it were allowed to stay in one place without flowing away or getting absorbed by the soil.

Rainfall is measured using a rain gauge. The rain gauge is usually anchored in the ground with the top of the gauge around 30cm above the ground surface to ensure that rain splash does not affect the results. The depth of the rain in millimeters can be read from the side of the container at least once a day (usually at 9:00a.m). A record is kept of the amount of rain (if any) that has fallen during the past 24 hours. At the end of a month the daily amount of rainfall records are added together and this gives the total amount of rainfall for that month.

Mean monthly rainfall: it is calculated by adding all the amounts of rainfall on daily basis for the month and dividing the sum by the number of days of themonth.

Total annual rainfall: it is calculated by adding the amounts rainfall of the 1 months.

Mean annual rainfall: it is calculated by adding the annual amounts of rainfall for 35 years and dividing the sum by the number of those years.

C. Measuring and Recording Air Pressure

Dear learner! *Which of the following instruments would you use if you were a meteorologist trying to measure the air pressure? Write your answer in the space provided and compare it against what you will read in the subsequent paragraph.* _____

_____

Have you tried? If so, that is fantastic. Air is made up of a number of mixed gases and has weight. It therefore exerts a pressure on the earth's surface that varies from place to place and from time to time. This force that presses on the surface of any object can be fairly accurately measured. The instrument for measuring pressure is a barometer. The unit more commonly used for measuring pressure is called millibar and millimeter. At sea level, the mercury column is 1013.25 millibars, or 760 mm.

d. Measuring and Recording Wind Speed

Wind speed can be measured using an anemometer. The anemometer should be held at arm's length, above the head so that the cups can rotate without any interference.

e. Measuring and Recording Wind Direction

Wind direction is reported by the direction it is blowing from, according to the compass. Wind blowing from the west is travelling eastwards so is called a westerly wind, not an easterly wind. Wind direction is often observed using a wind vane.

Resources

Adams, Willia M. et.al (eds) (1996). The Physical Geography of Africa. New York: Oxford University Press.

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Activity Five

1. Convert

a) a) 70°F to °C b) 25°C to °F c) 15°C to °F

_____

_____

_____

_____

Table 2.3: Average Temperature of Addis Ababa (1991-2020)

Months	J	F	M	A	M	J	J	A	A	O	N	D
Annual Min. Temperature (°C)	9	10	12	13	13	12	12	12	12	10	9	8
Annual Max. Temperature (°C)	24	25	25	25	25	23	21	20	21	23	23	23

Source: NASA Climate Data Service

2. By referring to Table 2.3;

a) Calculate the annual range of temperature.

b) Calculate the annual mean temperature.

Table 2.4: Average Rainfall of Addis Ababa, 2020

Months	J	F	M	A	M	J	J	A	A	O	N	D
Rainfall (mm)	13	30	60	80	85	140	280	290	150	25	7	7

Source: NASA Climate Data Service

3. By referring to Table 2.4;

a) a) Calculate the total annual rainfall

b) b) Identify the wettest and driest seasons.

Checklist

Dear learner! Now it is time to check your understanding of the measures of weather and climate. Read each of the following questions and answer them by putting a tick (√) mark in one of the boxes under the alternatives 'Yes' or 'No'.

S.N	Items	YES	NO
1	Can you measure the temperature variation by using the thermometer?		
2	Can you name the instrument which is used to measure the amount of rainfall?		
3	Can you identify the instrument that is used to measure air pressure?		
4	Can you identify the instrument that we use to detect wind direction?		

Is there any box that you marked 'No' underneath? If there is any, please go back to your text and read about it before you are going to do the following exercise.

SELF-TEST EXERCISES FOR SECTION FIVE

Part I. Write 'True' if the statement is correct and 'False' if it is wrong.

1. Daily range of temperature is the difference between the daily maximum and daily minimum temperature.
2. Mean daily temperature is calculated by adding the maximum and minimum temperature of the day.
3. Mean monthly rainfall is calculated by adding all the amounts of rainfall on a daily basis for the month.
4. Total annual rainfall is calculated by adding the amounts of rainfall of 12 months.
5. Mean monthly temperature is determined by adding together the daily averages.

Part II. For the following questions choose the best answer among the given alternatives.

6. Which of the following instrument is used to measure air temperature?

A. Wind vane
B. Barometer
C. Thermometer
D. Anemometer

7. Which of the following instrument is used to measure air pressure?

A. Barometer
B. Thermometer
C. Wind vane
D. Anemometer

8. Which of the following instrument is used to measure wind speed?

A. Thermometer
B. Rawinsonde
C. Wind vane
D. Anemometer

9. Which of the following instrument is used to measure rainfall?

A. Rawinsonde
B. Rain gauge
C. Barometer
D. Anemometer

10. Which of the following instrument is used to measure wind direction?

A. Wind vane
B. Thermometer
C. Anemometer
D. Barometer

UNIT SUMMARY

- Climate is the average condition of the atmosphere over a long period in a given area. Climatic elements include precipitation, temperature, humidity, air pressure, winds, etc. The spatial and temporal distribution of the climatic elements in Ethiopia is determined by various physical factors which are generally known as controls of climate. The most important are latitude, altitude, mountain barriers and the evolution of the earth and the inclination of the earth's axis.
- The apparent spatial variation of altitude, in Ethiopia has resulted in agro-ecological zonation of climate ranging from " Bereha" to "Wurch". Especially in the highlands, Ethiopia experiences four seasons, namely 'Kiremt', Meher', 'Bega' and 'Belg'. Laterally, due to the altitude effect, we see spatial variation of temperature, rainfall, vegetation, and population density.
- Based on the areal and seasonal variation of the spread of rainfall, Ethiopia is divided into five main rainfall regions, namely year-round rainfall region, the summer rainfall region, the autumn and spring rainfall region, the winter rainfall region and the merged spring, summer, and autumn rainfall regions.

GLOSSARY

Anticyclone - a high pressure system with an anticyclonic circulation.

Atmosphere - the mass of air surrounding the earth and bound to it more or less permanently by the earth's gravitational attraction.

Cyclone - a low pressure system with a cyclonic circulation.

Front - the boundary between two different air masses.

Leeward - is a location that is protected from the prevailing wind.

Relief rainfall - precipitation that results when moist air is lifted over a topographic barrier, such as a mountain range.

Windward - is a location that is exposed to the prevailing winds.

SELF-ASSESSMENT CORRECTED BY THE STUDENT

Give short answers to each of the following questions.

- What similarities and differences exist between weather and climate?
- What is air pressure?
- How mean annual temperature of a given place is calculated?
- What are the two factors that mostly affect the spatial variation of temperature in Ethiopia?
- What moisture-bearing winds prevail over your area?

SELF-ASSESSMENT CORRECTED BY TUTOR

- What do we mean by spatial and temporal in the context of Geography?
- Identify the factors that are responsible for the spatial and temporal variation of temperature and rainfall in Ethiopia.
- State the dominant wind systems over Ethiopia during the "Bega" and " kiremt " seasons.
- Identify the water bodies that have a significant impact on the spatial distribution of the elements of climate in Ethiopia.

ANSWER FOR SECTION LEVEL ACTIVITY

Answer for Section Level Activity One

1. Weather refers to the atmospheric condition of a given place for a short period of time. Climate is the average weather condition of a given place for a relatively longer period of time.

2. Weather refers to the atmospheric conditions of a given place for a short period of time, while climate is the average weather condition of a given place for a relatively long period of time. In other words, the day-by-day variations of atmospheric conditions (temperature, rainfall, cloud cover, humidity, wind, etc.) in a given area constitute the weather, whereas the climate is the long-term synthesis of such variations.

Answer for Section Level Activity Two

1. The most important elements of climate in Ethiopia are temperature,

precipitation, humidity, wind, air pressure, and cloud cover.

Answer for Section Level Activity Three

1. Based on their latitudinal location, places in Ethiopia experience different amounts of the angle of the sun. The latitudinal position of the sun also affects the position of the ITCZ, the low-pressure cell that controls the direction of movement of winds in the country. Therefore, latitude affects the spatial distribution of temperature and rainfall in Ethiopia.
2. Altitude and latitude
3. The major water bodies that have an impact on the spatial distribution of the elements of climate in Ethiopia are the Atlantic Ocean, Indian Ocean, Red Sea, and the Gulf of Aden.
4. Because of their tropical location all places found in Ethiopia experience the overhead sun (900angle of the sun) twice a year.

Answer for Section Level Activity Four

1. Since it is an individual-based activity, the answers are expected to vary from learner to learner. Therefore, let the distance learner try to answer it by him/herself.
2. Since it is an individual-based activity, the answers are expected to vary from learner to learner. Therefore, let the distance learner try to answer it by him/herself.
3. Since it is an individual-based activity, the answers are expected to vary from learner to learner. Therefore, let the distance learner try to answer it by him/herself.
4. Since it is an individual-based activity, the answers are expected to vary from learner to learner. Therefore, let the distance learner try to answer it by him/herself.

Answer for Section Level Activity Five

1. a) 21°C b) 77°F c) 59°F
2. a) 3.5°C b) 17.08°C
3. a) 1167mm
4. Summer or Kiremt (June, July and August) are the wettest seasons and November, December, and January (Winter or Bega) are the driest seasons

ANSWER KEY FOR SELF-TEST EXERCISES

Self-test Exercise Answers for Section One

1. False 2. True 3. True 4. False 5. True

Self-test Exercise Answers for Section Two

1. F 2. E 3. G 4. B 5. C 6. A 7. D

Self-test Exercise Answers for Section Three

1. B 2.D 3. A 4. C 5. B 6. A 7. D 8. C 9. A 10. B

Self-test Exercise Answers for Section Four

Part I. True/False Items

1. False 2. False 3. True 4. False 5. True

Part II. Multiple Choice Items

6. D 7. B 8. A 9. C 10. B

Self-test Exercise Answers for Section Five

Part I. True/False Items

1. True 2. False 3. False 4. True 5. False

Part II. Multiple Choice Items

6. C 7. A 8. D 9. B 10. A

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UNIT THREE

NATURAL RESOURCE BASE OF ETHIOPIA

Unit Introduction

Dear distance learner! In the previous unit, we looked at the climate of Ethiopia. Now we are going to deal with the natural resource base of Ethiopia which is concerned with the major natural resources including soils, water, natural vegetation, and wildlife that are foundation of any economic development, food security and other basic necessities for the Ethiopian population. If you want to successfully handle the contents we advise you to conduct field visits and make observations.

Unit Learning Outcomes

At the end of this unit, you will be able to:

- *recognize the concept of natural resources;*
- *elaborate on the major drainage systems of Ethiopia;*
- *explain the distribution of the major water resources in Ethiopia;*
- *state soils types and distribution in Ethiopia;*
- *explain factors responsible for difference in types of natural vegetation in Ethiopia;*
- *describe the types of wildlife in Ethiopia and factors that affect their distribution; and*
- *describe the spatial distribution and variation of minerals in Ethiopia.*

Key Terms

- *Afroalpine*
- *Biotic resource*
- *Conservation*
- *Endemic animals*
- *Metallic minerals*
- *Non-renewable resources*
- *Renewable resources*
- *Savanna woodlands*
- *Soil*
- *Xerophytes*

Unit Contents

3.1 Meaning of Natural Resources
3.2 Drainage Systems of Ethiopia
3.3 Water Resources of Ethiopia
3.4 Major Soils Types of Ethiopia
3.5 Major Mineral Resources and Their Distribution in Ethiopia
3.6 Biotic Resources of Ethiopia

Required study time:11 Hours

Unit Learning Strategies

Suggested learning strategies are:

- *written brainstorming questions;*
- *case study;*
- *field visit;*
- *Problem-solving method;*
- *individual project;*
- *report writing;*
- *observation;*
- *written activities;*
- *practical activities;*
- *self-test assessments;*
- *online dialog (if possible); and*
- *Electronic portfolios (if possible).*

Section 1 Meaning of Natural Resources

Section Overview

©***Dear learner!*** In this section, you are going to learn about the meaning and concepts of natural resources. Natural resources are assets occurring in nature that can be used for economic production or consumption.

Section Learning Outcomes

At the end of this section, you will be able to:

- *explain the concept of natural resources; and*
- *describe the classification of natural resources.*

Required study time:1 Hour

Dear learner! *What do you mean by "natural resource"? Please try to define it in your own words in the space provided below.* _____

_____

_____

Have you tried? As you may have guessed, natural resources are naturally occurring materials that are useful to man. They are classified into renewable resources and non-renewable resources. Plants, animals, soil, water, geothermal energy, wind energy, and solar radiation are categorized under renewable resources while all minerals, coal, crude oil, and natural gas are classified under non-renewable resources.

Renewable resources are resources that can be replenished by nature while non-renewable resources are resources that cannot be regenerated by nature and exist in limited amount.

In Ethiopia, these resources are under the influence of various interconnected factors like population pressure, agricultural expansion, migration, rapid urbanization, resettlement, climate change, and environmental pollution. The huge population of Ethiopia has been putting a great burden on the sustainability of almost all types of natural resources. As a result, there is serious degradation of land, water, forest, rangeland, and wildlife resources that appear to feed off each other.

Resources

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Activity One

1. Describe the concept of natural resources. _____

2. Classify natural resources. _____

3. Ethiopia's natural resources have been deteriorating from time to time. Why? _____

Checklist

Dear learner! Now it is time to check your understanding of the meaning and concept of natural resource. Read each of the following questions and answer them by putting a tick (√) mark either under 'Yes' or 'No'.

S.N	ITEMS	YES	NO
1	Can you define natural resources?		
2	Can you recognize the concept of natural resources?		
3	Can you describe the classification of natural resources?		

Is there any box that you marked 'No' underneath? If there is any, go back to your text and read about it before you move on to the following exercise.

SELF-TEST EXERCISES FOR SECTION ONE

For each of the following questions, choose the correct answer from the given alternatives.

1. All of the following are non-renewable resources EXCEPT

A. Coal
B. Crude oil
C. Animals
D. Natural gas

2. Which one of the following is a renewable resource?

A. Natural gas
B. Wind
C. Coal
D. Minerals

3. A natural resource that cannot be regenerated at a scale comparable to its consumption is called _____.

A. Non-renewable
B. Tide
C. Geothermal
D. Renewable

4. Energy from the flow of water is called _____.

A. Solar
B. Geothermal
C. Wave
D. Hydroelectric

5. Which one of the resources listed below is non-renewable resource?

A. Running water
B. Ground water
C. Metallic mineral
D. Solar radiation

Section 2 Drainage Systems of Ethiopia

Section Overview

©***Dear learner!*** We hope that you have been successful in studying the concept of natural resources. In this section, you are going to learn about the drainage systems of Ethiopia. In contrast to the other countries of the Horn, Ethiopia is endowed with many rivers and lakes. Because of this, the country is even described as the "water tower of Eastern Africa."

Section Learning Outcomes

At the end of this section, you will be able to:

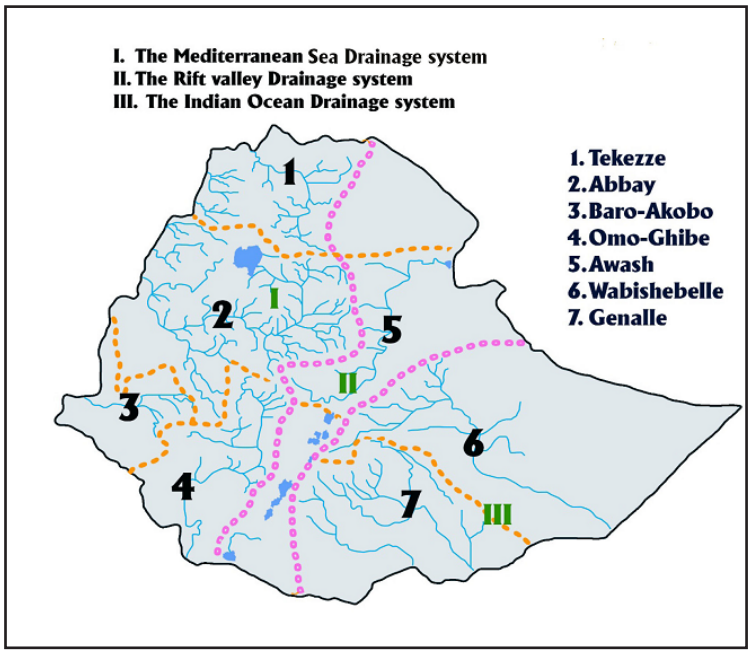
- *elaborate major drainage systems of Ethiopia.*

Required study time:2 Hours

Dear learner! *What do we mean by drainage system? Try to define it in the space given below.* _____

_____

Have you tried? If so, that is great. Drainage systems refer to the flow direction and destination of the rivers. The drainage systems of Ethiopia are the results of the geological events of the Cenozoic era.



The drainage systems of Ethiopia are basically classified into three major groups:

i. The Western (Mediterranean) sea drainage system
ii. The Southeastern (Indian Ocean) drainage system
iii. The Inland (Rift Valley) drainage system

Fig 3.1: The Drainage Systems of Ethiopia

i. The Western (Mediterranean Sea) Drainage System

The western drainage system is the largest of the three systems both in terms of catchment area and volume of water. It contributes 60% of the country's total annual water discharge. It is made up of major rivers and their tributaries namely:

- ***River Tekezze:*** *– This river drains the Massif of western Lasta, northern Gondar/ Semein and southwestern, western and central Tigray.*
- ***River Abbay:*** *– The River Abbay has its origin in the Gojjam plateau. A large number of streams join the river from the plateaus of western Shewa, southwestern Wollo, northern Wollega, and northern Illubabor. It has a semicircular course from Lake Tana, separating southeastern Gondar from Gojjam and separating Gojjam from Shewa.*
- ***River Baro-Akobo:*** *– This water course drains the wettest highlands of the southwest and crosses the border to join the Nile.*

These rivers join the Nile in Sudan and finally end up in the Mediterranean Sea.

ii. The Southeastern (Indian Ocean) Drainage System

This system is the second largest drainage system. It consists of the Genalle and Wabe Shebelle. These rivers collect water from the highlands of Hararghe, Sidamo, Bale and Arsi. This drainage system flows southeast, across the Somali arid, and semi-arid areas. It contributes about 32% of the country's total annual water flow.

The Wabe Shebelle, the longest river in the country, does not reach the Indian Ocean. It ends at the Benadir coast of Somalia. The Genale, on the other hand, reaches the Indian Ocean. It joins the Dawa River at the Ethio-Somalia border, where it acquires the name Juba.

iii. The Inland (Rift Valley) Drainage System

This system is the smallest of the three systems in terms of the catchment area, discharge of water, and volume of water. There are a number of lakes and smaller streams, like the Bilate and Gedabo, which flow into Lake Abbaya; the Segan, which flows into Chew Bahir; and the Meki and the Katar, which flow into Lake Ziway. The major rivers in this drainage system are the Awash and the Omo-Gibe.

The Awash River basin is the most utilized in the Rift Valley. The basin covers a total area of 110,000 km^2. It rises from the Shewan plateau near Ginchi town, a town about 100 kilometers west of Addis Ababa, and flows along the Rift Valley. It terminates in the salty lake of Abbe on the border with Djibouti. The middle and lower courses are part of the Great Rift Valley system (the upper course is not part of the system). The lower Awash River basin comprises the deltaic alluvial plains of the Tendaho, Assaita, and Dit Behri areas, and the terminal lakes area.

Resources

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Activity Two

1. Draw a sketch map that shows the drainage systems of Ethiopia (refer to the geography module for distance education)
2. To which direction do rivers in your locality flow? What determines their direction of flow?

Checklist

Dear learner! Now it is time to check your understanding of the drainage systems of Ethiopia. Read each of the following questions and answer them by putting a tick (√) mark in one of the boxes under alternatives 'Yes' or 'No'.

S.N	ITEMS	YES	NO
1	Can you define the drainage system?		
2	Can you describe the three drainage systems of Ethiopian Rivers?		
3	Can you explain natural factors controlling the drainage systems of Ethiopia?		

Is there any box that you marked 'No' under it? If there is any, return to your text and read about it before you go to the following exercise.

SELF-TEST EXERCISES FOR SECTION TWO

Part I. The following items focus on the major drainage systems of Ethiopia. Match items under column 'A' with their river basin types under column 'B'.

A	B
1. It drains the wettest highlands of the southwest	A. Tekezze
2. It is the most utilized river	B. Genale
3. It is the longest river	C. Baro Akobo
4. Ends its journey in the Indian Ocean	D. Wabe Shebelle
5. It is found in the largest drainage system	E. Awash

Part II. For the following questions choose, the correct answer from the given alternatives.

6. Which one of the following rivers of Ethiopia disappears at the end of its journey?

A. Genale
B. Gibe
C. Wabe Shebelle
D. Baro-Akobo

7. Which one of the following drainage systems in Ethiopia is the largest?

A. Southeastern
B. Western
C. The rift valley
D. Indian Ocean

8. Which one of the following rivers is not transboundary?

A. Tekezze
B. Awash
C. Baro-Akobo
D. Wabe Shebelle

9. The drainage pattern of Ethiopia is a result of

A. The nature and structure of rocks
B. High rainfall
C. Vegetation cover
D. The geological processes

10. Which one of the following river basins is not found in the western drainage system?

A. Abbay
B. Baro-Akobo
C. Tekezze
D. Genale

Section 3 Water Resources of Ethiopia

Section Overview

Dear learner! In this section, you will learn about the water resources of Ethiopia. As you are well aware, Ethiopia is the second richest African country in terms of water resource potential, following the Democratic Republic of Congo. In general, Ethiopia has adequate average annual rainfall in most areas, several major rivers and lakes, and significant groundwater resources.

Section Learning Outcomes

At the end of this section, you will be able to:

- *explain the distribution of the major water resources in Ethiopia;*
- *describe the characteristics of major rivers of Ethiopia; and*
- *recognize the significance of Ethiopian lakes and rivers.*

Required study time:2 Hours

3.3.1. Major Rivers of Ethiopia and Their Characteristics

Ethiopia is among the few countries that have many rivers. It has enormous potential water resources. As well as being numerous, Ethiopian rivers are energetic. They flow from the highlands of the interior to the peripheral lowlands and then to seas and lakes bouncingly. These conditions have made Ethiopia to be known as the "water tower of Northeastern Africa" and as the watershed between the Mediterranean Sea and the Indian Ocean drainage systems.

Dear learner! *Do you recall the major rivers of Ethiopia from your previous lessons? If so, that is great. Try to name them in the space provided and compare your answer with what you will see in the table below.* _____

_____

_____

_____

Table 3.1: Major Rivers of Ethiopia and Their Tributaries

Rivers	Catchment Area (km^2)	Length in kms			Major Tributaries
		Inside	Outside	Total	
Wabe Shebelle	205,407	1340	660	2000	Ramis, Erer, Dakata, Fafen, Yerer, Gobelle, Galleti, Mojo
Abbay	198,508	800	560	1360	Dabus, Didessa Fincha, Guder, Muger, Jemma, Beshillo, Shinta, Dinder
Genale	168,141	480	570	1050	Dawa, Weyb, Welmel, Mena
Awash	113,709	1200	-	1200	Akaki, Kessem, Borkena, Mille
Tekezze	87,733	608	560	1,168	Tirari, Anghereb, Ghiba, Guang
Gibe/Omo	77,205	760	-	760	Gojeb, Gilgel Gibe
Baro	75,718	227	280	507	Akobo, Gilo

3.3.2. Characteristics of Ethiopian Rivers

Dear learner! *Can you explain the general characteristics of the Ethiopian rivers and their tributaries? State your answer briefly in the space provided and compares it against what you will read in the following paragraph.* ___

_____

_____

_____

Have you written? As you may have described, the most important characteristics of Ethiopian rivers include:

- seasonal fluctuation in water volume;
- steep profiles; they arise from very high places and flow to the country's borders across lowlands;
- rapids and waterfalls along their courses;
- running through steep-sided river valleys and gorges; and
- serve as boundaries, both international and domestic.

Some of the Ethiopian rivers are given new names after they cross the country's borders. Examples:

- River Abbay becomes Blue Nile in the Sudan.
- River Tekezze becomes River Athbara in the Sudan.
- River Genale becomes River Juba in Somalia.
- River Baro becomes River Sobat in the Sudan.

3.3.3. Lakes of Ethiopia

Dear learner? Does Ethiopia have many lakes when compared to other African countries? _____

_____

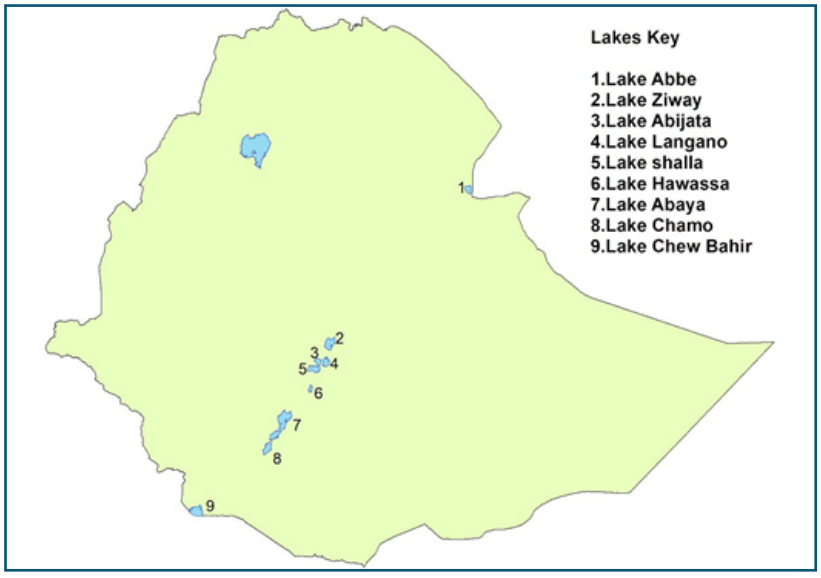
Did you try it? That's good. By African standard, Ethiopia is a country rich in lakes. Most of lakes found dispersed on the plateaus and clustered in the Rift Valley.

Most of the lakes are the result of structures that occurred during the Quaternary Period; i.e., they are not outcomes of climate. This fact is proved by the location of these lakes in the drier parts of the country. The natural lakes found in Ethiopia can be classified into highland and Rift Valley lakes.

Highland Lakes: These lakes are situated on the plateaus, either as crater or watershed lakes. These types of lakes are resulted from different types of structural formations.

A crater lake is formed after an explosive volcano breaks a mountain open, leaving a deep mouth. The mouth is filled with water – from either small streams or subterranean sources. The highland crater lakes in Ethiopia are Haik near Dessie and Hashenge near Korum . There are also crater lakes in different parts of Ethiopia. They include many small but deeper lakes in and around Bishoftu, e.g. Bishoftu, Kuriftu, Babbo Gaya, and Arsedi. Wonchi and Dendi around Ambo, Ginchi and Wellisso and Ziquala are the other crater lakes.

A watershed lake is formed when a sheet of lava dams up a shallow surface depression. For example, Lake Tana was formed during the Quaternary Period, when a sheet of flowing lava dammed the shallow depression that had already been formed between the Gojjam, and Gondar Massif.



Rift Valley Lakes: Unlike the highland lakes, the Rift Valley lakes are clustered. The Rift Valley lakes are formed in the depressions and basins caused by tectonic activities. They are found in a linear pattern along the floor of the Rift Valley (see Figure 3.2).

Figure 3.2: Major Rift Valley Lakes of Ethiopia

Table 3.2: Depth, Area and Location of Ethiopian Lakes

Lakes	Area (km^2)	Maximum depth (meters)	Type
Tana	3,600	9	Highland
Abbaya	1,160	13	Rift Valley
Chamo	551	10	Rift Valley
Ziway/Danbal	434	4	Rift Valley
Shalla	409	266	Rift Valley
Langano	230	46	Rift Valley
Hawassa	229	10	Rift Valley
Abijatta	205	14	Rift Valley
Haik	35	23	Highland
Hashenge	20	25	Highland

3.3.4. Significance of Ethiopian Lakes and Rivers

Dear learner! *Do you know the major rivers of Ethiopia across which major dams are constructed? If you know, please name them in the space provided and compare them against a list of rivers in the following paragraph.* _____

_____

_____

_____

Have you tried? If so, that is great. Ethiopian rivers and lakes are very important natural resources for the development of socio-economic and aesthetic value in the country. Some of their general benefits are given briefly below:

I. Hydroelectric Power (H.E.P.) Generation: rivers are the main source of hydroelectric power (H.E.P.) supplies for the country. Example:

- River Gibe – Gilgel Gibbe – 1, 2 and 3 H.E.P. plants,
- River Awash – Awash 1, 2, and 3 H.E.P. project,
- River Fincha – Fincha H.E.P. project,
- Tekezze – Tekezze H.E.P plant,
- Melka Wakena – Wabe Shebelle H.E.P,
- Koysha - Under construction,
- Great Ethiopian Renaissance Dam H.E.P plant – under construction.

II. Fishery: Ethiopian rivers and lakes are also the country's main source of fish. Examples: Lake Chamo, Lake Abbaya, Lake Tana, River Baro, etc

III. Major Irrigation Schemes: They are again very important water sources for irrigation. River Awash is the most utilized in this regard; this is because of the flat plains it crosses for hundreds of kilometers.

IV. Navigation: The River Baro is the only river in Ethiopia used for water transport. Similarly, Lake Tana, Lake Ziway and Lake Abbaya are important inland waterways.

V. Tourism and Recreation: Ethiopia's lakes and rivers provide recreation resorts and aesthetic value. Their scenic beauty emanates from the rich variety of birds, fish and other wildlife, spectacularly deep gorges, waterfalls of all description and the mists they produce. These panoramic features win the affections of the Ethiopian people and tourists and they are sites of the country's best recreational resorts. The economic potential of these scenic resources is enormous but it is not well developed yet.

Resources

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Activity Three

1. By referring to table 3.1, identify;

   A. the longest river in Ethiopia _____

   _____

   _____

   B. river with the largest catchment area in Ethiopia _____

   _____

   _____

   C. rivers forming an inland drainage system _____

   _____

   _____

   D. river with many tributaries compared to others. _____

   _____

   _____

Checklist

Dear learner! Now it is time to check your understanding of the major water resources of Ethiopia. Read each of the following questions and answer them by putting a tick (√) mark in one of the boxes under the given alternatives 'Yes' or 'No'.

S.N	ITEMS	YES	NO
1	Can you explain the distribution of the major water resources in Ethiopia?		
2	Can you describe the characteristics of the major rivers of Ethiopia?		
3	Can you recognize the significance of Ethiopian lakes and rivers?		

Is there any box that you marked 'No' underneath? If there is please go back to your text and read about it before you go to the following exercise.

SELF-TEST EXERCISES FOR SECTION THREE

Part I. Write 'True' if the statement is correct and 'False' if it is wrong.

1. Lake Tana is the largest lake in Ethiopia.
2. The Abbay is the longest river in Ethiopia.
3. The rivers of Ethiopia are suitable for navigation.
4. Ethiopia is rich in rivers and lakes.
5. Lake Wonchi is a highland lake

Part II. For the following questions, choose the correct answer from the given alternatives.

1. The deepest lake in Ethiopia is

   A. Lake Tana.
   B. Lake Langano.
   C. Lake Hashenge.
   D. Lake Shalla.

2. Which of the following rivers of Ethiopia is found to be navigable to a limited extent?

   A. The Abbay
   B. The Baro-Akobo
   C. The Awash
   D. The Genale

3. Which one of the following lakes is not a crater lake?

   A. Lake Tana
   B. Lake Wonchi
   C. Lake Ziquala
   D. Lake Arsedi

4. Which of the following Ethiopian rivers is the most economically utilized?

A. The Baro-Akobo
B. The Abbay
C. The Awash
D. The Tekezze

5. Which one of the following is false about the characteristics of Ethiopian rivers?

A. Rapids and waterfalls along their courses
B. Perennial and non-fluctuating in their volume of water
C. Running through steep-sided river valleys and gorges
D. Serve as boundaries, both international and domestic

Section 4 Major Soil Types of Ethiopia

Section Overview

Dear learner! In this section, you will learn about the soils of Ethiopia. First, you will learn the meaning, formation, components and uses of soil. Then, you are going to categorize the major types of soils found in Ethiopia. Finally, you are going to learn about the characteristics of these soils.

Section Learning Outcomes

At the end of this lesson, you will be able to:

- *distinguish major soil types in Ethiopia; and*
- *explain the characteristics of major soil types in Ethiopia.*

Required study time:2 Hours

3.4.1. Formation of Soils in Ethiopia

Dear learner! *From your experiences, can you describe what soil is and how it is formed? Try to define the term "soil" in your own words below.* _____

_____

_____

_____

Have you tried? As you may have defined, it is the loose material overlying the crust of the earth consisting mainly of very small particles. Its major components are water, air, organic and inorganic minerals. It is a dynamic, natural and complex substance that can support animals and plants.

The soils of Ethiopia are the result of:

- Parent rock material which has been broken into small particles by way of weathering and natural decomposition
- Climatic conditions, which largely determine the speed and nature of the processes that form the soil; for example, extreme heat, or cold, could stop the work of bacteria, and the amount of moisture influences several aspects of soil formation.
- Vegetation cover, which adds humus to the soil and renders support to the soil making animals and bacteria
- Topography, soils on the side of hills tend to be shallow, due to erosional losses.

On the plateaus that make up extensive areas in north, north western, south western, central and south eastern Ethiopia the parent rocks are volcanic origin and experience sufficient rainfall. The soils formed in these areas are red basaltic and black basaltic soils. Unlike the red basaltic soils, the black soils have high clay content that makes the soil difficult for farming.

In areas where the hard crystalline rocks are the parent rock, the soils are poor and thin. They are also rocky and acidic. They range in colour from grey to brown. They are found in Hararghe plateaus and Borena lowlands.

In the Afar region where recent volcanic deposits and dried-out lake deposits had occurred, very shallow and saline-dominated soils are formed. Due to time and climatic effects, these soils are not deep and fertile.

In the southeastern lowlands, where the parent rocks are sedimentary rocks, the soils lack humus, but they are rich in phosphorous and potash. They are also low in nitrogen content.

In the lower courses of the major rivers, transported soils often known as alluvial soils are dominant. These soils are fertile because of their volcanic origin and continuous nourishment of water.

People depend on soils; conversely, the quality of the soils depends on how wisely people use the land. Not only in countries like Ethiopia, whose economy is largely agrarian, but also in highly industrialized countries, soil is one of the most important bases of life.

3.4.2. Types of Soil in Ethiopia

The soils of Ethiopia are basically derived from volcanic, metamorphic and sedimentary rocks. According to the latest classification made by the FAO, there are eighteen classes of soil in Ethiopia.

Dear learner! *Can you list the names of soils in your locality or elsewhere? If so, write down some soil types you know in the space provided and compare your answer to what you will read in the paragraph that follows.* _____

_____

_____

Have you attempted? If so, that is great. Below are the main soil types. They cover more than 85 percent of the country.

1. Nithosols (Red Basaltic Soils): These soil types:

- cover about 12 percent of the country.
- are basically associated with high rainfall and are found in areas that were previously covered with forest.
- are predominant in the Western Highlands of Wollega, Kafa, Illubabor, the Southern Highlands of Sidama, the Central and Western Highlands of Shewa, the Highlands of Gojjam, and the Eastern Highlands of Hararghe.
- are mature soils with deep profiles. They are highly leached and lack soluble minerals like Sodium, Calcium, etc., but they are rich in iron and aluminum.
- are potentially good for farming and other agricultural practices since they are friable, and have a stable structure; as a result,
- are the most widely cultivated soil types. They are the best soils for coffee, inset, and cereals.

2. Vertisols (Black Basaltic Soils): soil types of this sort:

- cover about 10 percent of the total land of Ethiopia.
- have high clay content; so, they are sticky. For this reason and for poor drainage qualities, such soils are difficult to be used for farming purposes.
- have excellent nutrients that could provide support for agriculture, but their poor drainage qualities limit their use for grazing purposes.
- are largely found in Arsi, Bale and central Hararghe, where there are pronounced wet and dry seasons.

3. Cambisoils: Such soils:

- are soils that developed from the recent lava deposits of the Quaternary Period.
- are young and shallow.
- are found on the rugged and sloping terrain of the Plateau of Shewa (eastern escarpment) and Chercher Highlands.

4. Regosols: These types:

- like the cambisols, are shallow and young but they are coarse-textured.
- have low agricultural value.
- are found in the Danakil and Ogaden plains.

5. Xerosols: These soils:

- are generally young and shallow, and they are found in arid and semi-arid regions. They have a weakly developed profile.
- are found extensively in the Northeastern escarpment, Northwestern and Southeastern Lowlands.
- are characterized by high salt content and humus deficiencies.
- have little significance for agriculture except places where they could be irrigated.

6. Lithosols: Such soils:

- are similar to cambisols and regosols in their poor maturity and their location on steep slopes.
- are found in areas of low precipitation.
- cover the escarpments of the Northeastern and Chercher Highlands.

7. Fluvisols: This type of soils:

- are soils that rivers have transported from highlands to lowlands.
- cover about 10 percent of the country's total area.
- are associated with river, sea and lake deposits.
- have very good agricultural potential.
- are found extensively in the lower regions of the Omo, Awash, Abbay and Baro-Akobo Rivers.

Resources

Frances, M. (2016). Understanding Ethiopia: Geology and Scenery. Springer International publishing, Switzerland.

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Activity Four

1. List the soils of Ethiopia in the order of their suitability for agriculture from the best to the worst. _____

   _____

2. What is the basic difference between the Red Basaltic and the Black Basaltic soil? ___

   _____

   _____

3. Compare and contrast Xerosols and Fiuvisols _____

   _____

Checklist

Dear learner! Now it is time to check your understanding of the major soil types of Ethiopia. Read each of the following questions and answer them by putting a tick (√) mark in one of the boxes under alternatives 'Yes' or 'No'.

S.N	ITEMS	YES	NO
1	Can you define what a soil is?		
2	Can you distinguish major soil types in Ethiopia?		
3	Can you explain the characteristics of major soils types in Ethiopia?		

Is there any box that you marked 'No' underneath? If there is any, please return to your text and read about it before you go to the following exercise.

SELF-TEST EXERCISES FOR SECTION FOUR.

The following items focus on major soil types of Ethiopia. Match items under column 'A' with their soil types under column 'B'.

A	B
1. Are the most widely cultivated soil type	A. Fluvisols
2. Young and shallow soils found on the rugged and sloping terrain	B. Nithosols
3. Young and shallow soils found in arid and semi-arid areas	C. Vertisols
4. Are associated with river, sea and lake deposits	D. Cambisoils
5. Have high clay content	E. Xerosols

Section 5 Major Mineral Resources and Their Distribution in Ethiopia

Section Overview

Dear learner! In this section, you are going to learn about the major mineral resources and their distribution in Ethiopia. A mineral is a combination of elements. It is grouped as one set of non-renewable natural resources. A survey conducted by the Ministry of Mining and Petroleum, with assistance from the United Nations Development Program (UNDP), shows that Ethiopia has substantial reserves of mineral resources.

Section Learning Outcomes

At the end of this lesson, you will be able to:

- *elaborate major mineral resources of Ethiopia; and*
- *describe the spatial distribution of minerals in Ethiopia.*

Required study time:1 Hour

Dear learner! *Is Ethiopia rich in mineral resources? If, yes list names of minerals you know in your locality or elsewhere in the space provided and compare them against what you will read in the following paragraph.* _____

_____

_____

_____

Did you try? If so it is great. Now compare your response with the following explanation. According to some preliminary geological surveys, there is an agreement that Ethiopia has many different types of untapped mineral deposition. None of them is currently extracted on a large scale either for commercial or industrial use.

In Ethiopia non-metallic minerals are more produced annually compared to metallic ones. With the exception of common salt, almost all other products of minerals are produced on a small scale. Some amounts of these minerals are exported. Currently, a number of known occurrences and distribution of metallic materials and non-metallic minerals have been identified as follows:

I. Metallic Minerals

a) Gold

It has been extracted in Ethiopia since ancient times from alluvial deposits. There are two principal geological environments in Ethiopia in which gold is found. These include volcanic veins in Precambrian rocks and alluvial deposits. The largest active gold mines in Ethiopia are

Adola, Bule Hora, Arero, Moyale,Akobo, Lega Dembi, Sakaro, and the Tigray regions.

b) Platinum

It is the key input for manufacturing of many electronic equipment including mobile phones. The deposits are identified in the western parts of Ethiopia (northeast Yubdo, north of Gimbi and in the Akobo area of Gambella region).

c) Tantalum

Like platinum it is used for manufacturing of many electronic equipment including mobile phones. Kenticha, a place 50 kms South-east of Shakiso in Adola is identified as a tantalum-rich area. In other areas of Adola, tantalum bearing minerals have been found but none of these areas has been explored in detail.

II. Non-metallic Minerals

a) Potash and Salt: They are found in the Danakil depression (Dallol) area of the Northern Rift Valley. This area is known for its rich potash and salt deposits.

b) Soda Ash: Geological surveys indicated that some rift valley lakes of Ethiopia namely Abijata, Shalla, etc. contain 460 million metric tons of Sodium Carbonate. The concentration of salt, combined with a favorable climate makes this area potentially one of the best locations for soda ash production in the country.

c) Limestone: It is an important mineral resource for building and construction. It is used for the production of cement and chalk. Good reserves are found in Tigray, Shewa, and Harerghe.

d) Clay: Clay deposits are found in many parts of Ethiopia. It is used for pottery and brick industries.

e) Silica: It is an important raw material for glassy industries. Reserves of silica sand are found in Harer, Shewa, Gondar, Gojjam, Sidamo, Arsi, Tigray and Wollega.

f) Crude Oil and Natural Gas: Reserves of natural gas and crude oil are believed to be found in the Ogaden basin.

g) Coal: The lignite coal deposits are proved to exist in Shewa (Debre Brihan-Dessie road, Sululta and near Mojo), Sidama, Wollega.

Resources

Frances, M. (2016). Understanding Ethiopia: Geology and Scenery. Springer International publishing, Switzerland.

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Wolela, A. (1992). Significant coal deposits and their economical and mining possibilities in Ethiopia.

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Activity Five

1. Classify mineral resources. _____

   _____

2. Describe the socio-economic significance of mineral resources in Ethiopia. _____

   _____

   _____

Checklist

Dear learner! Now it is time to check your understanding of the major mineral resources and their distribution in Ethiopia. Read each of the following questions and answer them by putting a tick (√) mark in one of the boxes under alternatives 'Yes' or 'No'.

S.N	ITEMS	YES	NO
1	Can you define the term mineral resource?		
2	Can you elaborate major mineral resources of Ethiopia?		
3	Can you describe the spatial distribution of minerals in Ethiopia?		

Is there any box that you marked 'No' underneath? If there is any, please go back to your text and read about it before you go to the following exercise.

SELF-TEST EXERCISES FOR SECTION FIVE

Write true if the statement is correct and false if it is wrong.

1. In Ethiopia metallic minerals are more produced annually compared to the non-metallic ones.
2. Most Ethiopian coals fall in the category of lignite.
3. Precambrian rocks and alluvial deposits are the two geological settings where gold is found in Ethiopia.

4. Soda ash is an important raw material for glassy industries
5. Tantalum is used for manufacturing many electronic equipment including mobile phones.

Section 6 Biotic Resources of Ethiopia

Section Overview

Dear learner! In this section, you will learn about the biotic resources of Ethiopia. Ethiopia because of its geographical position, range of altitudes, rainfall patterns, and soil variability has an immense ecological diversity and a huge wealth of biological resources. This complex topography coupled with environmental heterogeneity offers suitable conditions for various vegetation and wildlife types.

Section Learning Outcomes

At the end of this lesson, you will be able to:

- *describe the major types of natural vegetation in Ethiopia; and*
- *explain variations in the distribution of wildlife in Ethiopia.*

Required study time:3 Hours

Dear learner! *Can you describe the notion "biotic resources" in your own words in the space provided? and compare it against what you will read in the following paragraph.* _____

_____

_____

Did you try? If so that is great. Now compare your answer with the following points. Biotic resources are living organisms in an ecosystem. They are typically sorted into three main categories: 1) Producers (including all green plants); 2) Consumers (including all animals and 3) Decomposers (including bacteria and fungi).

3.6.1. Major Types of Natural Vegetation of Ethiopia

Dear learner! *Can you define the term natural vegetation? Try to describe it below.* _____

_____

_____

Have you tried it? As you may have defined, natural vegetation refers to any original plant grown in and covering an area. The distribution of natural vegetation is influenced by many factors. The most important ones are altitude, climate, soil type, and drainage.

In Ethiopia, the types of the natural vegetation in an area are highly correlated with altitude and rainfall; they are also correlated with temperature. The lowlands have harsh environments due to low rainfall and are characterized by xerophytic plants, while the highlands are characterized by different types of tree stands and forests.

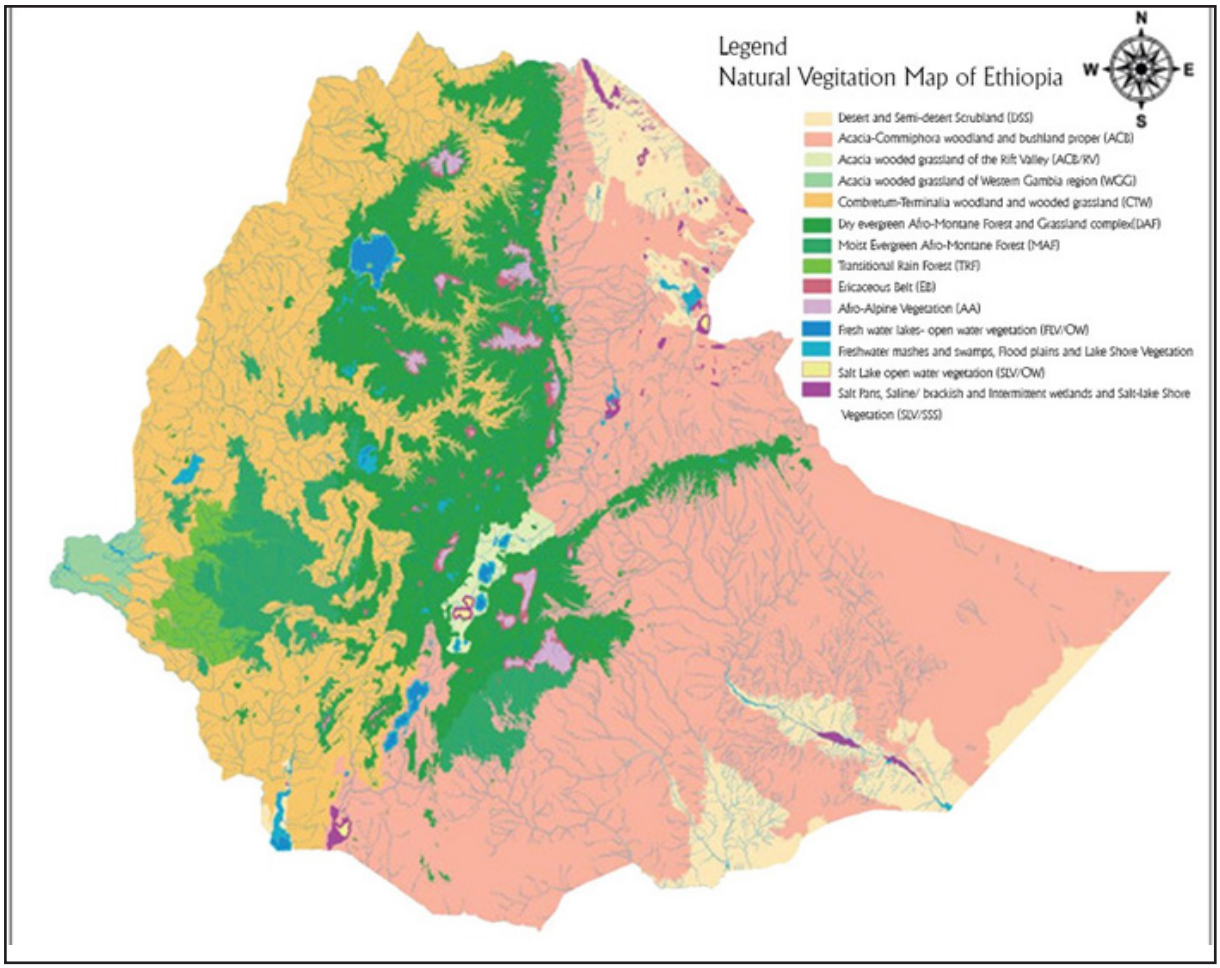

Figure 3.3: Distribution of the Major Natural Vegetation of Ethiopia

The natural vegetation of Ethiopia is classified into four major types based largely on altitude and climate.

a) Afroalpine and sub-Afroalpine
b) Forests
c) Woodland savanna
d) Semi-desert and Desert Vegetation

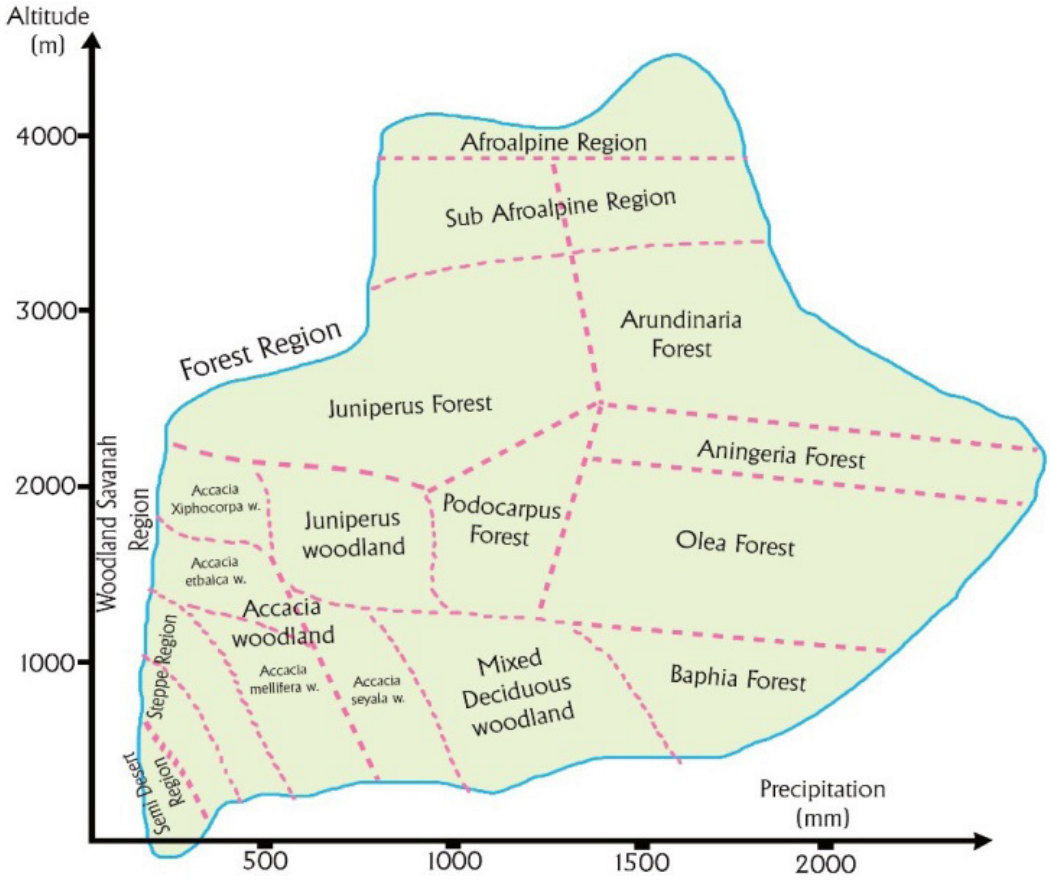

Figure 3.4: Vegetation Regions Correlated to Altitude and Mean Annual Rainfall

A. Afroalpine and Sub-Afroalpine

This type of vegetation is often known as high mountain vegetation. It is very much similar to the European Alpine vegetation. The Afroalpine type of vegetation is found at very high altitudes (above 3300 meters). Sub-afroalpine vegetation is found between 3000 – 3300 m, while Afroalpine vegetation is found at higher altitudes than these. In Ethiopia, Afroalpine and sub-Afroalpine vegetation are found in the Highlands of Semein and the Highlands of Bale.

(a) (b)

Figure 3.5: View of Afroalphine Vegetation (a) Bale Mountains and (b) Semein Mountains

Afro-Alpine vegetation consists of tussock grasslands, serules, scattered mosses and lichens. Sub-Afro Alpines vegetation is dominated by woodland scrubs. Gibra (Lobelia rhynchopetalum) and Asta (Erica arborea) are dominant plant species in this region of natural vegetation.

B. Forests

In Ethiopia, forests are found in areas where the altitude ranges from 450 – 3300 m and where the total annual rainfall is between 200 – 2200 mm (see Fig. 3.3). This wide variation in altitude and rainfall results in the formation of highland and lowland forests. These two types of forests have very different characteristics since they are the results of altitudinal zonation.

i. Highland Forests (forests that grow between 1500 - 3300 m a.m.s.l. altitude)

They consist of:

- Kerkha (Arundinarial) at an altitude of 2800 – 3000 m a.m.s.l.
- Tid (Juniperous Procera) or Coniferous trees at an altitude of 2200 – 2800 m a.m.s.l.
- Zigba (Podocarpus) at an altitude of 1800 – 2200 m a.m.s.l.
- Woira (Oliia Africana) and Kosso (Hagenia Abbyssinia at an altitude of (1500 – 1800) m a.m.s.l.

ii. Lowland Forests (forests that grow below 1500 m a.m.s.l. altitude)

These forests are known as gallery/riverine forests. In Ethiopia, they grow along the banks of the Awash, Wabe Shebelle, and Genale Rivers, etc. where moisture is available in the soil. The predominant trees are Sholla and Warka. In areas where mean annual rainfall exceeds 500 mm, Baphia forest predominates.

Figure 3.6: View of Forest of Southwest Ethiopia (Arbaminch)

C. Savanna Woodland

Like forests, Savanna woodlands are found in both highland and lowland areas (250-2300m) with significant annual rainfall variation of (200-1400mm). The woodland savannas are grass mixed with scattered trees, shrubs and bush lands. In different areas, they are consisting of:

- Juniperus woodlands-mountain grasslands with *Tid* trees
- Accacia woodlands-grasslands with *Ghirar* trees
- Mixed deciduous woodlands-grasslands with trees like *Sholla* and *Warka*

Savanna grasslands experience marked seasons and are characterized by scattered acacia trees. They are mainly dominant at lower elevations and drier climates than the forests.

In areas where mean annual rainfall is more than 1000 mm, these grasslands can form attractive park-like areas with acacia, wild fig, sycamore, and *kosso* trees. Ethiopia's savanna grasslands are found in the southern half of *Ziway, Langano, Abiyatta, and Hawassa.*

Figure 3.7: View of Woodland Savanna in Awash National Park

D. Semi-desert and Desert Vegetation

In these regions, xerophytic (i.e. drought-resisting plants) are the dominant vegetation. These are short acacia, thorn bushes, succulent plants and a few rough grasses. In Ethiopia, vegetation of this kind is found in the Eastern (Afar lowlands), Northwestern and Southeastern Lowlands (Ogaden lowlands), i.e., in areas where annual rainfall is below 600 mm and drought persists for a long period of time.

Figure 3.8: View of Desert Vegetation in Northwest of Asaita

3.6.2. Main Kinds of Wildlife in Ethiopia

Dear learner! *What kind of wildlife is found in Ethiopia? Let you try to list them in the space provided and compare them against what you will read in the subsequent paragraph.* _____

_____

_____

Have you tried it? Well. Owing to Ethiopia's great environmental diversity in relief, climate and natural vegetation, the country is believed to be very rich in all kinds of wildlife.

Ethiopia has about 277 species of mammals and 862 species of birds, 201 reptile species and 63 amphibian species. Of these, 7 species of mammals and 25 species of birds are endemic to Ethiopia. These wild animals are found in many parts of the country, but they are largely concentrated in the southern and western parts.

The wild animals of Ethiopia can be grouped into the following six broad categories:

1. **Common wild animals:** These animals are commonly found in many places of Ethiopia. For example hyenas, jackals, etc.
2. **Game animals:** Most of them inhabit the grasslands found in the lowlands. Ethiopia's game animals include herbivores and carnivores. Some examples of Ethiopia's game animals are:
   - Herbivores include browsers such as giraffes and grazers like wild asses, zebras, etc.
   - Carnivores include lions, leopards, cheetahs, etc.
3. **Arboreals (Tree animals):** These animals are animals that climb up trees. Ethiopia's arboreal animals, such as the colobus monkey, apes, baboons, etc. are mostly found in the rainforest regions of Ethiopia.
4. **Aquatic animals:** These creatures are animals that live in lakes and rivers, for example, hippopotamus, fish and crocodiles.
5. **Birds:** Ethiopia has different kinds of both endemic and migratory birds; for example, fish eagles, pelicans, geese, Abyssinian Ground Horn bill and flamingoes. Most of them are found in the rift valley sanctuaries and forest lands.
6. **Endemic animals:** These are wild animals found only in Ethiopia. These days Ethiopia's endemic animals exist in only very small numbers. They inhabit highlands and other areas. They are also at great risk of extinction. The following are some of them.
   - Walia Ibex (wild goat) is found in the Semein highlands.
   - Mountain Nyala (Dega Agazon) is found in the Bale Mountains.
   - Gelada' or 'Chilada' baboon is found in the Semein highlands.
   - Menilik's Bushbuk ('Dikula') is found in the Shewan and Bale highlands.
   - Swayne's Hartebeest ('Korkay') is found in the Nechsar park and the Sankalle sanctuary.
   - Semein Fox ('Key Kebero') is found in the Bale and Semein Highlands.
   - Wild Ass ('Yedur Ahiya') is found in the Afar and Southeast Lowlands.

These rare animals, especially the Walia Ibex and Semien Fox, are approaching extinction.

Resources

Afework Bekele, (2013). The Mammals of Ethiopia and Eritrea. Addis Ababa University Press.
Ib, F., Sebsebe Demissew, & Paulo, B. (2011). Atlas of the Potential Vegetation of Ethiopia. Addis Ababa University Press.
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Geography student textbook for grades 9 – 12

Activity Six

1. Make a field visit to a nearby natural vegetation site and perform the following activities:

   A. Draw a sketch map of the target area,
   B. Write a short report describing the area's predominant vegetation, and
   C. List the area's natural vegetation ((Refer to your geography module for distance learning).

2. Identify or state some of the common and endemic wild animals found in Ethiopia. Which type is prevalent in your *wereda* or *zone*?_____

   _____

   _____

Checklist

Dear learner! Now it is time to check your understanding of the biotic resources of Ethiopia. Read each of the following questions and answer them by putting a tick (√) mark in one of the boxes under alternatives 'Yes' or 'No'.

S.N	ITEMS	YES	NO
1	Can you describe the major types of natural vegetation in Ethiopia?		
2	Can you explain the distribution of natural vegetation in Ethiopia?		
3	Can you explain variations in the distribution of wildlife in Ethiopia?		

Is there any box that you marked 'No' underneath? If there is any, please return to your text and read about it before beginning the exercise.

SELF-TEST EXERCISES FOR SECTION SIX

Part I. The following items focus on the major natural vegetation of Ethiopia. Match items under column 'A' with their natural vegetation types under column 'B'.

A	B
1. Are grassy woodland	A. Desert vegetation
2. Found at very high altitudes (above 3300 meters)	B. Savanna grasslands
3. Consists of xerophytic plants	C. Arundinarial forests
4. The forests that grows between 2800 – 3000 meters	D. Riverine forests
5. Type of forests that grow along the river banks	E. Afroalpine vegetation

Part II. For each of the following questions choose the correct answer from the given alternatives.

6. Which type of wildlife is categorized as common wild animals?

A. Wild asses
B. Hyenas
C. Lions
D. Elephants

7. As *Walia Ibex* is to the Semein mountains, mountain *Nyala* is to

A. Awash park
B. Nechsar park
C. *Afar* and Southeast Lowlands
D. D. *Bale* Mountains

8. Which of the following provides the best example of a decomposer?

A. Fungi
B. Dead animals
C. Dead plants
D. Grass plants

9. Which type of plants is more adapted to drought and high temperature?

A. Juniperous Procera
B. Acacia
C. Xerophytic
D. Deciduous

10. Which one of the following is an endemic animal in the *Shewan* and *Bale* highlands?

A. Nyala
B. Wild ass
C. Chilada' baboon
D. Menilik's Bushbuk

UNIT SUMMARY

- Ethiopia has a wide variety of natural vegetation, water, wildlife and soil resources due to its diverse physical environment. . The altitude plays a significant role in determining the climate, natural vegetation, drainage systems and soil resources distribution.
- The drainage system of Ethiopia is the altitudinal effects, so rivers flow from the central highlands to the peripheral lowlands. This has made the rivers flow swiftly. Many bigger rivers drain towards neighboring countries. Because of this and the fact that Ethiopia possesses many rivers and lakes, it is known as the "Water Tower of East Africa".
- Ethiopia has different types of soils. They are basically derived from volcanic, metamorphic and sedimentary rocks. The major types of soil in Ethiopia are nithosols, vertisols, acrisols, cambisols, regosols, xerosols, yermisols, luvisols, fluvisols and lithosols. The volcanic soil, especially nithosol, is the most widely utilized soil. The country's cereals, coffee, inset, etc. are grown on this soil type.
- In Ethiopia, the types of natural vegetation in an area are highly correlated with altitude and rainfall. They are classified into five major types namely, Afro-alpine and sub-Afro alpine, forest, woodland savanna and semi-desert and desert vegetation. Ethiopia is a home of different wild animals of which some are endemic. These endemic animals are at risk of extinction.

GLOSSARY

Afro–alpine - a natural vegetation that grows at altitudes above 3300 meters.

Abiotic - all nonliving parts of an ecosystem.

Biotic - all living beings present in an ecosystem.

Agroforestry- the planting of trees that could provide edible fruits along with the purpose of covering the surface.

Deforestation -it is the process of indiscriminate destruction of the natural vegetation cover of an area without adequate replacement.

Endemic- Plant or animal found only in a particular country or region.

Grassland - any land area where the vegetation is dominated by grasses (i.e. plants of the botanical family Poaceae).

Land cover - the physical material present on the surface of the Earth, including categories such as vegetation (grasslands, shrubs, forests, etc.), bare ground, water, asphalt and artificial surfaces, and many others.

Over cultivation - is a continuous ploughing of a given farm land without fallowing or rotating crops.

Overgrazing - keeping too many cattle over a given grazing land.

Weathering - the breaking of rocks into smaller rocks, gradually becoming soil

SELF-ASSESSMENT CORRECTED BY THE STUDENT

Give short answers to each of the following questions.

- Identify the dominant factors that determine the drainage systems in Ethiopia.
- Which types of wildlife are categorized as game animals?
- Which soil classes in Ethiopia are very productive? What are the reasons for this productivity?
- Which type of vegetation is often known as high mountain vegetation?
- Which animal species live in the afro-alpine region of Ethiopia? Are any of these species endangered?

SELF-ASSESSMENT CORRECTED BY TUTOR

- Name five endemic wild animals of Ethiopia.
- Explain the difference between carnivores and herbivores and their dependability.
- What kinds of vegetation exist in the very low altitude areas of Ethiopia?
- List the major rivers of Ethiopia.
- What are the major problems regarding wild animals in Ethiopia?

ANSWER FOR SECTION LEVEL ACTIVITY

Answer for Section Level Activity One

1. A natural resource is defined as a naturally occurring, exploitable material that society perceives to be useful to its economic and material well-being.
2. Based on renewability, natural resources can be categorized as: renewable resources and non-renewable resources.
3. The major causes of natural resources degradation in Ethiopia are the high rate of population growth, severe soil loss, deforestation, low vegetative cover, unbalanced crop and livestock production and climate change.

Answer for Section Level Activity Two

1. Since it is an individual-based activity, the answers are expected to vary from learner to learner. Therefore, let the distance learner try to answer it by him/herself.
2. Since it is an individual-based activity, the answers are expected to vary from learner to learner. Therefore, let the distance learner try to answer it by him/herself.

Answer for Section Level Activity Three

1. Wabeshebelle
2. Wabeshebelle
3. Awash
4. Abbay

Answer for Section Level Activity Four

1. Fluvisols, nithosols, vertisols, cambisols, lithosols, regosols, and xerosols.
2. Black basaltic soils (Vertisols) have excellent nutrients that could provide support for agriculture and cover about ten percent of Ethiopia, while red basaltic soil (Nithosols) often found in regions that were previously covered by forest and cover about twelve percent of Ethiopia.

Answer for Section Level Activity Five

1. Minerals can be classified into metallic and non-metallic materials.
2. As raw material for a variety of manufacturing establishments, as a source of energy that is used to run machinery used for making fertilizers, as materials in building construction and for aesthetic and ornamental purposes.

Answer for Section Level Activity Six

1. Since it is an individual-based activity, the answers are expected to vary from learner to learner. Therefore, let the distance learner try to answer it by him/herself.
2. Since it is an individual-based activity, the answers are expected to vary from learner to learner. Therefore, let the distance learner try to answer it by him/herself.

ANSWER KEY FOR SELF-TEST EXERCISES

Self-test Exercise Answers for Section One

1. C 2. B 3. A 4. D 5. C

Self-test Exercise Answers for Section Two

Part I. Answer Key for Matching Items

1. C 2. E 3. D 4. B 5. A

Part II. Answer Key for Multiple Choice Items

6. C 7. B 8. B 9. A 10. D

Self-test Exercise Answers for Section Three

Part I. Answer Key for True/False Items

1. True 2. False 3. False 4. True 5. False

Part II. Answer Key for Multiple Choice Items

6. D 7. B 8. A 9. C 10. B

Self-test Exercise Answers for Section Four

1. B 2. D 3. E 4. A 5.C

Self-test Exercise Answers for Section Five

1. False 2. True 3. True 4. False 5. True

Self-test Exercise Answers for Section Six

Part I. Answer Key for Matching Items

1. C 2. A 3. D 4. E 5. B

Part II. Answer Key for Multiple Choice Items

6. B 7. D 8. A 9. C 10. D

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UNIT FOUR

POPULATION AND DEMOGRAPHIC CHARACTERISTICS OF ETHIOPIA

Introduction

Dear distance learner! In the previous unit three of this subject you have studied natural resource bases of Ethiopia such as drainage systems, soils, natural vegetation, wildlife and mineral resources of Ethiopia. In this unit, we are going to deal with population and demographic characteristics of Ethiopia.

The unit has five sections. The first section will introduce you to the concept of human population and the spatial and temporal variation of population growth and composition in Ethiopia. Section two is concerned with population distribution and urban and rural settlement patterns in Ethiopia. The third section deals with health and disease in the highlands and lowlands of Ethiopia. The fourth section provides the impacts of population growth on sustainable development in Ethiopia. Finally, the fifth section deals with the diversity of Ethiopia's language and religion.

Unit Learning Outcomes

By the end of this unit, you will be able to:

- *define the concept of human population;*
- *recognize the pattern of population growth in Ethiopia;*
- *examine population structure and trends in Ethiopia;*
- *explain the population characteristics of Ethiopia;*
- *demonstrate the population distribution and settlement patterns of Ethiopia;*
- *identify factors influencing the spatial distribution of health and diseases in lowlands and highlands of Ethiopia;*
- *analyze the impact of population pressure on resources in Ethiopia; and*
- *describe the diversity of language and religion in Ethiopia.*

Key Terms

- *Age dependency ratio*
- *Dispersed settlement*
- *Food scarcity*
- *Growth Rate*
- *Human population*
- *Nucleated settlement*
- *Population*
- *Population density*
- *Population Geography*
- *Population pyramid*
- *Settlement*
- *Sex ratio*

Unit Contents

4.1. Concept of Human Population
4.2. The Trends of Population Growth in Ethiopia
4.3. Population Composition
4.4. Population Distribution
4,5. Urban and Rural Settlement
4.6. Health and Disease in Ethiopia
4.7. Impacts of Population Growth on Sustainable Development in Ethiopia
4.8. Language and religion Diversity in Ethiopia

Required study time:12 Hours

Unit Learning Strategies

Suggested learning strategies are:

- *written brainstorming questions;*
- *case study;*
- *field visit;*
- *Problem-solving method;*
- *individual project;*
- *report writing;*
- *observation;*
- *written activities;*
- *practical activities;*
- *self-test assessments;*
- *online dialog (if possible);*
- *electronic portfolios (if possible).*

Section 1 Concept of Human Population, Trends of Population Growth and Composition in Ethiopia

Section Overview

Dear learner! This is the first section of the unit. In this section, you will learn about the concept of human population, trends in population growth and composition in Ethiopia. The human population is given great emphasis and is studied by various disciplines including population geography. The study of the human population is necessary for development and socio-economic activities.

Section learning outcomes

By the end of this section, you will be able to:

- *define the term human population;*
- *explain why geography studies population;*
- *discuss the rate of population growth past and present;*
- *assess factors that stimulate population growth in time and space; and*
- *describe the composition of Ethiopia's population.*

Required study time:3 Hours

4.1.1. Definition of Human Population

Dear learner! *What does the term human population mean? Please, try on the following space.* _____

_____

Have you stated? If so, that is great. In population studies the term population refers to the total number of human inhabitants of a specified area, such as a city, country, or continent, at a given time. The human population has been a matter of study for various academic disciplines such as geography, biology, sociology, medical science, history, etc. In geography as well, there is a separate branch that studies human population: Population Geography. It is concerned mainly with the spatial analysis of the human population. It focuses on population-space relationships. It also emphasizes the spatial aspects of human population and the interaction and interdependence between the human population and the physical environment.

The term population in population studies refers to the total number of human inhabitants of a specified area, such as a city, country, or continent, at a given time.

The human population is studied for many reasons including the following.

- It is very dynamic as it demonstrates significant quantitative and qualitative changes over time and space. Such changes have a tremendous impact on the socio-economic development of societies.
- Change in the size, composition, structure and location of human population can have policy implications.
- Knowing about the characteristics of the human population is important in order to adjust situations to existing realities

Population studies yield knowledge that is important for planning, particularly by governments, in fields such as health, education, housing, social security, employment, and environmental preservation.

The study of human population is also necessary for development and socio-economic activities. For example, population is the major source of the labour force for the productive and non-productive economic sectors, such as agriculture, manufacturing, teaching, health services, etc. Moreover, human population is the main productive force and creator of material wealth. This makes the study of population extremely important for the overall socio-economic development of a country.

4.1.2. Trends of Population Growth in Ethiopia

Dear Learner! *Do you know when the first census was made in Ethiopia?* ___

_____

_____

Have you tried? If not, no problem. Have a look at the following explanation. Ethiopia is the second most populous country in Africa. In 2020, its population was estimated to be 114.9 million (UN, 2021), which ranks 12th in the world, and the current growth rate is about 2.6 percent. According to the 2007 Census, the population of Ethiopia was 73.8 million. The country's population is among the fastest growing population in the world. It was estimated that, in 1900, Ethiopia had only 11.8 million people. This number increased to about 13 million in 1920 and 23.5 million in 1960, as it is shown in (Table 1.1). The table shows that the population of the country in 1960 doubled in 1990. These values show that, during those decades, it took 60 years for the population to double its size. In contrast, since 1960, the time required for the population to double has been on the decline. This is because of a rapid rate of population growth. For instance, the population doubled in size between 1960 and 1990, indicating a doubling time of only 30 years.

Table 4.1: Population Size and Growth of Ethiopia (1900-2020)

Year	Population (Million)	Annual Growth Rate (%)	Population DoublingTime (year)
1900	11.8	0.2	346
1910	12.1	0.5	139
1920	12.9	1.0	69
1930	14.4	1.2	58
1940	16.2	1.5	46
1950	19.2	2.0	38
1960	23.5	2.2	32
1970	29.5	2.3	30
1980	37.7	2.8	25
1984	42.6	3.1	22
1990	51.2	3.0	24
1994	53.5	2.9	24
2000	63.4	2.8	25
2007	73.8	2.6	35
2010*	79.0.	2.6	27
2020*	114.9	2.6	27

Source: CSA, 2009 and *UN, 2021

A historical profile of the growth rates of the Ethiopian population since 1900 shows that the population increased by less than 1 percent until about 1920. After 1920, however, the rate of growth slightly increased; and then, by 1950, it went up to 2 percent. The slow rate of population growth before 1920 reflected the country's high mortality rate. With worldwide efforts to control

malaria and other diseases in the 1950s and later, the growth rate rose from year to year and reached 2.8 percent in 1980. Between 1980 and 1990, the growth rate of Ethiopian population was around 3.0 percent. Between 2010 and 2020, the growth rate of Ethiopia was around 2.6 percent.

Although there has been a slight decline in the population growth rate between the three censuses, Ethiopia has one of the fastest growing populations in the world. Over the two decades between the three censuses, for instance, the population of Ethiopia increased from 42.6 million in 1984 to 53.5 million in1994 and to 73.8 in 2007. In 2020 the Ethiopian population was estimated to be 114.9 million (UN, 2021).

4.1.3. Population Composition in Ethiopia

Dear learner! *What is population composition? Please, try on the following space.* _____

_____

_____

Have you tried? If so, that is great. The population of a country can be divided in accordance with age, sex, occupation, language, religion and other attributes.

Population composition refers to those aspects of population that can be measured in terms of age, sex, marital status, family size, economic activities, nationality, language, and religion.

4.1.4. Age Structure

Dear learner! *What do you know about age and sex structure? What is the importance of studying the age structure of a population? Please try on the following space.* _____

_____

_____

_____.

Age structure is the classification of a given population into different age groups of various features. This structure becomes clear after we group all of the people in that population by age. In other words, age structure is the pattern that results from the distribution of members of a population into different age categories.

The distribution of population by age is among the most fundamental demographic characteristics of human population and that of demographic statistics. It plays an important role in the development of any society. The economic and cultural life of society critically depends upon the age structure of the population. Moreover, the planning process of any country makes use of this data extensively for the development of the economy, culture and regions.

Two important statistical tools for understanding age structure are:

a) age groups, and

b) population pyramids

A. Age Groups: Although we can use different sets of numbers to define age groups, the most widely used age groups are the five-year age groups 0-4, 5-9, 10-14, ..., 60- 64, 65+, and broad age groups 0-14, 15-64, 65+. In the broad age groups, age groups 0-14, 15-64 and 65+ are known, respectively, as young age (the young dependent population), working age (the economically active population), and old age (the elderly dependent population).

B. Population Pyramid

Dear learner! *What is population pyramid?* _____

_____

_____.

A population pyramid is a very useful aid in examining the age and sex structure of a population. It is a graphic representation of the distribution of the population by age and sex. In the age pyramid, the vertical axis is divided into years (usually a five year age group interval) from zero upwards and the horizontal axis shows the percentages of males and females within these groups. Percentages are calculated for both sexes separately or for the total population.

In countries where birth rates are high and death rates are also high, the population pyramid has the form of a triangle. This pattern is typical of the population of developing countries like Ethiopia, where many children are born, but few reach old age. In contrast, in the developed countries, with their lower birth rates and fewer people dying young, the population pyramid is more rectangular, narrowing only near its top. In these countries, both birth and death rates decline with a result showing the number of people in each group at an equivalent state.

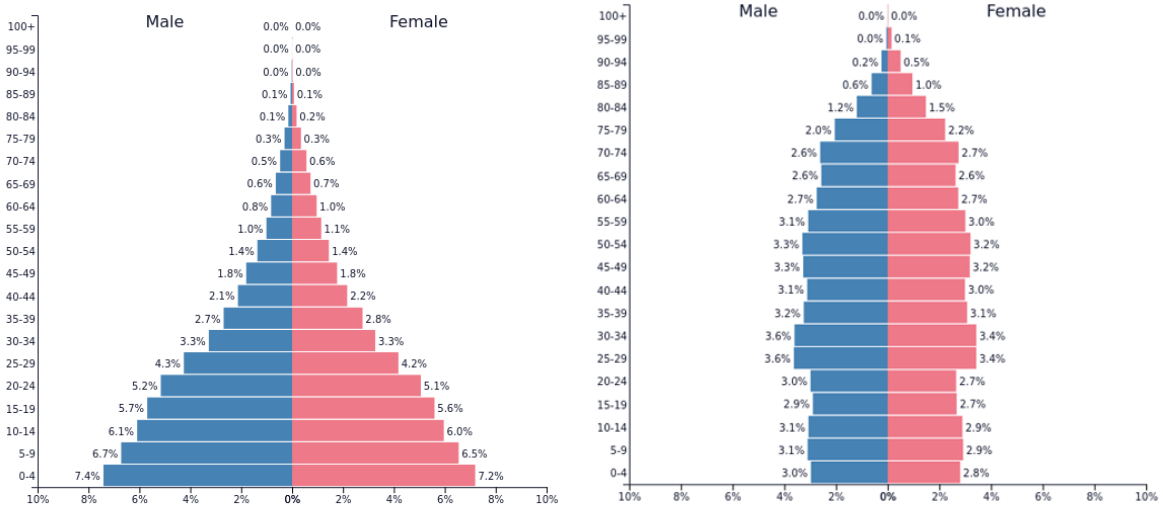

Figure 4.1: Population Pyramid of Ethiopia (a) and Sweden (b), 2020 (Source; www.populationpyramid.net)

In general, population pyramids of developing countries like Ethiopia have very broad bases, showing the dominance of the young-age population. These pyramids become increasingly narrower towards the top, advancing through the age groups, showing that the percentage of the population becomes less and less in the upper age groups (65-69, 70-74, etc.). The high percentage for the young age group is the result of a high birth rate and natural increase, while the small percentage for the old age group is the reflection of high mortality rate, which results in a low life expectancy.

Age structure is one of the most important demographic characteristics of a population.

- Age information is often used to understand the sizes of school-age, labour-force, elderly, and other populations.
- A population pyramid is usually employed to show the age distribution of a given population by age and sex.
- The population pyramid of Ethiopia has a broad base that narrows towards the top as age increases. This shape is typical of a population with a high fertility rate

Age Dependency Ratio (ADR)

Dear learner! *What do you understand by age dependency? Do you think Ethiopia has a problem with it?*_____

_____

_____

Age Dependency Ratio is the relationship between the working or economically active population and the non-working population. It is generally accepted that people in theiris young and old ages are dependent on the working-age population. The Age Dependency Ratio (ADR) is used to show the magnitude of this dependency in a given population. This means that the dependency burden, represented by the nonworking population in the young and old age groups, on the working-age population can be shown by the age dependency ratio. The formula for calculating the age dependency ratio (ADR) is:

$$\text{ADR} = \frac{(\%\text{of population aged } 0\text{-}14) + (\%\text{of population aged } 65+)}{\%\text{ of population aged } 15\text{-}64} \times 100$$

Suppose country ''Z'' has a total population of 65 million of which 40% of the total population 26 million) children aged (0-14) and productive age group (15-64) 50% of the total population (32.5 million) and the old age group (65 and above) 10% (6.5 million).

$$\text{ADR} = \frac{26,000,000 + 6,500,000}{32,500,000} \times 100 = 100/100$$

This shows that there are 100 dependents for every 100 working population. In other words, it means that each person of working age has, on average, to support one of the dependents

Ethiopia's age dependency ratio in 2020 was 76.8/100, this shows that there are 76.8 dependents on 100 working population. A high dependency ratio in Ethiopia indicates that the economically active population and the overall economy face a greater burden to support and provide the social services needed by children and elderly persons who are often economically dependent.

4.1.5. Sex Structure

Sex structure is one of the basic demographic characteristics of a population. Sex structure is very important for demographic analysis because it provides useful information about reproductive potential, human resources, and so on. Sex structure refers to the ratio of the male population to the female population in different age groups. It is usually expressed as the number of males per 100 females in a population. A ratio greater than 100 shows a greater number – called an excess – of males than females. Sex ratios can affect marriage prospects, labour force participation, and other social and economic variables. The formula for calculating a sex ratio is:

$$\text{Sex Ratio} = \frac{\text{Number of Males}}{\text{Number of Females}} \times 100$$

According to the 1984 census result, the sex ratio for the population of Ethiopia was 99.4. This means that there were about 99 males for every 100 females. The 1994 census result showed that it was 101.3 and in 2007 sex ratio was 101.9. In 2020, male to female ratio in Ethiopia was estimated to be 100.12 males per 100 females.

Resources

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Activity 1

1. Why is studying human population important?
2. For what purposes, do you think, governments use population information/data?
3. What is the advantage of studying population?

Checklist

Dear learners, here is a checklist provided for you to check your understanding. Put a tick mark (√) against each of the following statements. You are expected to respond under 'YES' or 'NO'

No.	Items	Yes	No
1.	Can you define the term human population?		
2.	Can you define the term population geography?		
3.	Can you explain the trends of population growth in Ethiopia?		
4.	Can you explain the scale of population growth in Ethiopia?		
5.	Can you explain how the population structure of Ethiopia changed over-time?		
6.	Can you describe the composition of the Ethiopian population?		
7.	Can you define population pyramid?		
8.	Can you calculate age dependency ratio?		
9.	Can you identify factors that stimulate population growth?		

Is there any box that you mark 'No' under it? If there is please go back to your text and read about it before you go to the following exercise.

SELF-TEST EXCERCISES FOR SECTION 1

Part I. Write True if the statement is correct and False if the statement is Incorrect.

1. Population Geography focuses on population-space relationships.
2. The slow rate of population growth in Ethiopia before 1920 reflected the country's high mortality rate.
3. Rapid population growth in Ethiopia today is a direct reflection of high fertility.
4. Human population changes have a tremendous impact on the socio-economic development of societies.
5. Ethiopia is the second most populous country in the world.
6. The main reason for the broad base of Ethiopia's population pyramid is high rate of mortality in the country.
7. The high age dependency ratio in Ethiopia is the result of large numbers of people in the old-age group.
8. The economic and cultural life of society critically depends upon the age structure of the population.
9. The small percentage of the old age group is the reflection of high mortality rate, which results in low life expectancy.
10. Ethiopia has one of the slowest –growing populations in the world.

Part II. Fill in the blank spaces with the correct word or phrase

1. _____ in population studies refers to the total number of human inhabitants of a specified area,
2. The last census was counted in Ethiopia_____
3. The study of human population is necessary for _____and _____ activities
4. _____ is a branch of human geography that deals with the number, composition and distribution of human population in relation to the environment.
5. Population is the major source of the labour force for the _____and _____ economic sectors.
6. _____is the classification of a given population into different age groups of various features.
7. Two important statistical tools for understanding age structure are_____ and _____
8. ---------- a graphic representation of the distribution of the population by age and sex.
9. In countries where birth rates are high and death rates are also high, the population pyramid has the form of a _____
10. The small percentage of the old age group is the reflection of high mortality rate, which results in low _____.

Section 2 Population Distribution, Urban and Rural Settlement in Ethiopia

Section Overview

Dear learner! In the previous section we hope that you have already studied the definition of population, the importance of studying human population and trends of population growth and composition in Ethiopia. Now, in this section, you will study about population distribution and urban and rural settlement in Ethiopia.

The most crucial fact of population geography is that people are not evenly distributed across the face of the earth. This means that some areas experience high population concentration, others moderate, low and some areas for different reasons may be unoccupied by human beings. In Ethiopia, the population is unevenly distributed for various physical and human-related reasons. Ethiopian settlements are broadly categorized as rural and urban. The primary bases for this dichotomy are the dominant economic activities and the degree of population density.

Section Learning Outcomes

By the end of this section, you will be able to:

- *discuss the spatial distribution of population in Ethiopia;*
- *identify factors affecting population distribution in Ethiopia;*
- *identify densely and sparsely populated areas of Ethiopia;*
- *describe settlement patterns of Ethiopian population; and*
- *differentiate urban and rural settlement patterns of Ethiopia.*

Required study time:4 Hours

Dear learner! *Do you know what population distribution means? How is it characterized in the context of Ethiopia? Please try to answer it below.* _____

_____

_____

Have you tried it? If so that is great. Population distribution refers to the way how population spreads out over a given area, i.e., of any size from a small area to the earth as a whole. The distribution of population is indicated by population density. Population density is the average number of people per square kilometre in a given area.

In Ethiopia, the population is unevenly distributed for various physical and human-related reasons. In the nation, people live mostly in areas with agreeable life conditions such as moderate climate, adequate supply of water, good vegetation cover, fertile soil, and absence of disease causing insects. For such preferences, most people are found concentrated in the highlands and plateaus of the country. These places have the country's most favourable natural conditions for settlement and crop cultivation. Therefore, those areas have attracted denser population than the lowlands. The highlands, where there are no vector-borne diseases, have generally been the areas of high population concentration. On the other hand, the lowlands are of low population concentration. Thus, 77.5 percent of the population of Ethiopia lives in the highlands at altitudes above 1800 meters, and only 22.5 percent lives at altitudes below 1800 meters.

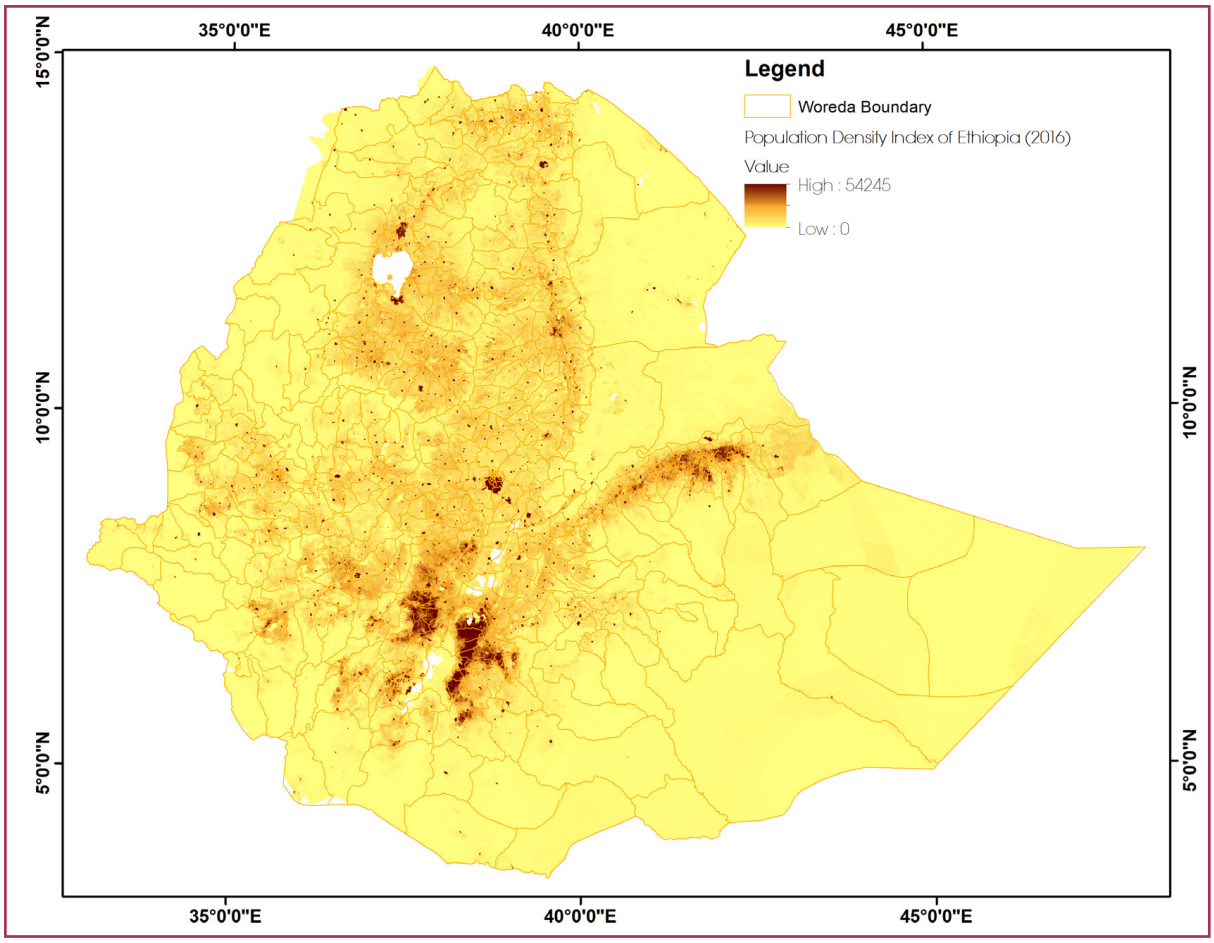

Figure 4.2: Population Distribution Map of Ethiopia

4.2.1. Measures of Population Distribution

Population distribution is a measurable concept. It is measured by using population density. Population density refers to the number of people per unit area. There are various density measures. Among them, crude density is the most widely used method to measure population distribution. It is found by dividing the total population by the total area. It is man land ratio. In 1990 crude density for Ethiopia was 40.74 people/km^2 and this has increased to 52 people /km^2 in 1998; and in 2020; 103.9 people/ /km^2.

$$CD = \frac{TP}{TA}$$

Where CD is crude density, TP is total population and TA is total area

The distribution of Ethiopia's population generally is related to altitude, climate, and soil type. Figure 2.1 indicates uneven population distribution in Ethiopia. The highest population concentration is found in the highlands, which are endowed with moderate temperature, rich soil, and adequate rainfall. The lowlands are very sparsely populated mainly this happens because of high temperatures and low rainfall,

There is a considerable variation in population density among the administrative regions of the country. Excluding the urban based administrative regions (Harari, Dire Dawa and Addis Ababa) Southern Nations, Nationalities and Peoples (SNNP) region are the administrative area with the largest population density (173 people/ km^2) followed by Amhara region (131.9 people/km^2), Gambella (13 people/km^2), Somali, Afar; and Benishangul-Gumuz are regions with low densities of population. Crude population density conceals /many of the variations within regions.

Table 4.2: Population Density of Ethiopia by Administrative Regions

Region	Population	Area(km2)	Density(p/km^2)
Tigray	5,247,005	84,722	61.9
Afar	1,723,000	72,053	23.9
Amhara	20,401,000	154,709	131.9
Oromia	33,692,000	284,538	118.4
Somali	5,453,000	279,252	19.5
Benishangul Gumz	1,005,000	50,699	19.8
SNNPR	18,276,000	105,476	173.3
Gambella	409,000	29,783	13.7
Harari	232,000	334	716
Addis Ababa	3,273,000	527	6,210
Dire Dawa City Administration	440,000	1,559	282
Total	90,078,000	1,106,000	84.7

Source: CSA, Statistical Abstract, 2015.

Note:

- Recently two administrative regions were established from Southern Nation Nationalities and Peoples region namely; Sidama Regional State and Southwest Ethiopia People Regional State.

When population densities are considered in terms of zones, the variation of population density in Ethiopia is generally greater than the differences among the regions. Some of the zones with very high densities are Gedeo, Kambata, Guraghe, Wolayta and Hadiya; where densities exceed 300 persons per km^2. On the other hand, peripheral zones such as Kamashi, and Metekel have population densities of less than 20 persons/km2. Likewise, if population densities of lower administrative units are considered, the variations could still be greater.For instance, Wanago, Damot Gale, Aleta Wendo, Yirga Chefe, Dara, Kacha Bira, Angacha, Sodo Zuria, Shebedino and Kedida Gamela have crude densities exceeding 500 people/km^2; while woredas with extremely low densities (less than 10 people/km2) include Guba Woreda (Benishangul Gumuz Region), Dolo Woreda (Somali Region), Gog Woreda (Gambela Region). Therefore, it could be generalized that "the lower the administrative unit the greater the variations in population density"

4.2.2. Factors Affecting Population Distribution in Ethiopia

Dear learner! *You can easily see from the preceding lesson that the distribution of population in Ethiopia is extremely uneven. What factors do you think are responsible for such spatial variation in the distribution of people over land?* _____

_____

Have you tried? If so that is good. The distribution of population in Ethiopia is extremely uneven. This extreme unevenness is the result of a number of factors operating in combination. These factors can be grouped into two: physical and human.

A. Physical Factors

The most significant physical factors affecting the distribution of population in Ethiopia are the following.

- Climate (mainly rainfall and temperature)
- Soil fertility
- Natural water supply
- Relief (slope and altitude)
- Vegetation cover

In Ethiopia, most of the physical factors are influenced by altitude. Therefore, altitude is the most crucial physical factor influencing patterns of population distribution and settlement in the country. Studies in climatology make it clear that rainfall increases while temperature decreases with an increase in altitude. Incidentally, this means that rainfall is very low and temperature is high in lowland areas, while rainfall is high and temperature is moderately low in the highlands. Since soil formation and vegetation growth are closely associated with adequate rainfall and moderate temperature, highlands tend to have better soils and vegetation cover.

Lowlands in Ethiopia are characterized by a scarcity of rainfall, high temperatures, and poor vegetation and soil conditions. In addition to these negative factors, the prevalence of tropical diseases such as malaria and yellow fever contributes to the sparse population distribution in such areas.

For reasons of tropical diseases, most of the valleys of the major rivers of Ethiopia are also characterized by sparse population concentration. The main exception to this is the Awash River Valley, where irrigation agriculture is practiced. This overall pattern differs from what can be seen in other parts of the world, where valleys of major rivers are zones of large concentrations of people. However, with improvements in agricultural and medical technology, Ethiopia's lower major river valleys might, in the future, attract more people from the densely populated highland areas.

Table 4.3: The Relationship between Altitude and Population in Ethiopia

Altitude (Meters)	Area (%)	Population (%)
Above 2600	5.8	10.4
1800-2600	31.8	67.1
1400-1800	28.1	11.5
1000-1400	13.4	8.2
Below 1000	21.5	2.8
Total	100	100

Source: Aynalem Adugna, 1987.

Dear learner! From Table 2.2 above we can understand that 77.5 percent of the population of Ethiopia lives in areas with altitudes above 1800 meters, and these areas constitute only 37.6 percent of the total area of the country. The area above 1,400, which makes up 65.7 percent of the total area of Ethiopia, supports 89.0 percent of the population of the country. However, caution could be made, as there are many severely dissected areas within the highlands with few or no people.

Lowlands are characterized by a scarcity of rainfall, high temperature, and poor vegetation and soil conditions. In addition, the lowlands tend to be infested with tropical diseases like malaria and yellow fever which contribute to the sparse population distribution.

B. Human Factors

Dear learner! *Can you mention the major human factors that have influenced population distribution in Ethiopia?* _____

_____

_____

Have you tried? If so that is great. Now compare with the following points. The major human factors which have influenced population distribution in Ethiopia are the following.

- Types of economic activity
- Historical patterns of population movement

Types of Economic Activities

The types of economic activity performed in an area strongly influence the carrying capacity of that land. Consequently, the carrying capacity influences the number of people that can inhabit a given area. Being a country of diverse environmental and cultural conditions, Ethiopia offers ample evidence of these relationships.

The arid and semi-arid lowland areas of Ethiopia are areas that are more suitable for pastoralist activities than for crop farming. By its nature, pastoralism is an economic activity that requires large areas of grazing lands. In most pastoralist areas of Ethiopia, the land requirement for

grazing is as large as 20 hectares or more per head of cattle. The arid and semi-arid lowlands of Ethiopia that are inhabited by pastoralists and semi-pastoralists are sparsely settled. Hence, with pastoral herding, population densities are extremely low.

As it has been said earlier, compared to pastoralist areas, crop-farming areas have greater carrying capacity and higher densities of population. This is typically the case in the highland areas of Ethiopia where natural conditions are suitable for crop cultivation. In the crop-farming highland areas, the man-land ratio is significantly higher than the one in the pastoralist lowlands.

However, the crop-farming areas of Ethiopia do not have uniform carrying capacities or population densities. Population density is significantly influenced by the types of crops cultivated. For instance, in the northern and north central highland areas of Ethiopia, the most cultivated crops are cereals. Cereals have relatively low yields per unit area. Therefore, these areas tend to have relatively lower carrying capacities and population density. In contrast, the southern, *enset,* and coffee-growing regions of the country have greater yields per unit area. This is an important reason for the very high population densities in some zones and weredas of the southern region that you read about earlier.

The development of commercial farms in some parts of Ethiopia, such as Awash valley, is another significant factor in population movements and their effects on population distribution. Some decades ago, there were very few people in the Awash valley. However, because of the development of many small and a few large commercial farms, several thousands of settled and migratory people are found there.

In Ethiopia, urban and industrial growth/expansion are other human factors that bring about population redistribution over time, and they are responsible for considerable spatial variation of population density at present.

Historical Patterns of Population Movement

The historical pattern of population movement in Ethiopia is also another human factor affecting population distribution in Ethiopia.

4.2.3. Urban and Rural Settlement

Dear learner! *Can you define the term "settlement£? What is the difference between a rural settlement and an urban settlement? Let you try on the following space and compare it with the subsequent descriptions.* _____

_____

_____

_____

The term settlement refers to the characteristic groupings of population into occupancy units, together with the facilities in the form of houses and streets, which serve the inhabitants. It is

also defined as a place in which people live, carrying out a variety of activities, to make their livings such as trade, agriculture, and manufacturing.

The origin of settlements can be traced back to the caves where people gathered for protection against the natural forces or human beings, together with their residences, and buildings in defence against rival tribes. There are varieties of settlements, and they are changing rapidly over time. These include hamlets, villages, towns, cities, metropolises, megalopolises, etc. In all cases, however, 'settlement' designates an organized colony (stores, factories, warehouses, etc.) paths, and streets.

Different settlement types develop mainly in response to some physical and human factors. Studies of settlements are concerned with the facilities humans construct in the process of living in an area and using its resources. Naturally, settlements are situated as strategically as possible with respect to natural features, such as water, fuel, food, and protection, as well to access to transportation and communications.

Ethiopian settlements are broadly categorized as rural and urban. The primary bases for this dichotomy are the dominant economic activities and the degree of population density. Urban settlements are usually branded by non-agricultural economic activities, while rural settlements are typically agricultural. Leaving social, cultural and physiological differences aside, rural and urban settlements in Ethiopia can very well be distinguished by population densities, which are generally very high in urban settlements compared to the relatively lower densities of population in rural settlement areas.

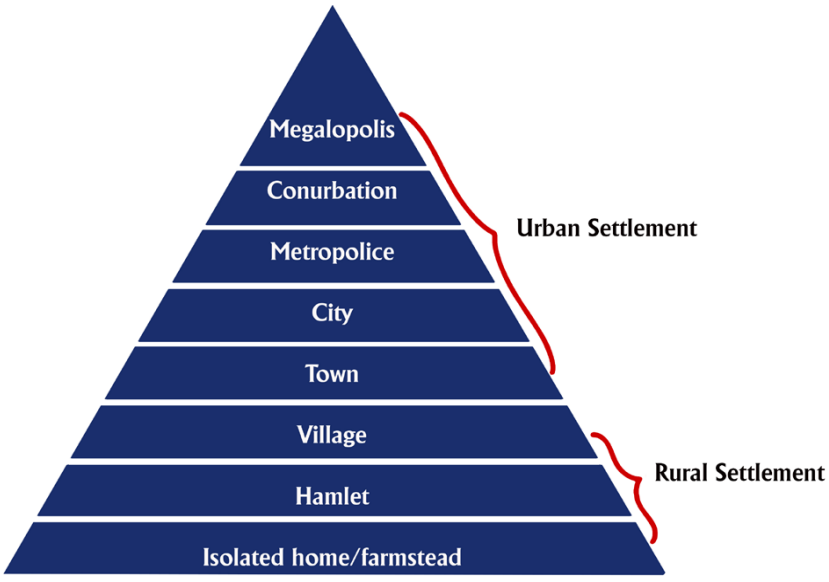

Figure 4.3: Hierarchies of Settlement

Rural Settlements

Dear learner! *What do you think are the differences between rural and urban settlements? What kinds of settlements exist in the rural areas of Ethiopia?* _____

_____

Rural settlement is the name given to all villages and dispersed (scattered) settlements in areas far from urban centres. Such settlements are widely dispersed and dominated by isolated homesteads. The inhabitants of rural settlements are mainly engaged in agriculture. Settlements in the rural areas of Ethiopia can be broadly grouped into two types: permanent and temporary settlements.

A. Permanent Settlements

Dear learner! *What kinds of settlements are considered permanent? In which areas of Ethiopia are these types of settlements mostly found? Highlands or lowlands?* _____

_____

Settlements are considered permanent if their locations do not frequently change, i.e., if they remain in place for more than ten years. In this sense, most rural settlements in the highland areas of Ethiopia are permanent. The permanent rural settlements of Ethiopia are mostly associated with the crop-farming highland areas of the country.

The permanent rural settlements of Ethiopia can also be broadly divided into two types: the scattered (diffused or dispersed) settlements and the grouped (nucleated) settlements. In areas of scattered settlements, homesteads are separated by relatively long distances. On the other hand, the grouped settlements are characterized by a large number of homesteads concentrated in one place

In Ethiopia, the Derg Regime's compulsory villagization program resulted in the formation of grouped settlements (villages) in many parts of the country. In most parts of the northern regions of the country, such settlements have remained in place for years with the idea that they would enhance communal ownership of land and the provision of social services. However, because the program was conducted by forcing people into villages against their will, and the services were non-existent, people began to return to their original sites, in a manner of reversal move. This movement began even before the regime was overthrown. The government of Ethiopia has recently conducted villagization programs that are based on people's will to leave their original settlement sites. Besides, the resettlement program of the FDRE government has also been implemented within similar administrative regions.

B. Temporary Settlements

Dear learner! *What kinds of settlements are temporary? Do you know the areas of Ethiopia in which these types of settlements are mostly found?* ____

_____

_____

_____

Temporary settlements are mobile settlements inhabited by nomadic people of lowland Ethiopia. The rift valley region and lowlands of the west, east and south are characterized by hot and dry conditions. This harsh climatic condition forces people living in these areas to seasonally move from one area to another with their herds.

Urban Settlements

What kinds of settlements are considered urban? Do you know the features that make urban settlements different from rural settlements in Ethiopia? __

_____

_____

Did you answer? Good. Urban settlements, on the other hand, are always larger and more compact, or nodal. In the rural settlements, the concern is chiefly with primary production, and the most commonly agriculture. In urban settlements, on the contrary, the primary goods produced by farmers, miners, or lumbermen are processed in manufacturing plants, transported, bought, sold, and financed. Urban settlements include residences in cities and towns.

In addition, urban centers have always been centers of civilization and they are the intellectual and social capitals, that perform functions of a political, educational, and social character. More vitally, urban centers, in economic spheres, are major transport centers, the main assembly and break of bulk points, the great markets, and the major financial nodes.

The process of the development of urban settlements is known as urbanization. In most parts of Africa, urbanization is a recent phenomenon, and it is attributed to colonialism. Urbanization in Ethiopia is not influenced by European colonialism. It is an unplanned, natural phenomenon of the late 19th and early 20th centuries.

Not all grouped settlements are classified as urban centers. Different countries use different criteria for assigning the status of urban the center of a settlement. The major criteria used in Ethiopia are:

- the settlement has a minimum of 2000 people;
- two-thirds of the population in the settlement are engaged in non-agricultural activities;
- the settlement has a chartered municipality; and
- the presence of social services and amenities.

(A) (B)

Figure 4.4: Rural (A) vs Urban (B) Settlement in Ethiopia

The number of settlements meeting these criteria in 1984 was about 322. These settlements had 10.23 percent of the total population of the country, and this is one of the least urban population sizes in the world. The number of settlements with more than 2,000 people in 1994 had increased to 539. These make up 12.8 percent of the country's population. In 2007, the number further rose to 927.In 2020, the urban population was about 20 percent of the country's population.

The distribution of urban centers in Ethiopia shows considerable spatial variation. This could be explained in terms of the varying concentration of industries, and services such as schools, health institutions, water supplies, electricity, means of transport, etc.

Resources

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Activity 2

Answer the following questions

1. What are the major factors that attract large populations to the highland areas of Ethiopia for settlement?
2. Why are the lowland areas of Ethiopia sparsely populated?

Checklist

Dear learners! A checklist is provided here for you to use to make sure that you understand. Put a tick mark (√) against each of the following statements. You are expected to respond under 'YES' or 'NO'

	Items	YES	NO
1.	Can you define population density?		
2.	Can you discuss the spatial distribution of the population in Ethiopia?		
3.	Can you mention recently established regions in Ethiopia?		
4.	Can you state factors affecting population distribution in Ethiopia?		
5.	Can you define the term settlement?		
6.	Can you define permanent settlement?		
7.	Can you define temporary settlement?		
8.	Can you realize settlement patterns of Ethiopian population?		
9.	Can you differentiate urban and rural settlement patterns of Ethiopia?		
10.	Can you describe the hierarchies of Settlement?		

Is there any box that you mark 'No' under it? If there is, please go back to your text and read about it before you go to the following exercise.

SELF-TEST EXCERCISES FOR SECTION 2

Part I. Determine whether each of the following sentences is 'True' or 'False'

1. Altitude is the most crucial physical factor influencing patterns of population distribution in Ethiopia.
2. In Ethiopia, the population is evenly distributed.
3. Climate has direct and indirect impacts on population distribution.
4. Population density is significantly influenced by the types of crops cultivated.
5. In Ethiopia, fertility is higher in urban centres than in rural areas.
6. Different settlement types develop mainly in response to some physical and human factors.
7. The inhabitants of urban settlements are mainly engaged in agriculture.
8. People living seasonally in the lowlands of Ethiopia move from one area to another with their herds.
9. Urbanization in Ethiopia is influenced by European colonialism.
10. Different countries use different criteria for assigning the status of the urban center of a settlement.

Part II. For the following questions, choose the correct answer from the given alternatives.

1. Which of the following areas is the most sparsely populated in Ethiopia?

A. Kembata
B. Sidama
C. Gedeo
D. Borena
E. Hadiya

2. The arid and semi-arid lowland areas of Ethiopia are areas that are more suitable for-

A. Crop farming
B. Pastoralist activities
C. Trade
D. Manufacturing
E. Agriculture

3. In Ethiopia, the highest population concentration is found in

A. High land
B. Lowland
C. Plain
D. A and C
E. Mountain

4. The most densely populated region in Ethiopia-

A. Afar
B. Gambella
C. Somali
D. SNNPR
E. Tigray

5. Which of the following physical factor affects the distribution of population in Ethiopia?

A. Climate
B. Soil fertility
C. Vegetation cover
D. Relief
E. All of the above

6. Settlements widely dispersed and dominated by isolated homesteads are

A. Rural settlement
B. Urban settlement
C. Dispersed settlement
D. Nucleated
E. Clustered

7. Which of the following is the permanent rural settlement of Ethiopia?

A. Scattered
B. Nucleated
C. Dispersed
D. Grouped
E. All of the above

8. Settlements are mobile inhabited by nomadic people of lowland Ethiopia are

A. Permanent
B. Temporary
C. Nucleated
D. Urban
E. Clustered

9. People living in rural settlements are mainly engaged in

A. Industry
B. Trade
C. Mining
D. Agriculture
E. Tourism

10. Urban settlements are usually branded by

A. Non-agricultural economic activities,
B. Agricultural Economic activity
C. Primary economic activity
D. B and C
E. Mining sector

Pat III. Fill in the blank spaces with the correct word or phrase

1. The major human factors which have influenced population distribution in Ethiopia are _____.
2. In the pastoralist areas of Ethiopia, population densities are _____.
3. _____ is the number of people per unit area.
4. _____is the most widely used method to measure population distribution.
5. The primary bases for the separation of rural and urban settlement in Ethiopia are the dominant _____ and the degree of _____.
6. Settlements are considered _____if their locations do not frequently change.
7. The process of the development of urban settlements is known as urbanization.
8. In Ethiopia crop-farming areas have greater _____ and higher _____.
9. The arid and semi-arid lowland areas of Ethiopia are most suitable for _____

Section 3 Health and Disease in Ethiopia

Section Overview

Dear learner! In the previous section, you studied about population distribution, Urban and Rural Settlement in Ethiopia**.** In this section, you will study the distribution of health and disease in Ethiopia. Ethiopia's investment in health has resulted in improvements in the health condition of its population. Despite great progress, Ethiopia is still facing a high burden of disease.

The Health Extension Program (HEP) has certainly contributed to the increased access and coverage of high-impact public health interventions in the country. Improved public health interventions such as malaria control efforts, access to safe drinking water, improved toilet facilities, and vaccination against childhood diseases are some of the factors behind the improved health outcomes in Ethiopia.

Section Learning Outcomes

By the end of this section, you will be able to:

- *identify factors influencing spatial distribution of health and diseases in lowland and highland of Ethiopia;*
- *explain the contribution of the health extension program; and*
- *explain some of the root causes of the poor health status of the population.*

Required study time:2 Hours

Dear learner! *Can you mention some of the root causes of poor health status of the population in Ethiopia? Please try.* _____

_____

_____

_____.

Did you answer? Good. Ethiopia's investment in health has resulted in improvements in the health condition of its population. For example, life expectancy has increased from 56.8 years in 2005 to 65.5 years in 2016). Three consecutive Ethiopian Demographic and Health Surveys (EDHS) (2005, 2011, and 2016) have indicated declining trends in neonatal, infant, under-five and maternal mortality. Despite great progress, Ethiopia is still facing a high burden of disease.

The Health Extension Program (HEP) has certainly contributed to the increased access and coverage of high-impact public health interventions in the country. Improved public health interventions such as malaria control efforts, access to safe drinking water, improved toilet facilities, and vaccination against childhood diseases are some of the factors behind the improved health outcomes in Ethiopia.

The Government of Ethiopia has been investing heavily in strengthening health system through its pro-poor policies and strategies which brought about significant gains in improving the health status of Ethiopians. Despite recognizable improvements, Ethiopia still has a heavy burden of diseases but a low rate of self-reported illness and low health facility coverage and utilization. The available literature indicates that the majority of ill health in Ethiopia is related to potentially preventable, communicable diseases and nutritional disorders. Some of the root causes of the poor health status of the population are:

1. **Lack of access to clean water**: Rivers and lakes remain the most important sources of water, particularly for people in rural areas although such waters are largely unsafe.
2. **Lack of adequate nutrition**: Studies reveal that malnutrition is rampant and is among the highest in the world. About half of the children under the age of five are malnourished, stunted or wasted. Malnutrition remains high as the country has not

attained food security, or due to poor knowledge about nutritional requirements and dietary habits.

3. **Diseases related to beliefs, behaviours and traditional practices** that have a negative effect on health status include Female Genital Mutilation (FGM), and early marriage.
4. **Lack of health services**: The healthcare infrastructure of the country has suffered from underfunding, and health service coverage is less than 50% of the population. The services tend to be urban-biased.

The combined problem of poor health and inadequate nutrition is likely to have life-long effects on children, making them physically unfit, unproductive, mentally inactive and less dynamic. Since protein and energy malnutrition affects the ,adult working population, the impact on agricultural production and productivity is likely to be high.

The lowlands of Ethiopia tend to be infested with tropical diseases like malaria and yellow fever which contribute to the sparse population distribution. The major killer diseases that account for about 75% of all deaths include prenatal-maternal conditions, acute respiratory infections, malaria, nutritional deficiency for children under 5 years, diarrhea, AIDS, and tuberculosis.

Despite significant improvements, Ethiopia's health situation is still at a staggering situation. The current health workforce consists of 0.04 doctors, 0.43 nurses, and 0.05 midwives per population of 1000, also represented as: one doctor for 26,943 people, one nurse for 2,311 people, and one midwife for 21,810 people. In order to overcome the lack of human resources for health and low utilization of health services, the country adopted a strategy to train the health extension workers (HEP) and midwives as well as scale up family planning.

There are variations among the regions of Ethiopia in population per hospital and hospital bed. Regions like Amhara, Somali and SNNP have population-hospital ratios of over 10,000 in each case. These three regions also have high population - hospital bed ratios. The implication is that there could be many people with no chance of seeing a doctor or having access to a hospital bed even if they wished to. Large numbers of people should also travel several tens of kilometres to arrive at the location of the nearest hospital. Since Ethiopia's high population growth rate will continue for the coming couple of years, and given the low rate at which the services are expanding, it could be assumed that there will be problems in health and other areas of services.

Resources

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CSA. (2017). Ethiopia Demographic and Health Survey 2016. Addis Ababa. Available from: https://dhsprogram.com/pubs/pdf/FR328/FR328. pdf. Central Statistical Agency

Activity 3

Answer the following questions

1. Explain the root causes of the poor health status of Ethiopia population?
2. Explain the contribution of health extension program for the improvement in health condition of Ethiopia's population.

Checklist

Dear learners, here is a checklist is provided for you to check your understanding. Put a tick mark (√) against each of the following statements. You are expected to respond under 'YES' or 'NO'

	Items	YES	NO
1.	Can you explain the contribution of the health extension program?		
2.	Can you explain some of the root causes of the poor health status of the population?		
3.	Can you explain the distribution of disease between highlands and low-lands of Ethiopia?		
4.	Can you identify the major killer diseases in Ethiopia?		
5.	Can you explain factors influencing the distribution of health and disease in Ethiopia?		

Is there any box that you mark 'No' under it? If there is, please go back to your text and read about it before you go to the following exercise.

SELF-TEST EXCERCISES FOR S,ECTION 3

Part I. Determine whether each of the following sentences is 'True' or 'False'

1. There are variations among the regions of Ethiopia in population per hospital and hos-pital bed.
2. In Ethiopia, the health extension program has contributed to the increased access and coverage of public health interventions.
3. Rivers and lakes remain the most important sources of water, particularly for people in urban areas of Ethiopia.
4. Ethiopia is still facing a high burden of disease.
5. Disease-related to beliefs, behaviours and traditional practices have a positive effect on health status.

Pat II. . Fill in the blank spaces with the correct word or phrase

1. The lowlands of Ethiopia tend to be infested with tropical diseases like _____and _____
2. Some of the root causes of the poor health status of the population are:-
3. Regions like _____, _____ and _____ have population-hospital ratios of over 10,000 in each case
4. Ethiopian Demographic and Health Surveys 2005, 2011, and 2016 have indicated declining trends in_____, _____, _____ and _____ mortality.

Section 4 Impacts of Population Growth on Sustainable Development in Ethiopia

Section Overview

Dear learner! In this section, you will study the impacts of population growth on sustainable development in Ethiopia. Rapid population growth causes serious environmental degradation in areas where it occurs. It causes, for example, deforestation, water and air pollution, soil erosion, destruction of resources, etc., all of which are both consequences and causes of climatic change. Climatic change brings about global warming, desertification, drought and famine. Emphasize that all of these are results of environmental degradation which, as has just been pointed out, is itself caused by rapid population growth. In Ethiopia, many places have been suffering from these problems.

Section Learning Outcomes

By the end of this unit, you will be able to:

- *explain the impact of population growth on Ethiopia's socioeconomic condition;*
- *explain the consequences of deforestation in Ethiopia; and*
- *describe the impact of population growth on Ethiopia's environmental condition.*

Required study time:2 Hours

Dear learner! *Can you mention some of the challenges of rapid population growth in Ethiopia? Can you mention some of the real problems that have resulted from population growth in your locality?* _____

_____

_____

Did you try it? Good. As you have already studied, the size of Ethiopia's population has been growing very rapidly. The population growth rate is much higher, and it is increasing much faster than the economic growth rate and is growing beyond the carrying capacity of the country's natural resources, such as land, water, soil, forests, etc. These negative results of rapid

population growth have caused many environmental and socioeconomic problems that are stated hereunder.

I. Population Growth and Environmental Degradation

Environmental degradation is a process through which the natural environment is compromised in some way, reducing biological diversity and the general health of the environment. In Ethiopia, massive environmental degradation has occurred during the last few decades due to natural factors, unwise use of its natural resources, unsound ecological practices, and population pressure. The major factor accelerating the environmental degradation rate is man's abusive actions, such as the removal of the natural vegetation cover through deforestation, over-grazing, and inappropriate agricultural practices. The population which is growing at a very rapid rate of about 2.6 percent annually has been clearing forests and vegetation at an alarming rate in order to meet its increasing requirements of food, fiber and energy.

The land degradation problem is affecting considerable parts of Ethiopia, especially the highlands, mainly due to water erosion. Soil erosion is the main feature of land resource depletion leading to desertification which leads to reduced agricultural production and a shortage of food. Overall, the effects of population pressure and resulting environmental degradation have driven the country into widespread food insecurity, drought and famine for the last three decades. The main activities that are responsible for environmental degradation in Ethiopia include the removal of vegetation cover and over-cultivation as a result of the rapidly increasing population requirements for crop production and fuel wood. In addition, overgrazing and high livestock density resulted in the deterioration of rangeland resources.

II. Population Growth and Food Production

The situation of food in Ethiopia during the last successive three decades is largely dominated by a decline in domestic food production. Ethiopian agriculture is dominated by smallholder peasant farming which contributes about 95% of the annual food production of the country. This sector is dependent mainly on traditional and subsistent farming methods (with very limited use of modern technologies) and rainfall. Moreover, the rising population pressure and clearing of forests to satisfy its basic demands such as food and energy made the soil susceptible to wind and water erosion that can affect both soil fertility and food production in Ethiopia.

The sustained deterioration in per capita food production and hunger has resulted in widespread malnutrition, particularly among children in many parts of Ethiopia, which will lead to physical and mental impairment over the next successive decades.

III. Population Growth and Fuel wood Consumption

Though fuel wood is the most important source of energy in Ethiopia, its supply is steadily collapsing in most parts of the country because it is being collected faster than it can regrow. Increased forest clearance to create farmland, wood for construction purposes, and forage has led to a shortage of fuel wood, deforestation, and environmental degradation. The forest cover

resource in Ethiopia has been declining significantly over time. This is caused mainly by rapid population growth and the increasing population's needs for forest resources such as wood and land. Many people in the country use wood for cooking, heating, and lighting, as well as for houses and furniture. Similarly, the increasing demand for agricultural and settlement lands is a major cause of forest destruction in the country. In Ethiopia, there is a direct correlation between population density and deforestation – the more people there are in an area, the more trees they cut down. New trees do not spring up to replace the old ones.

Such deforestation has various negative consequences, both directly on the natural environment, and indirectly on the socio-economic conditions of the people. Its direct consequences include the following:

- It accelerates soil erosion.
- It destroys biodiversity.
- It affects rainfall by decreasing evapotranspiration.
- It affects the natural beauty of the affected areas

In Ethiopia, rapid population growth leads to deforestation mainly because of people's increasing needs for more:

- fuel wood;
- agricultural land;
- settlement land; and
- grazing land.

IV. Population Growth and Pollution

Pollution refers to any undesirable change in the natural conditions of water, air, and other components of the natural environment that has negative effects on the health and activities of human beings and other living creatures.

Dear learner! *Can you mention some of the causes of air and water pollution? Is water pollution a problem in your locality?* _____

_____

_____

Have you tried? If so, that is great. Water and air pollution are mainly caused by human activities in households, industries, farmlands, means of transportation, and so on. However, it can also be caused by natural events such as volcanic eruptions, wildfires, and the like.

When an area is overcrowded (i.e., inhabited by a rapidly growing number of people, the natural environment is polluted by a variety of unwanted and harmful wastes that people's activities produce. In Ethiopia, pollution is a major problem in overpopulated urban centers. In large cities like Addis Ababa, most people live in unsafe environments that have extremely polluted air and water. They are surrounded by the garbage and pollutants that households, industries, automobiles, and other sources discharge.

In Ethiopia, rapid population growth leads to environmental pollution by increasing emission of the amounts of pollutants such as:

- sewage, solid wastes, and pollutant gases generated by households;
- pollutant gases, liquids, and solid chemicals generated by expanded industries;
- pollutant gases generated by the increasing number of automobiles; and
- agricultural pollutants, such as fertilizers, pesticides, animal wastes, etc.

V. Population Growth and Provision of Social Services

Effect on Education: The rapid population growth has resulted in a growing demand for education. Nowadays, the total number of students has increased enormously, but there are still a large number of children who do not get the chance to go to school. In many urban centres schools have overcrowded classrooms.

Effect on Health: Ethiopia has poor health status and a high rate of population growth. The majority of the population has limited access to modern health services. Relatively, the situation in urban areas is better than in rural areas. Growing poverty, a low level of education, inadequate access to clean water, a shortage of sanitary facilities and poor access to health facilities have contributed to the poor health situation in Ethiopia.

Resources

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Activity 4

Answer the following questions

1. What are the indirect consequences of deforestation on socio-economic conditions?
2. Explain how rapid population growth affects the provision of health care services.
3. Explain how agricultural activity is affected by rapid population growth.

Checklist

Dear learner, here is a checklist provided for you to check your understanding. Put a tick mark (√) against each of the following statements. You must select either 'YES' or 'NO' as your response.

No.	Items	YES	NO
1.	Can you explain how agricultural activity is affected by rapid population growth?		
2.	Can you explain how rapid population growth affects the quality of education in Ethiopia?		
3.	Can you explain the direct and indirect consequences of deforestation?		
4.	Can you indicate different places exposed to environmental degradation?		
5.	Can you describe some of the consequences of deforestation in Ethiopia?		
6	Can you explain how rapid population growth in Ethiopia affects the productivity of farmers?		
7	Can you explain how rapid population growth affects the quality of education in Ethiopia?		

Is there any box that you mark 'No' under it? If there is please go back to your text and read about it before you go to the following exercise.

SELF-TEST EXCERCISES FOR SECTION 4

Part I. Determine whether each of the following sentences is 'True' or 'False'

1. There is a direct relationship between fertility and education.
2. In Ethiopia, population growth is faster than economic growth.
3. The population of Ethiopia is rapidly growing beyond the carrying capacity of the natural environment and its resources.
4. In Ethiopia, there is no direct correlation between population density and deforestation.
5. The forest covers resource of Ethiopia has been increasing significantly over time.

Part II. For the following questions, choose the correct answer from the given alternatives.

1. Rapid population growth results in

   A. Food sufficiency
   B. Food shortage
   C. Shortage of Housing
   D. B and C

2. The major factor accelerating the environmental degradation rate is

A. Deforestation
B. Overgrazing
C. Inappropriate agricultural practice
D. All Of the above

3. _____refers to any undesirable change in natural conditions of water and air.

A. Pollution
B. Deforestation
C. Overgrazing
D. Farming

4. The land degradation problem is affecting considerable parts of Ethiopia, especially

A. The lowlands
B. The highlands
D. Arid and Semi-Arid areas
E. Rift Valley

5. Which of the following is the direct consequence of deforestation?

A. Accelerates soil erosion.
B. Destroys biodiversity.
C. It affects rainfall
D. All of the above

Section 5 Language and Religion Diversity in Ethiopia

Section Overview

Dear learner, this is the fifth section of unit four. In this section you will study the language diversity and the major religions in Ethiopia. Ethiopian languages belong to two Supper Families: Afro-Asiatic and Nilo-Saharan. Ethiopians are ethnically diverse, with the most important differences based on linguistic categorization.

Section Learning Outcomes

By the end of this section, you will be able to:

- *describe the language diversity of Ethiopia; and*
- *distinguish the major religions in Ethiopia.*

Required study time:4 Hours

4.5.1. Language

Dear learner! *What are the languages used for communication in your locality? Please try to answer on the following space.* _____

_____

_____

Did you try? That is good. Ethiopians are ethnically diverse, with the most important differences on the based om linguistic categorization. Ethiopia is a country where about 80 languages are spoken. The Ethiopian languages belong to two super Families:

i. Afro-Asiatic and
ii. Nilo-Saharan.

Most Ethiopian languages belong to the Afro-Asiatic Super Family.

I. Afro-Asiatic

The Afro-Asiatic super family is divided into three families, namely:

a) Cushitic;
b) Semitic and
c) Omotic.

a) Cushitic: The Cushitic languages are predominantly spoken in central, southern, eastern and northeastern parts of Ethiopia mainly in the Afar, Oromia, Sidama, and Somali Regional States. It has the largest number of speakers and the widest spatial coverage. This family of languages consists of many individual languages such as Oromo language (Afaan Oromoo), Somali language (Af-Somali), Sidama language (Sidaamu Afo), Afar language (Qafaraf), Kembata language (Kambatissa), Hadiya language (Hadiyissa), Halaba language (Halabissa) and Gedeo language (Gedeoffa) and others.

b) Semitic: The Semitic languages are spoken in northern, central and eastern parts of Ethiopia, particularly in the regional states of Tigray, Amhara, Harari and the Southern Nations, Nationalities and Peoples' Regional State. Some of the Semitic Languages include Amhara language (Amarigna), Tigrai language (Tigrigna), Gurage language (Guragigna), Adere language (Aderigna), and Argoba language (Argobigna).

c) Omotic: The Omotic languages are predominantly spoken in the south–central and south-western parts of Ethiopia, mainly between the Lakes of southern Rift Valley and the Omo River. The languages, that make up this family, are numerous although they are not as widely spoken as the Cushitic and Omotic. Wolaita language (Wolaitatto), Dawuro language (Dawurootsuwa), Kafa language (Kafi noono), and Konta language (Kontaatsuwa) are some of the languages spoken in this family.

II. Nilo-Saharan

The Nilo-Saharan languages are spoken in the western lowlands of Ethiopia along the border with Sudan, in Gambella and Benishangul Gumuz Regional States. The individual languages of the Nilo-Saharan Super Family include Kunama language, Beiji language, Gumuz language, Mao language, Kewam language, Nuer language, Annuak language, and others.

4.5.2. Religion

Ethiopia is home to diversified religions. According to the Ethiopian Central Statistical Agency's (2007) census data, the national religious composition of Ethiopia includes: Orthodox (43.5%), Islam (33.9%), Protestant (18.6%), Catholic (0.7%), and others (3.2%).

Resources

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Activity 5

Answer the following questions

1. Describe the language diversity of Ethiopia.
2. Distinguish the major religions in Ethiopia.

Checklist

Dear learners! Here is a checklist provided for you to check your understanding. Put a tick mark (√) against each of the following statements. You are expected to respond under 'YES' or 'NO'

No	Items	YES	NO
1.	Can you describe the language diversity of Ethiopia?		
2.	Can you distinguish the major religions in Ethiopia?		
3.	Can you explain linguistic categories and language spoken in Ethiopia?		
4.	Can you explain two super families of languages in Ethiopia namely?		
5.	Can you list the Afro-Asiatic language families?		
6	Can you list an individual language that belongs to the Cushitic language family?		

SELF-TEST EXCERCISES FOR SECTION 5

Part I. For the following questions, choose the correct answer from the given alternatives.

1. Which of the following languages are spoken in the western lowlands of Ethiopia along the border with Sudan?

   A. Cushitic
   B. Semitic
   C. Omotic
   D. Nilo-Saharan

2. Most Ethiopian languages belong to:

   A. Afro-Asiatic Supper Family
   B. Nilo-Saharan Supper Family
   C. Cushitic
   D. Semitic

3. Which of the following statement is true?

   A. Ethiopia is home to diversified religions
   B. Ethiopians are ethnically diverse
   C. The Ethiopian languages belong to two super Families
   D. All of the above

Pat II. Write short answers to each of the following questions.

1. Which parts of Ethiopia's Semitic languages are predominantly spoken?
2. List down each individual language that belongs to the Cushitic language family.
3. What are the three families of language that belongs to Afro Asiatic Super families?
4. In which part of Ethiopia are the Nilo-Sahara languages predominantly spoken?
5. What are the major religious compositions in Ethiopia?

UNIT SUMMARY

- Human population is the number of people living in a definite area. The study of human population is also necessary for development and socio-economic activities.
- The term population, in population studies, refers to the total number of human inhabitants of a specified area, such as a city, country, or continent, at a given time.
- Ethiopia is the second most populous country in Africa. with a population of 114.9 million. With a growth rate of 2.6 percent, the country's population is among the fastest growing in the world.
- In Ethiopia a high percentage of the national population is in the young age group. This is the result of a high birth rate.
- In Ethiopia, the population is unevenly distributed; due to various physical and human-related factors.
- Settlements in Ethiopia are broadly categorized as rural and urban. The primary bases for this distinction are the dominant economic activities and population density.
- The majority of Ethiopian population (80 percent) currently lives in rural areas.
- The lowlands of Ethiopia tend to be infested with tropical diseases like malaria and yellow fever.
- In Ethiopia, rapid population growth has brought about serious negative impacts on the country's socio-economic development and its environmental protection.
- Ethiopians are ethnically diverse, with the most important differences on the based on linguistic categorization.
- Ethiopia is a country where more than 80 languages are spoken. The Ethiopian languages belong to two Super Families: Afro-Asiatic and Nilo-Saharan.

GLOSSARY

Life expectancy – how long people in certain countries are expected to live.

Census - a counting of people by the government every ten years to gather data for planning of schools, hospitals, etc. This is unreliable for a number of reasons.

Child Dependency ratio - the number of children in relation to the number of working (economically active) population, usually expressed as a ratio.

Death rate- the number of deaths per 1000 people per year.

Dependent Population - those who rely on the working population for support e.g. the young and elderly.

Depopulation - the decline or reduction of population in an area.

Overpopulation - where there are too many people and not enough resources to support a satisfactory quality of life.

Population density – relates population to area, (average) the total population in a country or region divided by its area (people/km2).

Population pyramids – age & sex structure of a population can be shown in this type of graph, factors control the shape, birth & death rates & migration.

Quality of Life- things that affect your standard of living.

Sedentary- Fixed in place not nomadic.

Settlement - refers to the characteristic groupings of population into occupancy units, together with the facilities in the form of houses and streets, which serve the inhabitants

Sparsely Populated - an area that has few people living in it.

Working population - people in employment who have to support the dependent population.

SELF-ASSESSMENT CORRECTED BY THE STUDENT H

1. How do we acquire information or data about human population?
2. Which region is the most densely populated in Ethiopia?
3. Describe the status of your region with respect to the spatial distribution of population.
4. What is a population pyramid?
5. What are the reasons for the broad base and narrow apex of Ethiopia's population pyramid?
6. What does sex ratio mean?
7. What do you know about the concept of settlement?
8. Why are temporary settlements found in the nomadic herding areas of Ethiopia?

WRITTEN ASSIGNMENT CORRECTED BY TUTOR

1. What does age dependency ratio mean?
2. What is the significance of studying the sex composition of population?
3. Explain the main difference between rural settlement and urban settlement.
4. Explain the root causes of the poor health status of the population in Ethiopia.
5. What were the major factors that contributed to the development of urban settlements in Ethiopia?
6. What are some of the consequences of deforestation in Ethiopia?
7. By referring to the table below, answer the questions that follow:

Country	Total Population	Female population	Young Age population (%)	Old Age Population (%)
X	800,000	500,000	42	8
Y	1,250,000	790,000	20	15
Z	930,000	405,000	50	6

a) Calculate sex ratio for each country

b) Calculate ADR for each country

c) Which country shows the highest dependency ratio?

ANSWER FOR UNIT 4 SECTION LEVEL ACTIVITIES

Activity 1

1. It is important for planning in fields such as health, education, housing social security, employment and environmental preservation.
2. It provides information needed to formulate government population policies that seek to modify demographic trends in order to achieve economic and social objectives.
3. There are a number of advantages of studying population. These include:
   - *It is essential for economic planning;*
   - *Studying population numbers and their pattern of distribution is important for satisfying social needs; and*
   - *It is important for the overall socio-economic development of a society.*

Activity 2

1.
   - *Favourable climate (moderate temperature and adequate rainfall)*
   - *Adequate supply of water*
   - *Absence of tropical diseases*
   - *Availability of fertile soil*

2. It is because of:
   - *The harsh climatic condition*
   - *Inadequate water*
   - *Infertile soil*
   - *The presence of tropical diseases*

Activity 3

1.
   - *Lack of access to clean water*
   - *Lack of access to clean water*
   - *Disease related to beliefs, behaviours and traditional practices*
   - *Lack of health services*

2. The health extension program HEP has certainly contributed to the increased access and coverage of high-impact public health interventions in the country. Improved public health interventions such as malaria control efforts, access to safe drinking water, improved toilet facilities, and vaccination against childhood diseases are some of the factors behind the improved health outcomes in Ethiopia.

Activity 4

1. Some of the indirect consequences of deforestation include:
   - *Reduced agricultural productivity.*
   - *Reduced socio economic progress.*
   - *Climatic change*

2. When population grows rapidly, it leads to:
   - *High demand for health care services*
   - *Difficulty of the government in meeting the demands of the people for more health care services.*
   - *High pressure on the existing health care services that causes deterioration of the quality of the services.*

3. When population grows rapidly, it affects agricultural activity due to mainly:
   - *The scarcity of farmlands*
   - *Fragmentation of farmlands*
   - *Over-cultivation of farmlands*
   - *High rate of soil erosion*
   - *High rate of deforestation*
   - *Over-grazing*

Activity 5

1. The Ethiopian languages belong to two super Families:
   - *Afro-Asiatic and*
   - *Nilo-Saharan.*

   Most Ethiopian languages belong to the Afro-Asiatic super Family.

I. Afro-Asiatic: The Afro-Asiatic super family is divided into three families, namely:

a) *Cushitic; the Cushitic languages are predominantly spoken in central, southern, eastern and northeastern parts of Ethiopia*
b) *Semitic the Semitic languages are spoken in northern, central and eastern parts of Ethiopia*
c) *Omotic languages are predominantly spoken in the south–central and south-western parts of Ethiopia*

II. Nilo-Saharan: The Nilo-Saharan languages are spoken in the western lowlands of Ethiopia along the border with Sudan.

2. Ethiopia is home to diversified religions. National religious composition of Ethiopia include: Orthodox Christian, Protestant Christian, Catholic Christian, Islam, and others.

ANSWER KEY TO SELF-TEST EXERCISES OF UNIT 4

Self-test Exercise Section 1

Part I. Answer key for True or False Items

1. True	2. True	3. True	4. True	5. False
6. False	7. False	8. True	9. True	10. False

Part II. Answer for Fill in the Blank Space

1. Population
2. 2007
3. Development and Socio-economic activities
4. Population Geography
5. Productive and non-productive
6. Age structure
7. Age group and Population Pyramid
8. Population Pyramid
9. Triangle
10. Life expectancy

Self-test Exercise Section 2

Part I. Answer key for True or False Items

1. True 2. False 3. True 4. True 5. False
6. True 7. False 8. True 9. False 5. True

Part II. Answer key for Multiple Choice items

1. C 2. B 3. A 4. D 5. E
6. A 7. E 8. B 9. D 10. A

Part III Answer for Fill in the Blank Space

1. Types of economic activity and Historical patterns of population movement
2. Low or sparse
3. Population density
4. Crude density
5. Economic activities and population density
6. Permanent
7. Urbanization
8. Carrying capacity and density of population
9. Pastoralist activities

Self-test Exercise for Section 3

Part I. Answer key for True or False Items

1. True 2. True 3. False 4. True 5. False

Part II. Answer for Fill in the Blank Space

1. Malaria and Yellow fever
2.
   a) *Lack of access to clean water*
   b) *Lack of adequate nutrition*
   c) *Disease related to beliefs, behaviours and traditional practices and*
   d) *Lack of health service*
3. Amhara. Somali and SNNPR
4. Neonatal, infant, under five and malnutrition

Self-test Exercise for Section 4

Part I. Answer key for True or False Items

1. True 2. True 3. True 4. False 5. False

Part II. Answer key for Multiple Choice Items

1. D 2. D 3. A 4. B 5. D

Self-test Exercise for Section 5

Part I. Answer key for Multiple Choice items

1. C 2. A 3. D

Part II. Answer key for Short Answer

1. The Northern, central and eastern part of Ethiopia.
2. This family of languages consists of many individual languages such as the Oromo language (Afaan Oromoo), Somali language (Af-Somali), Sidama language (Sidaamu Afo), Afar language (Qafaraf), Kembata language (Kambatissa), Hadiya language (Hadiyissa), Halaba language (Halabissa) and Gedeo language (Gedeoffa) and others.
3. Cushitic Semitic and Omotic
4. 4.The Nilo-Saharan languages are spoken in the western lowlands of Ethiopia along the border with Sudan, in Gambella and Benishangul Gumuz Regional States.
5. Orthodox Christian, Protestant Christian, (18.6%), Catholic Christian, Islam, and others.

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Geography

Distance Learning Material

Grade 9

Module I

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