GEOGRAPHY

DISTANCE LEARNING MATERIAL

GRADE 12

MODULE ONE

FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA
MINISTRY OF EDUCATION

FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA
MINISTRY OF EDUCATION

GEOGRAPHY

DISTANCE LEARNING MATERIAL

MODULE ONE

Writers	**Tamiru Abate and Asfaw Mohammed (PhD)**
Pedagogical editor	**Abera Husen (PhD)**
Language editor	**Fekede Menuta (PhD)**
Designer	**Andargachew Abeje(MSc)**

First Published xxxxx 2022 by the Federal Democratic Republic of Ethiopia, Ministry of Education, under the General Education Quality Improvement Program for Equity (GEQIP-E) supported by the World Bank, UK's Department for International Development/ DFID-now merged with the Foreign, Common wealth and Development Office/FCDO, Finland Ministry for Foreign Affairs, the Royal Norwegian Embassy, United Nations Children's Fund/UNICEF), the Global Partnership for Education (GPE), and Danish Ministry of Foreign Affairs, through a Multi Donor Trust Fund.

The Ministry of Education wishes to thank the many individuals, groups and other bodies involved – directly or indirectly – in publishing this Textbook. Special thanks are due to Hawassa University for their huge contribution in the development of this textbook in collaboration with **Addis Ababa University, Bahir Dar University**, J**imma University and Semera University.**

Printed by:
xxxxxxxx PRINTING
P.O.Box xxxxxx
xxxxxxx, ETHIOPIA
Under Ministry of Education Contract no. xxxxxxxxxxx

ISBN: 978-999944-2-046-9

TABLE OF CONTENTS

UNIT FOUR
ISSUES OF SUSTAINABLE DEVELOPMENT II..... 119

General Introduction

Dear learner, we hope you have enjoyed your study of the distance learning of geography for grade eleven which deals with the formation of the earth's continents, natural resources and conflicts over resources, world population problems, major global environmental problems, geographic issues and public concerns, such as geo-spatial information and data processing. Dear learner! This learning material one for grade twelve is a continuation of the lessons in grade eleven. It particularly deals with the theories of continental drift, plate tectonics, geological processes and the landform caused by these processes.

We hope that you are able how to proceed in learning in distance with the kind of module. However, we would like to mention the following procedures for your study of this material. New topics and sub-topics with detailed explanations are provided for you. Besides, some activities are given following the topics and reflective activities are given proceeding to the descriptions of each topic. These reflective activities should be done by yourself. Of course, the answers for each activity are given at the end of the module. At the end of each section, there is a checklist that helps you to assess 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 module. Otherwise, you have to go back and revisit the section. Moreover, at the end of each module, the summary of it and the required reference materials are given. Finally, there is an assignment for submission in the module. Therefore, you are expected to do the assignment carefully and submit it to your tutor. We wish you great success.

This distance material consists of two modules. The first module has four units (1-4), and the second module equally has for units consisting of unit 5 to 8. The first module will be studied in the first semester while the second module in the second semester.

Module one Introduction

In this module, you are going to study about the geological processes; earth's climate change trends, management of natural resource conflicts and about population policies and programs. With these basic contents, you are expected to study very well at your pace; be aware of and appreciate the geological processes that make-up the different land features, the impacts of global climate change, management of natural resource conflicts, and about the policies and programs related to rapidly growing populations.

Module Contents

Module learning outcome

- explain the theory of continental drifting and controversies surrounding it;
- describe and explain the movement of the lithospheric plates over geological time;
- explain the main types of plate boundary and how they interact at triple junctions;
- describe and explain the driving and retarding forces that influence plate motion at different plate boundaries;
- explain how plate movements relate to plate boundaries; and
- explain the major geological processes which resulted in the formation of continents.
- explain basic concepts of climate change;
- distinguish between natural and human induced climate change;
- analyze trends in climate change in Ethiopia and the world at large;
- recognize the major climate change mitigation and adaptation strategies;
- explain the purpose and pillars of the Ethiopian Climate Change Resilient Green Economic Strategy;
- assess the major international conventions and agreements in view of their aspirations and achievements so far.
- recognize the meaning of sustainable development;
- recognize the main focus, goals and principles of sustainable development;
- explain the principle and characteristics of good governance;
- understand the problems of land use policy in Ethiopia.

Module assessment methods

A. Formative assessment

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

B. Summative assessment

- Mid-term examination
- Assignment
- Portfolios
- Final examination

UNIT ONE
MAJOR GEOLOGICAL PROCESSES ASSOCIATED WITH PLATE TECTONICS

Unit Introduction

Dear students, most of the contents in this unit are familiar to you as you were introduced in the previous grades lessons that discussed about geological history of Ethiopia and the formation of the earth's continents. This is a continuation of those lessons on related matters. The unit particularly deals with the theories of continental drift, plate tectonics, geological processes and the landform caused by these processes. In order to address these contents, explanation, practical activities, observation, questioning, and report writing are suggested as the major methods of learning. The start-up questions and activities are given in each sub-unit to encourage you. Summaries and exercises are also designed to explore the key concepts in more detail.

Unit contents

Unit Outcomes

By the time students complete this unit, they will be able to:

- Explain the theory of continental drift and controversies surrounding it.
- Describe the movement of the lithospheric plates over geological time.
- Explain the main types of plate boundary and how they interact at triple junctions.
- Describe the driving and retarding forces that influence plate motion at different plate boundaries.
- Explain how plate movements relate to plate boundaries.
- Identify the major geological processes in the formation of continents.

The Required Study Time: 16 hours

Unit Learning Strategies

In the unit, the suggested learning strategies are:

- written brainstorming questions;
- Problem-solving method;
- individual project;
- report writing;
- observation;
- written activities;

SECTION ONE
1.1. Continental Drift Theory

Section Overview

Dear learner! In this section, you will learn about continental drift, pieces of evidence in support of continental drift theory, and the main critics of the theory. The Continental drift theory suggests that the earth's continents have moved over geologic time relative to each other; thus, appearing to have "drifted" across the ocean bed. The continental drift theory also entails that the present continents were formed from a single continent called PANGAEA. In the early Triassic period, Pangaea started to break into several parts. The northern part of Pangaea is known as LAURASIA. The southern part of Pangaea is known as GONDWANALAND. Both continents are further subdivided into the present continents. Through the process of drifting, the continents reached their present location. The process of continental drift as a whole took place over millions of years. Shreds of evidence supporting continental drift theory may include: ancient climate similarities, fossil evidence and similarity of rock structures between Africa and South America, as well as the outlines of the continents, especially the continental shelves, which seem to fit together.

Section Learning Outcomes

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

- describe the continental drift theory and its relation to the formation of the current continents,
- identify the continents that constituted Laurasia and Gondwanaland;
- explain the geological pieces of evidence that support continental drift theory;
- describe how continental drift theory and plate tectonics are related.

1.1.1 Concept of Continental drift theory

Dear learner, do you recall the notion of the Continental drift theory from your previous grade study? Did you remember? Well, try to define the "Continental drift theory" in your own words and relate your attempts to the definition given next.

The Continental drift theory is a suggestion that the earth's continents have moved over geologic time relative to each other; thus, appearing to have "drifted" across the ocean bed. The continental drift theory suggests that the present continents were formed from a single super continent called PANGEA.

In the Triassic period of the Mesozoic era, Pangaea started to break into several parts. The northern part of Pangea is known as LAURASIA. The southern part of Pangea is known as GONDWANALAND. Both continents further drifted into the present continents. This process of continental drift as a whole took place over millions of years. Figure 1.1 below illustrates the process of continental drift and related changes over time.

Hence, refer to the components of the figure contrasted 4- world maps representing continental positions & features from remote to recent respectively; and interpret what they portray to construct your understanding.

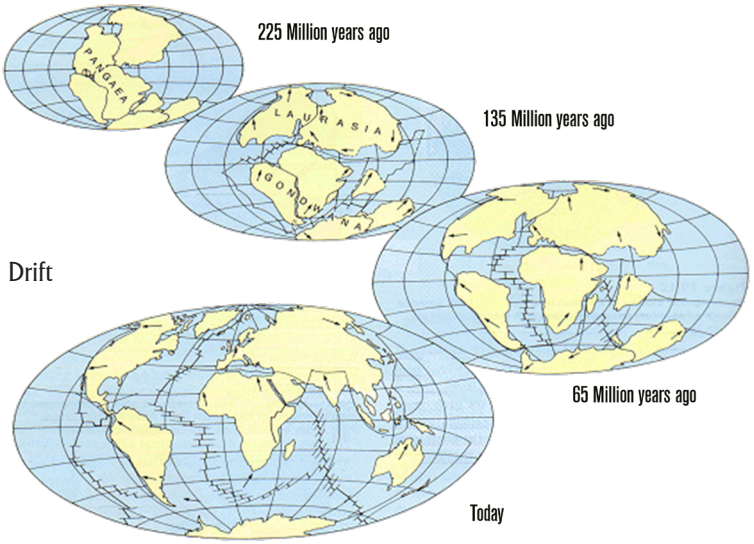


Figure 1.1: Continental Drift

Pangea was the first single continent. This continent broke in to two forming Laurasia and Gondwanaland. Then, both continents are still further subdivided in to the present continents. Through the process of drifting the continents were able to reach their present location. The process of drift as a whole took place over millions of years.

1.1.2 Geological Shreds of Evidence Favoring Continental Drift theory

Dear learner! What pieces of evidence are there in support of continental drift theory? Please list down the evidence in support of the continental drift theory.

Have you tried? You can answer by reviewing the note given below. The concept of continental drift theory was proposed by German meteorologist Alfred Wegener in 1912. Wegener used the following geological evidence to support his theory:

1. Coastline Similarity: The coastlines of Africa and South America have remarkable similarities on the opposite side of the Atlantic Ocean. These coastlines fit together like pieces of a jigsaw puzzle. The fitness of the continental margins can easily be shown with the help of a diagram in figure 1.2.

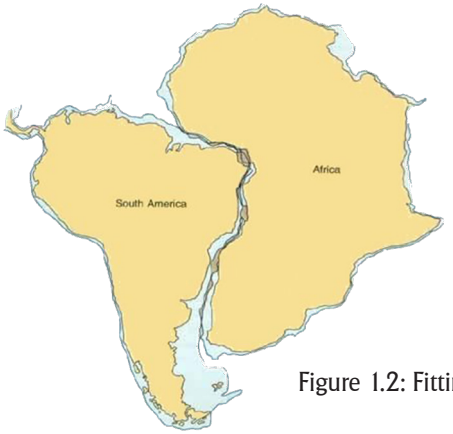


Figure 1.2: Fitting of Africa and South America together

2. Rock type and structural similarities: When we fit the continents of Africa and South America "back together again", we find that:

- Similar rock types extend from one continent to the other
- The rocks are also the same age.
- Moreover several mountain belts also extend from one continent to the next.

3. Fossil Evidence: Fossils of Mesosaurus (a small reptile that lived about 250 million years ago) are found on both sides of the Atlantic in South America and Africa implying that the continents were once joined together.

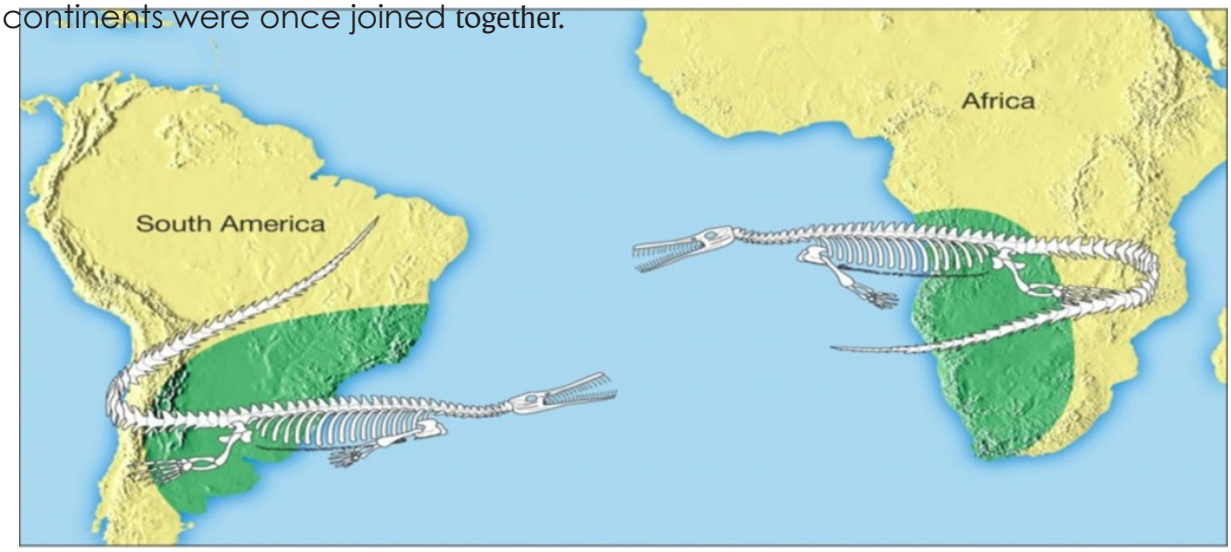


Figure 1.3: Distribution of Mesosousarus

4. Paleoclimatic Evidence: studies of past climates provide some of the strongest pieces of evidence in support of continental drift.

Dear learner: Was Wegener's theory of continental drift accepted easily? Read the lesson note presented next with concentration for a deep understanding of the issue raised.

However, Wegener's theory of continental drift was rejected by the scientific community of the time. The main reasons for this rejection were:

1. Wegener was not a geologist by profession, which of course was most welcome by his opponents.
2. Most influential geoscientists at that time were based in the Northern Hemisphere, whereas most of the conclusive data came from the Southern Hemisphere.
3. Wegener thought that Pangaea did not break up until the Cenozoic era, and scientists found it hard to believe that so much continental drift could have occurred in so short a time.
4. The greatest problem remained the lack of direct evidence for the movements of continents and the needed explanation for the mechanism.

Resource

Greene, M. T. (2015). Alfred Wegener: Science, exploration, and the theory of continental drift. JHU Press.

Wilson, J. T. (1963). Continental drift. Scientific American, 208(4), 86-103.

Activity 1.1

Explain the main pieces of evidence that suggest the continents were joined together

Checklist

Dear learner; please check how far you understand the given lesson by answering the following questions by writing '√'.

№	Items	Yes	No
1	describe the continental drift theory and its relation to the formation of the current continents?		
2	identify the continents that constituted Laurasia and Gondwanaland?		
3	explain the geological pieces evidence that support continental drift theory?		

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 exercise 1.1

Dear learner; we hope you enjoyed reading the notes and doing the activities. We think you found them interesting and relevant. Now, attempt questions 1-5 that are given below to evaluate how far you have understood the lesson you studied.

Part I:

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

1. Which one of the following is part of the old Gondwanaland?
   A. North America B. Asia C. Europe D. Australia
2. What is the name of the huge sea that existed around Pangea?
   A. Atlantic Ocean B. Tethys C. Amazon D. Antarctica E. None
3. Which of the following was proposed by Alfred Wegener?
   A. Plate Tectonics B. Continental Drift C. Ocean floor spreading D. All
4. Which one of the following is part of the continent of Laurasia?
   A. North America B. Asia C. Europe D. Australia
5. Which of the following statements is not true about Plate tectonics?
   A. If a new oceanic crust is being formed, elsewhere it must be destroyed
   B. Plate movement is slow, but usually continuous
   C. Most significant landforms are at their boundaries.
   D. None of the above

Part II.

Short note writing: Give short answers to the following questions (1-5) (5 points).

6. List down the names of the continents that make up Laurasia.
7. Which continent of Laurasia is the biggest one?
8. List down the names of the continents that makeup Gondwanaland.
9. Which continent of Gondwanaland is currently buried under snow?
10. Laurasia and Gondwana are separated by which sea?

Feedback to Activity 1.1

The shreds of evidence that exist in support of continental drift theory are:

1. Coastline Similarity: The coastlines of Africa and South America have remarkable similarities on the opposite side of the Atlantic Ocean. These coastlines fit together like pieces of a jigsaw puzzle.
2. Rock type and structural similarities: When we fit the continents of Africa and South America "back together again", we find that:
    - Similar rock types extend from one continent to the other
    - The rocks are also the same age.
    - Moreover several mountain belts also extend from one continent to the next.
3. Fossil Evidence: Fossils of Mesosaurus (a small reptile that lived about 250 million years ago) are found on both sides of the Atlantic in South America and Africa implying that the continents were once joined together.
4. Paleoclimatic Evidence: studies of past climates provide some of the strongest pieces of evidence in support of continental drift.

Answer Key Self-test exercise 1.1

1. D 2. B 3. B 4. D 5. D
6. North America, Eurasia
7. Eurasia
8. The Gondwanan supercontinent consisted of present-day landmasses of Africa, South America, India, Madagascar, Australia and New Zealand.
9. Antarctica
10. The two large landmasses of Laurasia and Gondwanaland were separated by a long, shallow inland sea called the Tethys Sea.

Dear learner; how did you find the lesson? I think you enjoyed it and found it very interesting and exciting. I hope you did well in the self-testing. Review and check the extent to which you have achieved the intended lesson objectives of the section. If you did well, then you should go on to the next section. What do you think?

SECTION TWO
1.2 PLATE TECTONICS THEORY

Section Overview

Dear learner, in previous the section we dealt with continental drift theory. In this section, we will try to learn about plate tectonic theory. Plate tectonics theory is a theory developed in the late 1960s to explain how the outer layers of the earth move. The Structure of the Earth comprises three layers: The crust, mantle, and core. Each of these layers is further subdivided. The crust consists of continental and oceanic crust. The mantle, the upper most part is a solid rock like the crust (lithosphere), while the rest of the mantle is not weak and plastic (asthenosphere). The core consists of an outer liquid region surrounding a solid center. Plate tectonics is the modern theory of the movement of Earth's outer shell, or lithosphere. The lithosphere consists of both the crust, and the solid outermost layer of the mantle beneath. The lithosphere is broken into many large (major) plates and several smaller (minor) ones.

The plates float on a much hotter layer of partially molten rock called the asthenosphere, which is also part of the mantle. The asthenosphere slowly churns, driven to movement by the radioactive heating of the planet's core. This churning causes the plates of the lithosphere to move at a rate of a few centimeters a year. The way the plates interact at their margins depends on whether the crust forming the top of the plate is oceanic or continental.

As the plates move, they may converge, diverge, spread apart; or slide past each other along fractures called transform faults. It is at these plate boundaries that most of the world's major landforms occur and where earthquakes, volcanoes and mountain building take place. Therefore you are advised to identify the intended section learning outcomes and make effort to master the respective content learning area.

Section Learning Outcomes

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

- Explain the plate tectonic theory;
- Identify the continental plates and oceanic plates;
- List the major plates and the minor ones;
- Locate the major and the minor tectonic plates on a map;
- identify the major plate tectonic boundaries; and
- explain how plate tectonics is related to geological processes.

KEY TERMS:

- Plate tectonics,
- Plate boundary,
- Asthenosphere,

Dear learner: What is plate tectonic theory? What are the layers of the earth? Student check to what extent your reflective points to the preceding questions approximate with the following descriptions.

According to plate tectonic theory, the layer, called the asthenosphere, allows the uppermost mantle and crust, together called the lithosphere, to slide across the top of it. Earth's lithosphere is broken into about a dozen large pieces called plates (Figure 1.4). These plates may be entirely made up of continental rocks, both continental and oceanic rocks, or entirely of oceanic rocks. Plates move slowly at a rate of a few centimeters per year and change size.

Dear learner; Plate tectonics is the study of the movement of plates and landforms which result from their movement. The plates move in different directions, and meet each other at plate boundaries.

Tectonic plates are subdivided in to major and minor tectonic plates. A major plate is any plate with an area greater than 20 million km2. The major tectonic plates are: the African, Antarctic, Eurasian, Indo-Australian, North American, Pacific and South American plates. These plates comprise the bulk of the continents and the Pacific Ocean. A minor plate is any plate with an area of less than 20 million km2. Some examples are: the Somali Plate, Nazca Plate, Indian, Arabian, Philippine, and Sunda.

Dear learner: What is the difference between the continental plate and the oceanic plate?

As you might have distinguished them, the difference between continental plate and oceanic plate is explained in the following paragraph.

Based on their thickness and nature of the crust, plates are divided in to continental plates and the oceanic plates (see figure 1.4).

Oceanic plates are much thinner than continental plates. The rocks and geological layers are much older on continental plates than on oceanic plates. The Continental plates are much less dense than the Oceanic plates. The Granite and recycled material are much lighter than the heavy basalt layers of the ocean plates.

Dear student, thus the plate tectonics theory serves us as the foundation upon which we understand the geologic processes that shape the Earth.

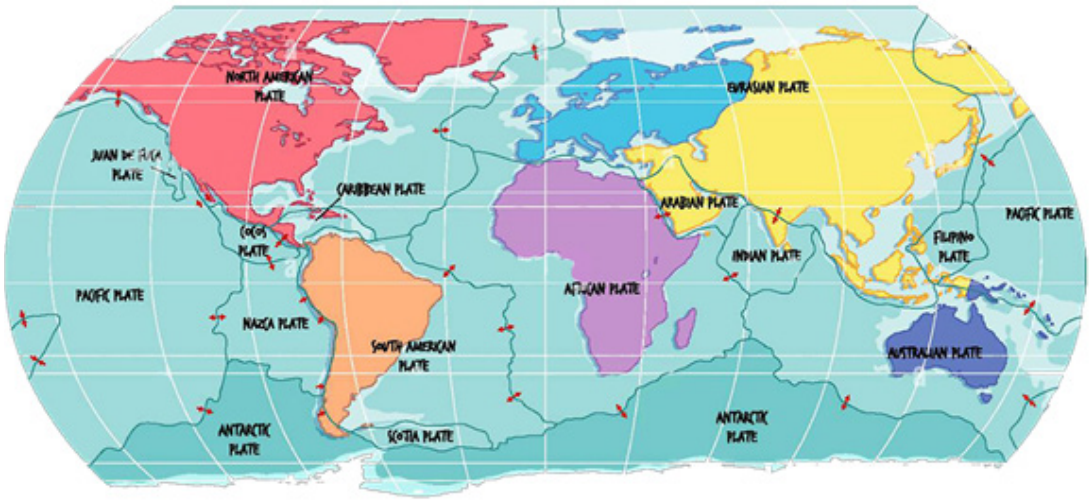


Figure 1.4: The Tectonic plates and their boundaries

1.2.2 Plate Movements and Plate Boundaries

Dear learner, what happens when two plates interact at their margins?

As you expect, the way the plates interact at their margins depends on whether the crust forming the top of the plate is oceanic or continental. Continental crust made largely of granite is less dense than oceanic crust made largely of basalt.

As the plates move, they may:

1. Converge, or come together; forming convergent (Destructive) boundary;
2. Diverge, or spread apart; forming divergent (Constructive) boundaries or
3. Slide/ past each other along fractures called transform (Conservative) boundaries.

Dear student, what is the difference between convergent, divergent and conservative boundaries?

a. Convergent plate boundaries

Student, what happens when two tectonic plates converge?

Convergent plate boundaries are boundaries where two plates move toward each other. At such boundaries, the denser plate will be forced under, or subducted beneath, the less dense one. The subducted crust is eventually destroyed. This happens when the oceanic crust meets the continental crust and when the oceanic crust meets another oceanic crust. For example, the eastward-moving Nazca Plate, under the southeastern Pacific Ocean, is being subducted under the westward-moving South American Plate. The denser oceanic crust is pushed down into the mantle, causing it to melt and produce magma (molten rock). The magma and gases rise to the surface, and are vented through the western crust of South America, forming the volcanoes of the Andes Mountains.

If two oceanic plates converge, the subduction of one under the other may produce an arc of volcanic islands. The Mariana Islands of the western Pacific Ocean were formed this way.

Student, two blocks of continental crust may converge as well. The resulting pressure can deform the crust. If one block is denser, that block may slide under the other, mainly lifting the other plate rather than sinking too much itself. A good example of this is the convergence of the northward moving Indo-Australian Plate with the Eurasian Plate. Thus, as India met Asia, the collision produced the highest mountain range on Earth: the Himalayas.

b. Divergent plate boundary

Dear student, where do we find the Divergent plate boundary?

Divergent plate boundary occurs in the place where plates move away from each other at oceanic ridges, such as in the middle of the Atlantic Ocean. There, rising magma from the underlying asthenosphere intrudes and erupts beneath and at the oceanic ridge to create a new seafloor. This pushes the plates on either side away from each other in opposite directions.

Undersea volcanoes and crust expanded by heating have produced a long undersea ridge, but with a rift in the middle where the plates are separating. This process is known as seafloor spreading. Shallow earthquakes are common at oceanic ridges. Divergence can also happen on continents, producing fractures called rift valleys. A modern example is the East African Rift Valley.

c. Transform Fault Boundaries

Dear student what do we mean by transform boundaries?

Student, in some places, plates slide past each other laterally along fractures in the crust. These places are called transform faults. The plates stick and then occasionally slip, producing earthquakes.

Student where do we find transform Fault boundaries in the world?

Most transform faults are found on the seafloor along the undersea mountain chains called oceanic ridges, but the faults also occur on continents, such as the San Andreas Fault in California.

(Figure 1.8). Thus as plates move past each other along transform faults, the crust is neither destroyed nor

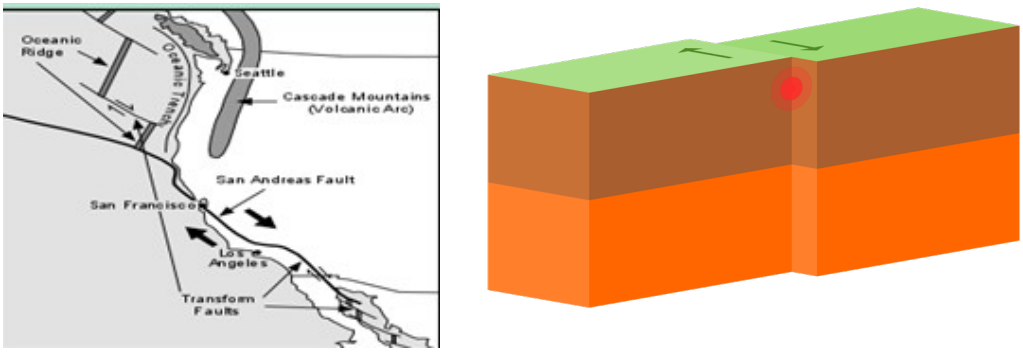


Figure 1.8: Transform Fault

Plate tectonics is driven by the internal energy of the Earth. Although there is some debate among geoscientists as to the exact mechanism, most agree that the motion of the plates is ultimately driven by convection currents in the mantle. Refer to Fig.1.9 and relate to the lesson note.

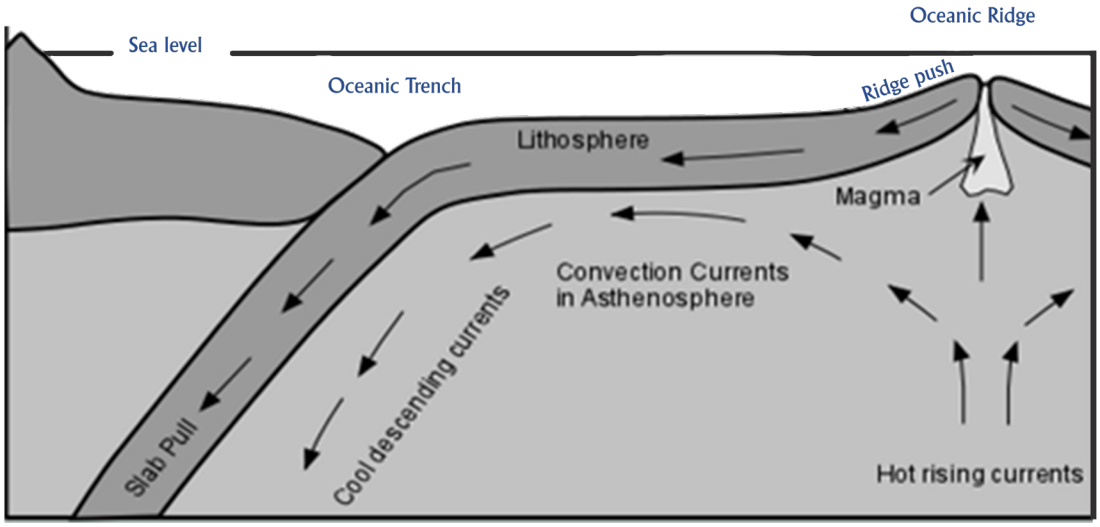


Figure 1.9: Convection currents in the Asthenosphere

As the plates move, they may: converge, diverge, or Slide/ past each other. Most transform faults are found on the seafloor along the undersea mountain chains called oceanic ridges.

Resource

Anderson, M. (2012). Introduction to Earth Science, Investigating Plate Tectonics Earthquakes, and Volcanos. New York: Britannica Education Publishing.

Bull, W. B. (2007). Tectonic Geomorphology of Mountains: A New Approach to Paleoseismology. Carlton, Victoria 3053: Blackwell Publishing Ltd Blackwell.

Cox, A., Brian, R., Cox, A., & UN, S. (1986). Plate Tectonics, How It Works. London: Blackwell Scientific Publications.

Activity 1.2

1. Discuss what happens when plates
   A. Converge;
   B. Diverge; and
   C. Slide each other

Feedback to Activity 1.2

A. Where two plates (converge) move toward each other at such boundaries, the denser plate will be forced under, or subducted beneath, the less dense one. The subducted crust is eventually destroyed.

B. Divergent plate boundary occurs where plates move away from each other at oceanic ridges, such as in the middle of the Atlantic Ocean. There, rising magma from the underlying asthenosphere intrudes and erupts beneath and at the oceanic ridge to create a new seafloor. This pushes the plates on either side away from each other in opposite directions.

C. Undersea volcanoes and crust expanded by heating have produced a long undersea ridge, but with a rift in the middle where the plates are separating. This process is known as seafloor spreading. Divergence can also happen on continents, producing fractures called rift valleys. A modern example is the East African Rift Valley.

D. Where plates slide each other, the plates stick and then occasionally slip, producing earthquakes. Most transform faults are found on the seafloor along the undersea mountain chains called oceanic ridges, but the faults also occur on continents, such as the San Andreas Fault in California.

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 alternatives 'Yes' or 'No'.

№	Items	Yes	No
1	explain the plate tectonic theory?		
2	identify the continental plates and oceanic plates?		
3	list the major plates and the minor ones?		
4	locate the major and the minor tectonic plates on a map?		
5.	identify the major plate tectonic boundaries?		
6	explain how plate tectonics is related to geological processes?		

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 exercise 1.2

Dear learner; we hope you enjoyed reading the notes and doing the activities. I think you found them interesting and relevant. Now, attempt the questions that are given below to evaluate how far you have understood the lesson you studied.

Part I.

For the following questions choose the best answer among the given alternatives. (8 points)

1. Most geologists rejected Alfred Wegener's idea of continental drift because_____.
   A. Wegener was interested in what Earth was like millions of years ago.
   B. Wegener used several different types of evidence to support his hypothesis.
   C. They were afraid of a new idea.
   D. Wegener could not identify a force that could move the continents.
2. Alfred Wegener called the super single continent as_____.
   A. Pangea C. All lands
   B. Wegener land D. Eurasia
3. Which of the following was not used by Wegener as evidence of continental drift?
   A. Evidence of volcanoes. C. Paleo-climatic evidence.
   B. Fossil records D. The fit of the continents.
4. Which one of the following is part of the old Gondwanaland?
   A. North America C. Europe
   B. Asia D. Australia
5. What is the theory that states that parts of the Earth's crust slowly drift atop a liquid core?
   A. Theory of Evolution C. Geocentric Theory
   B. Heliocentric Theory D. Continental Drift Theory
6. Which of the following is not a major tectonic plate?
   A. African Plate C. Eurasian plate
   B. Antarctic plate D. Arabian plate
7. Which of the following rock types is most representative of the composition of the oceanic crust?
   A. Shale C. Schist E. Limestone
   B. Granite D. Basalt
8. Which of the following rock types is most representative of the composition of the continental crust?
   A. Shale C. Schist E. Limestone
   B. Granite D. Basalt

Part II.

Answer questions 9-12 by writing 'True' for the correct statements or 'False' for the wrong statements (2 points).

9. The theory of plate tectonics states that the earth's crust and upper mantle are moving around on the mantle.
10. Transform faults are found only on the seafloor along the undersea mountain chains called oceanic ridges.
11. The plate tectonics theory explains the causes of mountain building, volcanoes, and earthquakes.
12. At convergent boundaries, plates move away from each other.

Part III.

Give short answers to questions 13-14. (5 points)

13. When did Pangaea start to break into several parts?
14. What is the significance of plate tectonic theory?
15. List down the names of the major tectonic plates. Which are the minor ones?
16. What is the difference between continental plates and oceanic plates?
17. What is the difference between convergent and divergent plate boundaries?
18. What is a transform plate boundary?

Answer Key to Self-test Exercise1.2

I. MULTIPLE CHOICES ITEMS								II.TRUE/FALSE ITEMS			
1	2	3	4	5	6	7	8	9	10	11	12
D	A	A	D	D	D	D	B	TRUE	FALSE	TRUE	FALSE

13. In the Triassic period of Mesozoic era.
14. The plate tectonics theory serves as the foundation upon which we understand the geologic processes that shape the Earth.
15. The major tectonic plates are: the African, Antarctic, Eurasian, Indo-Australian, North American, Pacific and South American plates. Some of the minor plates are: Somali Plate, Nazca, Indian, Arabian, Philippine, and Sunda Plate.
16. Oceanic plates are much thinner than continental plates. The rocks and geological layers are much older on continental plates than on oceanic plates. The Continental plates are much less dense than the Oceanic plates. The Granite and recycled material are much lighter than the heavy basalt layers of the ocean plates.
17. A divergent plate boundary occurs in a place where plates move away from each other whereas Convergent plate boundaries occur where two plates move toward each other.
18. Transform fault boundaries are where plates slide past each other laterally along fractures in the crust.

Dear learner; how did you find the lesson? I think you enjoyed it and found it very interesting and exciting. I hope you did well in the self-testing. Review and check the extent to which you have achieved the intended lesson objectives of the section. If you did well, then you should go on to the next section. What do you think?

SECTION THREE
1.3. MAJOR GEOLOGICAL PROCESSES AND RESULTING LANDFORMS

Section Overview

Dear learner! In this section, you will learn about the major geological processes and the resulting landforms on the earth's surface. Earth movements below the crust produce landforms of wide area and often great height, while the agents of denudation: rain, frost, river, ice, wind and sea wave, constantly work on the landforms modifying their surfaces and sometimes completely changing their appearance.

Earth's movements cause rocks to fold and fault, and they give rise to earthquakes and volcanoes. Isostatic adjustment and plate movement cause stress in rocks that make up the earth's crust. Crustal stress occurs when lithosphere plates collide, separate, or rub together. Such stress causes a strain on crustal rocks. Strain is a change in the shape or volume of rocks that results from the stress of being squeezed, twisted, or pulled apart.

The three main types of stress are compression, tension and shearing. When rocks respond to stress by becoming permanently deformed without breaking, the result is folding. Folding is most easily observed where, gradually, compressional forces move rock layers from horizontal positions into alternating ridges, anticlines, troughs, and synclines. The sides of a fold are called limbs. If compression continues, then simple folds are changed first to asymmetrical folds, then into over folds and finally into over-thrust folds.

The highest mountain chains in the world are made up of folded mountains and are commonly found where continents have collided. The process of fold mountain building is called orogeny.

Faults are fractures along which movements take place. Faulting can be caused by either lateral or vertical forces, or either compression or tension. In a non-vertical fault, the hanging wall is the rock above the fault plane and the foot wall is the rock below the fault plane

There are three types of faults. A reverse fault forms when compression causes the hanging wall to move up relative to the foot wall. A thrust fault is a special type of reverse fault. The fault plane of a thrust fault is nearly horizontal. Because of the low angle of the fault plane, the rocks in the hanging wall are pushed up and over the rocks in the foot wall.

A strike-slip fault is when the rock on either side of the fault plane slides horizontally. Strike-slip faults often occur along transform boundaries.

Earthquakes are sudden vibrations or tremors in the earth's crust. Earthquakes are also the result of internal forces. Earthquakes occur most commonly near places where the collision occurs.

The main collision regions where earthquakes occur are the mid-oceanic ridges, the ocean trenches and volcanic islands, and regions of crustal compression.

The sliding of two plates past each other in a horizontal or vertical direction also produces violent waves which cause earth tremors. Beneath the earth's crust there is a hot, liquid rock called magma.

Where plates separate from or collide with each other, the magma can sometimes force its way up through cracks in the crust until it reaches the surface. This process and effect are known as volcanic eruptions.
Landforms associated with volcanism may be classified into intrusive and extrusive rock formations. The product of intrusive volcanicity is sills, dikes, and batholiths, while the product of extrusive volcanicity is lava plateaus, geysers, and hot springs.

External forces act upon the surface of the earth. Rocks at the earth's surface are constantly wearing away or denuding by the force of weathering and erosion. Weathering is the simple breaking down of rocks that lie exposed to weathering. There are two types of weathering: mechanical and chemical weathering.
Mechanical weathering breaks rocks up into smaller pieces. Its main agents are frost, temperature change, plants and animals.

Chemical weathering causes the rock to dissolve or decompose. Its main agent is rain. Erosion is also a form of weathering the breaking down of rock particles.
Erosion is caused by moving water moving ice, and moving air. Materials that are carried away by the forces of erosion are eventually deposited in other areas. This is known as a deposition. Drawing on the section components highlighted above, focus on the learning objective outlined.

Section Learning Outcomes

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

- distinguish between endogenic and exogenic forces of the earth;
- describe the major geological processes and their importance;
- describe the process of each internal force;
- relate some major landforms with their respective internal forces;
- explain the effects of earthquakes on infrastructure like buildings, dams, and roads;

KEY TERMS:

- Convergent,
- Transform,
- Divergent,
- Conservative,
- Constructive,
- Folding,
- Faulting,
- Anticline,
- Syncline,
- Vents,
- Fissures,
- Craters,
- Tsunamis

Dear learner: the term "geological processes" describes the natural forces that shape the physical makeup of our planet earth. Plate tectonics, erosion, chemical weathering and sedimentation are examples of forces that significantly affect the Earth's surface and account for the major features of the surface of the earth.

Dear Student, imagine about the geological process and make points regarding what involve in the process before reading the note described.

The geological processes are closely studied by geologists and earth scientists to:

- Improve the understanding of the planet's history;
- Help to locate useful resources, such as metal ores; and
- Aid the prediction of potentially disastrous events, such as earthquakes, tsunamis and volcanic eruptions.

Some of the geological processes that bring about changes on the surface of the earth are divided into two. They are:

1. Endogenic or internal forces
2. Exogenic or external forces.

Dear student, what is the difference between indogenic and exogenic forces?

1.3.1 Endogenic or internal forces

What are endogenic forces? What examples of internal forces affecting the earth's part-surface can you think of from your experience?

Dear student, compare what you have said about the question posed to the explanation made in the next paragraph. Endogenic/Internal forces are forces that come from the inside of the earth. These forces create irregularities or unevenness on the face of the earth. They also form ups and downs on the crust of the earth by breaking, bending, or folding the rock. Some of the endogenic forces include:

1. Folding
2. faulting
3. earthquakes and
4. Volcanic eruptions.

1.FOLDING

Student, how does folding occur on the earth's surface?

Folding occurs when rock layers are pushed by the earth movements sideways. The movement may be only from one direction. It may also be from two directions. When rock layers are pushed from two directions, they are compressed. The rock layers are folded (see Figure 1.10).The layers of rock bend up to form an upfold or anticline. Those which bend down form a downward arch or syncline.

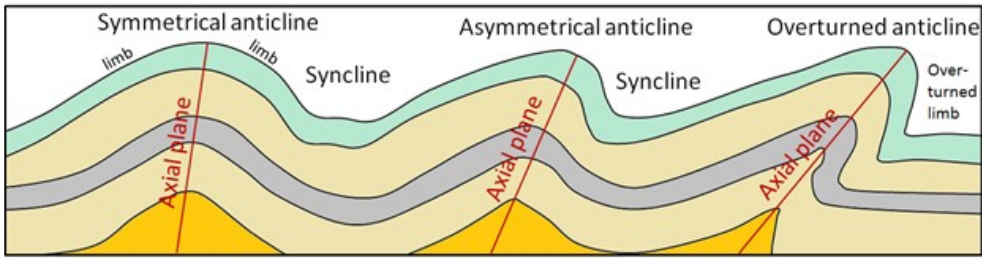


Figure1.10: Anticline, syncline

If compression continues then simple folds are changed into asymmetrical folds, over-folds and over-thrust folds. (Figure 1.10)

An asymmetrical fold is when one limb is steeper than the other.

Over fold is when one limb is pushed over the other limb.

Overthrust fold: is when pressure is very great, a fracture occurs in the fold and one limb is pushed forward over the other limb. Dear student, note figure 1.10 very well and try to identify the folding caused key features and associated events to it. Dear learner, how Fold Mountains are formed?

How Fold Mountains are formed: Fold Mountains consist of great masses of folded sedimentary rocks. In the beginning, these rocks must have been laid down on the bottom of sea floors. This deposition on sea floors continued for millions of years. At last, very wide and thick layers of sedimentary rocks were formed. Later on, they were folded through compression. Student, what are the major types of Fold Mountains?

Types of Fold Mountains

The Fold Mountains of the world are grouped into two: They are:

1. Young fold mountains, and
2. Old fold mountains

Student, how can we classify Fold Mountains into two categories?

During the last 400 million years, there have been three main mountain-building periods. These periods experienced mountain-building processes known as orogenesis.

Fold Mountains formed during the first and second mountain-building periods are known as old fold mountains. Old Fold Mountains are dating back 250 to 300 million years, and they are characterized by Lower and more weathered. Scandinavian (Calidonides) Mountains, the Appalachian Mountains, and the Urals are some examples of old Fold Mountains. The last and most recent is known as Alpine orogeny. Mountains belonging to this period include the Andes, Rockies, Alps, Himalayas, Atlas and Australian Alps. They are called young fold mountains. Dear student, for more comprehension refer to figure 1.11 and try to identify the positions and types of Fold Mountains of the world.

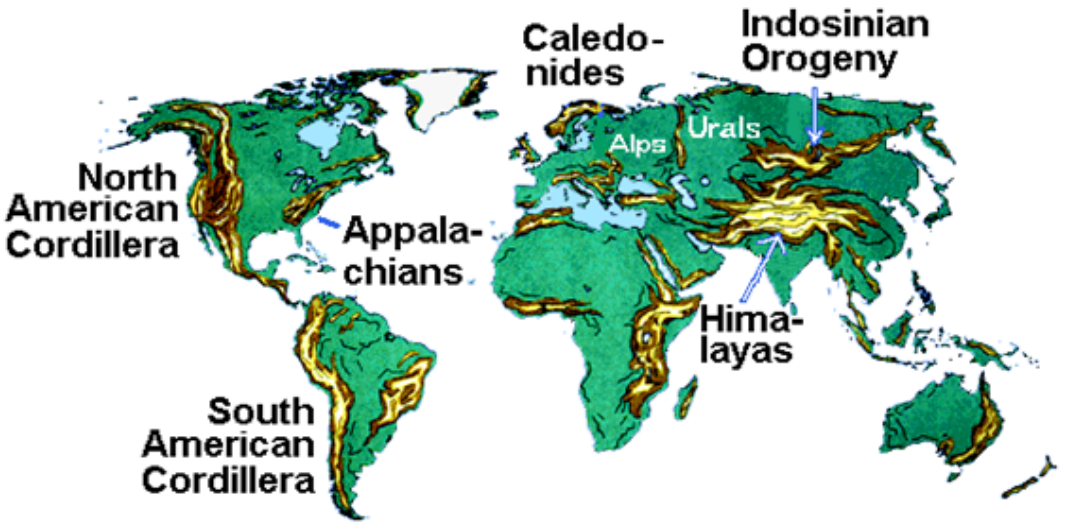


Figure 1.11: major Fold Mountains of the world

2. FAULTING

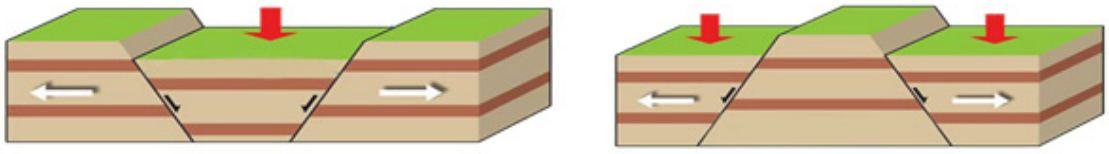
Student, what is the difference between folding and faulting?

A fault is a crack in the earth's crust. It is formed by the forces of tension and compression. A fault may occur in the rocks along a single line. When this happens, rocks are displaced either upward or downward. Usually a series of faults could develop on the surface of the earth. These faults may be roughly parallel to each other. Where parallel faults have occurred, the land in between may sink or may be forced to move upwards. These movements of the earth will result in the formation of the following landforms:

1. Rift valleys
2. Block mountains

Rift valleys: They are formed when the land between two faults sinks. The blocks on both sides of the valley form plateaus (e.g. Figure 1.12a).

Block Mountains: They are formed when the land between two parallel faults is pushed upward. A block mountain is called a horst (e.g. Figure 1.12b).



(a) Graben/ Rift Valley (b) Horst/ Block Mountain

Figure 1.12: Rift valley and Block Mountain

3. EARTHQUAKES

Dear student, have you ever noticed an earthquake?

The sudden shaking of the ground that occurs when masses of rock change position below the Earth's surface is called an earthquake. The shifting of the rock releases a great amount of energy, sending out shock waves that travel through the rock, and cause the ground to shake. These shock waves, called seismic waves by Earth scientists, may be powerful enough to alter the surface, thrusting up cliffs and opening great cracks in the ground.

Student, where do we find the major fault lines of the world?

Earthquakes occur most often along geologic faults, which are fractures in the rocks of Earth's crust. The major fault lines of the world are located at the fringes of the huge tectonic plates that make up the crust. Earthquakes, called temblors by scientists, occur almost continuously. Fortunately, most of them can be detected only by sensitive instruments called seismographs. A scale used for reading the effect of an earthquake is called a Richter scale. Richter scale, measures the effect in a logarithmic scale (Figure1.13).

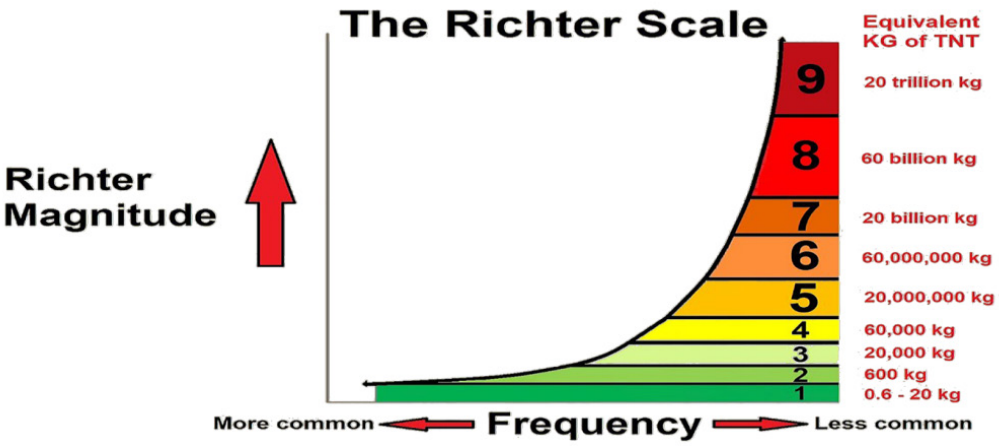


Figure1.13: Richter scale

The strongest and the most destructive quakes are associated with ruptures of the crust, which are known as faults. Earthquakes often cause dramatic changes at the Earth's surface.

In addition to the ground movements, other surface effects of earthquakes include changes in the flow of groundwater, landslides, and mudflows. Earthquakes can do significant damage to buildings, bridges, pipelines, railways, embankments, dams, and other structures.

Underwater earthquakes can cause giant waves called tsunamis (Figure1.15). Tsunamis can be catastrophic, with the potential to wipe out coastal settlements.

Figure 1.15: Tsunamis, effects of the earthquake

Student, take minutes and review about main points of folding, faulting and earthquake you have learned and summarize your understanding.

4. Volcanism

What is volcanism and its effects on the earth's surface?

Your response to the question is hoped to initiate your interest in the next lesson study. Accordingly relate your points to the descriptions made about volcanic processes.
Volcanism is the process by which molten rock or magma, together with gaseous and solid materials is forced out on the surface of the earth. Magma may reach the surface of the earth through two types of openings:

1. Vents
2. Fissures

Vents are holes or openings like a pipe throw which magma flows out into the surface of the earth. If lava emerges via a vent, it builds up a volcano (a cone- shaped mound).
Fissures are large and narrow cracks or fractures in the rock. Molten materials may move upward along the cracks and spread out over the surroundings. If the lava emerges via a fissure, it builds up a plateau.

Volcanoes: The word volcano refers to the form or structure, usually conical, produced by accumulations of erupted material. In some volcanic eruptions, the molten rock called magma when it is underground and lava when it reaches the surface flows slowly out of the vent.

Volcanoes occur mainly near the boundaries of tectonic plates. They form along belts of tension, where plates diverge, and along belts of compression, where plates converge. Nearly 1,900 volcanoes are active today or are known to have been active in historical times. Of these, almost 90 percent are situated in the Pacific Ring of Fire (Figure .17).

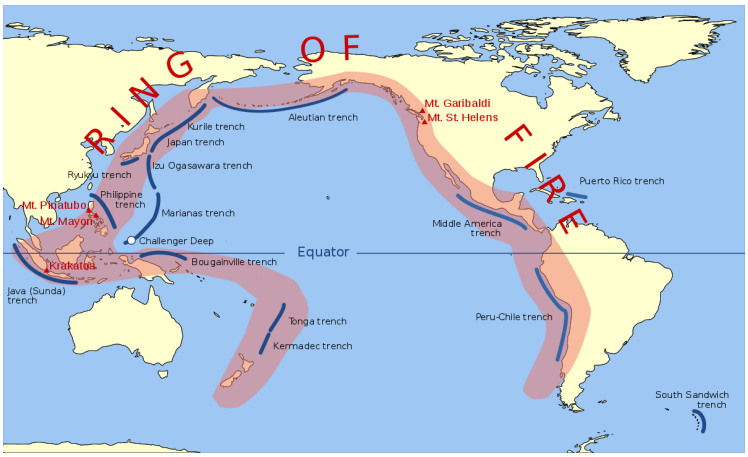


Figure 1.17: Pacific Ring of Fire

Landforms created by volcanoes include craters and calderas.

What is the difference between craters and calderas?

Craters are formed either by the massive collapse of material during volcanic activity, by unusually violent explosions, or later by erosion during dormancy. (Figure1.21).

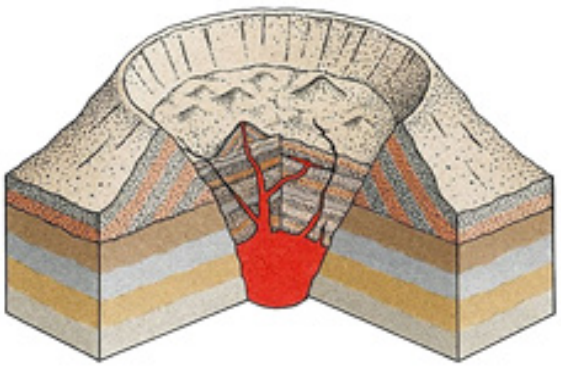


Figure1.21: Crater volcano

Calderas are large, basin-shaped depressions. Most of them are formed after a magma chamber drains and no longer supports the overlying cone, which then collapses inward to create the basin (Figure1.22).

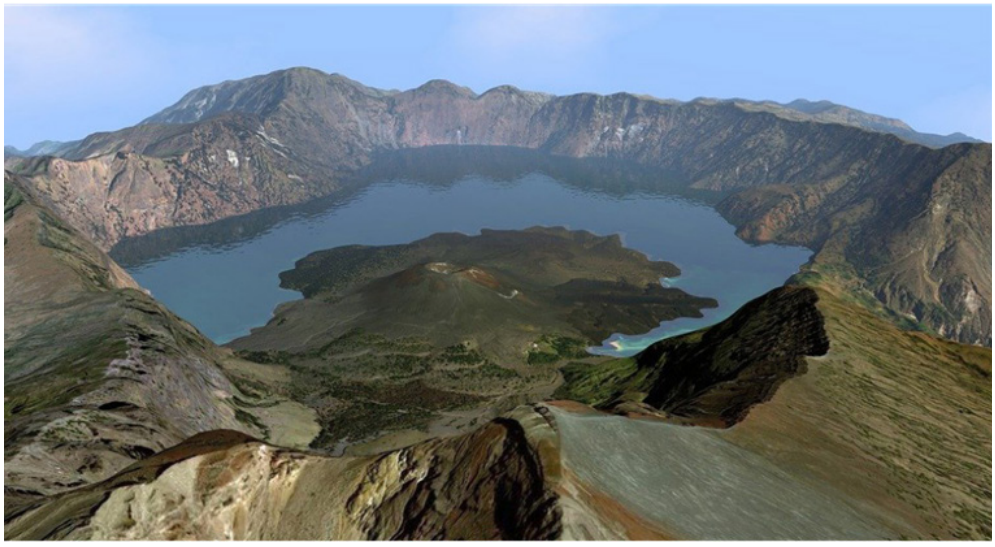


Figure 1.22: Calderas; Segara Anakan Crater Lake, Rinjani Mt., Indonesia

Craters are formed by the outward explosion of rocks and other materials from a volcano. Calderas are formed by the inward collapse of a volcano. Craters are usually more circular than calderas. (Calderas may have parts of their sides missing because land collapses unevenly.

What are the intrusive or plutonic igneous rocks formed beneath the Earth's surface?

When magma cools and solidifies within the crust intrusive or plutonic igneous rocks are formed deep beneath the Earth's surface. Thus, intrusive land forms are the results of part of the magma that solidifies within the crust: Some of the intrusive igneous rocks include batholith, dyke, and sill (Figure1.23).

Batholith is a very large dome-shaped intrusion of igneous rock. It is located several kilometers deep in the crust, and extends over hundreds of square kilometers. Sometimes, it forms the core of a mountain.

Sill is a near-horizontal intrusion of igneous rock between two rock layers. The cooled rock forms a sheet more or less parallel to the surrounding layers of rocks.
Dyke is formed as the magma rises through a near-vertical crack. As the magma cools, it forms a vertical sheet of rock or a wall-like structure.

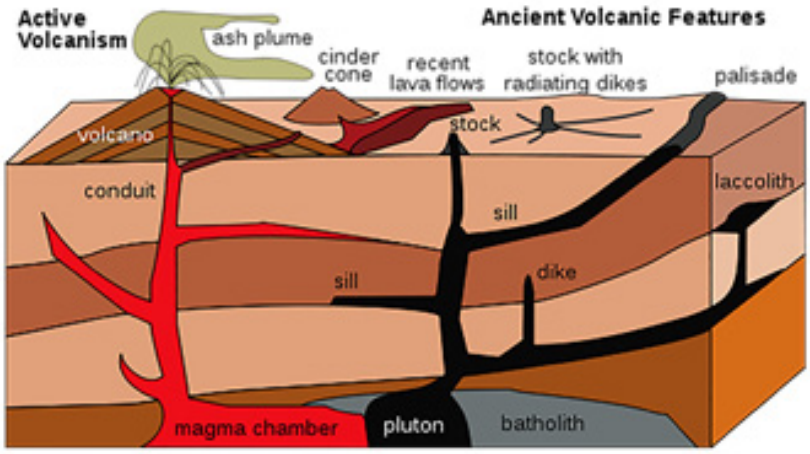


Figure1.23: Batholith, Sill and Dyke

Dear student, what is the difference between batholith, sill and dyke?

1.3.2 EXTERNAL (EXOGENIC) FORCES

Dear learner, we hope you have understood internal forces and their effect on the earth's surface well. Hence, now, based on the experience construct your understanding of external forces affecting the earth's surface presented in the following lesson note. External forces are forces that act on the surface of the earth from the outside. These forces/agents include running water, wind, moving ice, sea waves, etc.

Usually external forces level the up and down of the earth. This process occurs in two ways:

1. Denudation and
2. Deposition

Denudation is the lowering of the land by wearing away the surface of the earth. Denudation consists of:

1.Weathering and
2. Erosion

Weathering refers to the gradual break down of rocks into pieces. These rocks lie on the surface of the earth. Weathering of rocks takes place in two ways. They are:

1. Physical (Mechanical) weathering
2. Chemical weathering

Physical weathering is the process by which rocks are broken into smaller pieces. Each fragment has similar chemical characteristics to the original. Three important physical processes cause rocks to break down into pieces. They are:

I. Thermal expansion and contraction
II. Frost action
III. Plant and animal action

Thermal expansion and contraction: This takes place in hot and dry areas, where temperature brings change to the surface of the rocks. In such areas, in the daytime, rocks are heated greatly. This causes the surface layers of rocks to expand.

At night temperature becomes low. The same layer which has expanded at daytime contracts at night. Due to this contraction and expansion process, the rock layers peel off and fall to the ground. The process of breaking rock layers caused by changes in temperature is called exfoliation (Figure 1.24).

Figure1.24: Exfoliation

Frost action: When water freezes, its volume increases. If the water in the cracks of rocks freezes, it expands and pushes the sides of the cracks. Then the cracks widen and deepen. Frost action is very common in the cooler areas of the world. Due to frost action rocks break up into pieces. Then, the fragments collect around the lower slopes of the rocky outcrops. Such rock collections are called screes.

Plants and animals' action: The roots of some plants, especially trees, enter the cracks of rocks. When the roots continue to grow, they need more space. Then, they force the cracks and widen them. This leads to the breaking down of the rock. Creatures such as worms, rabbits, and moles, make holes in the ground to find food and shelter. While doing this, they break up rocks.

Chemical weathering: This involves complete changes in the internal structure of rocks. Chemical weathering can occur because of:

- Rain action,
- Plants and animals

Rain action/carbonation: Water is the most important agent of chemical weathering. Rain water dissolves oxygen and carbon dioxide as it falls through the atmosphere. Therefore, such water is not pure. Some minerals like iron will rust when they become in contact with rainwater that has dissolved oxygen from the atmosphere. Rusting makes iron weak and breakable. Minerals that have carbonates are dissolved when they come in contact with rainwater that has carbonic acid. Limestone is one example.

Chemical weathering is most active in limestone. When water flows between layers of limestone, it dissolves and erodes parts of the rock and forms holes. These holes become larger and wider as they continue to be eroded. Finally, very large underground water holes called caves are formed. Rivers that pass through limestone areas often flow underground through caves. Example of this Weyb river in Bale or Sof Omar (Figure1.25).

In the underground cave, water passes slowly through the roof of the cave. Thus, a drop of water hangs from the ceiling of the cave. When the drop of water falls, a small amount of the solution is left as a deposit on the ceiling. After a long time, these small deposits build up to form a limestone column that hangs down from the ceiling. This is known as a stalactite. The water drops that falls from the ceiling form small deposits on the floor. These deposits slowly build upward and form other limestone columns from the floor. We call these stalagmites. After a long time, a stalactite hanging down from the ceiling may join with a stalagmite growing upward to form a pillar. Thus, the ceiling and the floor of the cave are connected by such pillars (Figure 1.25).

Figure1.25: Stalagmites and stalactites in Sof Omar Cave in Ethiopia

How do animals and plants act as agents of chemical weathering?

Bacteria in the presence of water break down certain minerals in the soil. Plants also absorb minerals. Moreover, decaying vegetation produces organic acid which causes a further break down of minerals. All these actions help to weaken and breakup the rocks.

Erosion and Deposition:

How do we define erosion?
What are the causes and effects of erosion?

Dear learner, attempt the questions posed and get prepared for the next lesson study. Soil erosion is the movement of soil and rock particles from one place to another. The major agents of erosion include:

- Running water
- Underground water
- Wind
- Sea waves
- Glaciers
- Running water erosion:

Running water includes all sorts of water that flows on the surface of the earth. Among the external forces, running water is more powerful in shaping the surface of the earth.

Running water results in different types of landforms (see Figure1.26). Some of them are the following:

Sheet erosion: It occurs when surface water moves in a wide flow. This moving water erodes top soil evenly.

Rill erosion: It occurs when surface water cuts small channels or ditches in the soil.

Gully erosion: This happens when floods join together and cut the ditches wider and deeper. Gully erosion can become severe the place where all or most of the vegetation has been removed

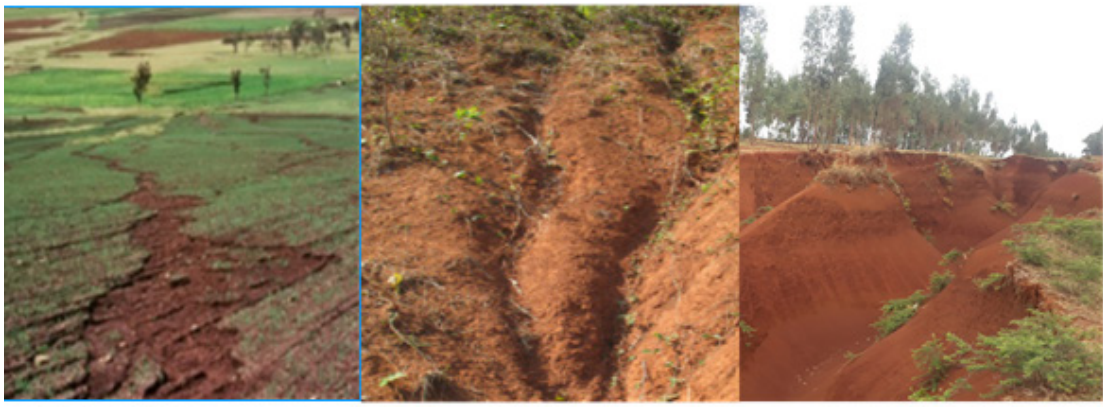


Figure 1.26: Sheet, Rill and Gully erosion (from left to right).

Student, take minutes and examine what figure 1.26 portrays, interpret what it represents and reflect on humans responsibility to alter the situation.

Landform associated with a river course:

a. Upper course: a river is swift and strong. Therefore, it cuts a deep gorge or canyon.
b. The middle course of the river: the river valley becomes wider and larger. The volume of water increases because of the many tributaries that join the main river at its confluence.
c. The lower course of a river: a river flows slowly. It has a wide and flat-floored valley. Most materials carried in suspension are deposited.

These materials do form different features along the course of the river.

Major land forms associated along a river course include:

V-shaped valleys: are narrow and steep-sided valleys in the upper course of a river. They have the shape of the letter "V".

Gorge: It is a valley that is deep and narrow with steep walls. The rock walls are nearly vertical.

Waterfalls: They are formed when a river flows over a hard rock that cannot be eroded. The soft rock is eroded fast. Thus, the hard rock will remain hanging over which water

Figure1.27: V-shaped valley, Waterfalls and gorge (from left to right)

Types of middle-course landforms are: Meanders and Ox-bow Lake.

Meanders: It is the winding of a river making zigzag movements (Figure.28).

Ox-bow Lake: It is a crescent-shaped lake occupying a cut-off channel that has been abandoned. It is bent like the shape of the letter 'U' (Figure1.28).

Figure1.28: Meanders Ox-bow Lake, respectively from the left to the right

Types of lower-course landforms are flood plain and delta.

Flood plain: It is a land surface formed from sediments deposited along the banks of the lower course of a river (Figure 1.29).

Delta: It is a triangular piece of land found at the mouth of a river (Figure1.29). The name originated from the Greek letter delta.

Figure1.29: Flood plain& Delta, respectively from the left to the right.

Dear student, what are the common features performed by the wind?

Wind action: It is very powerful in the desert and semi-desert areas. The most common features formed by the wind in these areas include the Sand dunes, Barkhan, and Loess deposits.

The Sand-dunes are little hills of sand (Figure1.30) formed when sand collects around obstacles, such as rock or bits of vegetation.

Barkhan is a hill with the shape of a crescent moon or quarter moon.

Loess deposits are fertile soils in deserts deposited by wind. There are large loess deposits in North China.

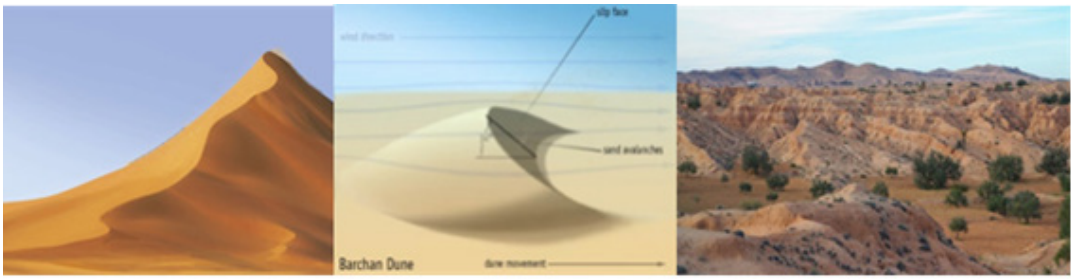


Figure1.30: Sand dunes, Barkhan, Loess (Left to right)

Learner, what are the common features performed by sea water along the coastal lands?

The work of the sea: The most important features formed along the coast lands by work of the sea include a beach, spit and lagoon.

The beach is a strip of land along the sea coast covered by varied types of sediments (Figure1.30). Spit is a low-lying, narrow deposit of sand or silt attached at one end to the land moving deep into the sea at the other end (Figure1.30). A lagoon is an area of salt water separated from the sea by loose sand banks (Figure1.30).

Dear student what is the difference between beach, spit and lagoon?

Figure 1.31: beach, spit, lagoon (left to right)

Mass wasting:

Student, what do we mean by mass wasting?

Mass Wasting refers to the down slope movements of rock, regolith, and soil under the influence of gravity. Actual gravity is the controlling factor for mass wasting. There are also other factors. The major ones are:

- Water;
- The angle of the slope, and
- The activities of people.

How do water and the angle of the slope cause mass wasting?

Dear student, please attempt this question and make points before reading the details about factors causing mass wasting.

Water: We know that a portion of rain water that falls on land soaks into the ground. Part of the socked water collects into the pores of the sediments. Such water could reduce the cohesion among the particles which results in a lack of internal resistance. Subsequently, the materials are set in motion by the force of gravity.

The Angle of the Slope: The steepest slope at which materials remain firm varies from 25 to40 degrees. This depends on the size and shape of the particles. For example, the larger and more angular particles maintain the steepest slopes. If the angle is increased, the rock debris will adjust by moving down the slope.

Student, which activities of people create favorable conditions for mass wasting?

Activities of people: People often create favorable conditions for mass wasting along steep and unstable slopes. This happens due to farming and overgrazing of the areas. In different parts of Ethiopia, mass wasting occurred several times. This phenomenon resulted in the destruction of human life and properties. Student, at this stage it is hoped that you have identified the nature of endogenic and exogenic forces and their effects on the face of the earth. In this regard imagine and reflect on what humans should do when they face in such problems and then, perform the activity and exercises that follow.

Resource

Greeley, R., & Iversen, J. D. (1987). Wind as a geological process: on Earth, Mars, Venus and Titan (No. 4). CUP Archive.

Dietrich, W. E., & Perron, J. T. (2006). The search for a topographic signature of life. Nature, 439(7075), 411-418.

Activity 1.3

What is the difference between weathering and mass wasting?

Answer Key to Actiity1.3

The difference between weathering and mass wasting is Weathering refers to the gradual break down of rocks into pieces. These rocks lie on the surface of the earth. Mass Wasting refers to the down slope movements of rock, regolith, and soil under the influence of gravity.

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 alternatives 'Yes' or 'No'.

№	Items	Yes	No
1	Define geography as a subject?		
2	Describe the scope of geography?		
3	Recognize the branches of geography?		
4	Identify the sub-branches of physical geography?		

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 exercise 1.3

Dear learner; I hope you enjoyed reading the notes and doing the activities in section two. I feel you find them all fascinating and made you curious. Now, do the questions given from 1-9 to appraise yourself on how far you understood the lesson you studied.
Instruction: Attempt questions 1-9 based on the instructions given.

Part I.

Multiple choice: Choose the best answer from the given alternatives (6 points)

1. In the atmosphere, carbonic acid forms from the reaction of carbon dioxide and _____.
   A. fossil fuels C. oxygen
   B. nitrogen D. water
2. Which of the following factors would increase the chemical weathering rate?
   A. increasing rainfall C. increasing organic activity
   B. increasing temperature D. all of these
3. Which of the following conditions promotes slow chemical weathering?
   A. cold temperatures C. high rainfall
   B. thick soils D. fracturing
4. The largest intrusive feature is a_____
   A. Dike C. laccolith
   B. sill D. batholith
5. Sheet-like intrusions that form vertical or steeply-dipping sheets of igneous rock are:
   A. Dike C. Pluton
   B. Sill D. batholith
6. Sheet-like intrusions that form a horizontal or gently-dipping sheet of igneous rock are:
   A. Dike C. Laccolith
   B. Sill

Part II.

Short note writing: Give short answer to the following questions (7-9) (6 points).

7. What are some of the major fold Mountains of the world?
8. What is the instrument that measures the magnitude of earthquakes?
9. What are the three types of volcanoes?

Answer Key to Self-test exercise 1.3

Dear learner; I hope you did well in the self-testing. You are now at the stage of completion of the 4th section of the unit. Thank you for doing the self-test questions. Please compare your answers with the feedback given and make corrections for any errors, if available.

1.C 2.B 3.B 4.D 5.A 6. B

7. The major fold mountains of the world are Himalaya, Andes, and Alps mountains.
8. Seismographs are instruments used to record the motion of the ground during an earthquake.
9. There are three types of volcanoes: cinder cones, composite volcanoes, and shield volcanoes.

Dear learner; how did you find the lesson? I think you enjoyed it and found it very interesting and exciting. I hope you did well in the self-testing. Review and check the extent to which you have achieved the intended lesson objectives of the section. If you did well, then you should go on to the next section. What do you think?

Unit SUMMARY

The continental drift theory entails that the present continents were formed from a single continent called PANGAEA. Plate tectonics is the modern theory of the movement of Earth's outer shell, or lithosphere. The theory of plate tectonics helps explain how the world's large landforms were formed. This theory views the earth's crust as divided into more than a dozen rigid, slow-moving plates.
The movements of these plates construct continents, mountain ranges, and ocean basins; tectonic movements also cause earthquakes and volcanic eruptions. Earth movements within and below the crust produce landforms of wide area and often great height, while the agents of denudation: rain, frost, river, ice, wind and sea wave, constantly work on the landforms modifying their surfaces and sometimes completely changing their appearance.

The three main types of stress are compression, tension and shearing. When rocks respond to stress by becoming permanently deformed without breaking, the result is folding. Folding is most easily observed where, gradually, compressional forces move rock layers from horizontal positions into alternating ridges, anticlines, troughs, and synclines. The highest mountain chains in the world are made up of folded mountains and are commonly found where continents have collided. The process of folding mountain building is called orogeny.
Faults are fractures along which movements take place. Faulting can be caused by either lateral or vertical forces, or either compression or tension. In a non-vertical fault, the hanging wall is the rock above the fault plane and the foot wall is the rock below the fault plane.

There are three types of faults. A reverse fault forms when compression causes the hanging wall to move up relative to the foot wall. A thrust fault is a special type of reverse fault. The fault plane of a thrust fault is nearly horizontal. Because of the low angle of the fault plane, the rocks in the hanging wall are pushed up and over the rocks in the foot wall.

Earthquakes are sudden vibrations or tremors in the earth's crust. Earthquakes are also the results of internal forces. Earthquakes occur most commonly near places where the collision occurs.
The main collision regions where earthquakes occur are the mid-oceanic ridges, the ocean trenches and volcanic islands, and regions of crustal compression. The sliding of two plates past each other in a horizontal or vertical direction also produces violent waves which cause earth tremor. Beneath the earth's crust there is a hot, liquid rock called magma.

Where plates separate from or collide with each other, the magma can sometimes force its way up through cracks in the crust until it reaches the surface. This process and effect are known as a volcanic eruption.

Landforms associated with volcanism may be classified into intrusive and extrusive rock formations. The product of intrusive volcanicity is sills, dikes,and batholiths, while the product of extrusive volcanicity is lava plateaus, geysers, and hot springs.

External forces act upon the surface of the earth. Rocks at the earth's surface are constantly wearing away or denuding by the force of weathering and erosion.

Weathering is the simple breaking down of rocks that lie exposed to weathering. There are two types of weathering: mechanical and chemical weathering. Mechanical weathering breaks rocks up into smaller pieces. Its main agents are frost, temperature change, plants and animals. Chemical weathering causes the rock to dissolve or decompose. Its main agent is rain. Erosion is also a form of weathering the breaking down of rock particles.

Erosion is caused by moving water moving ice, and moving air. Materials that are carried away by the forces of erosion are eventually deposited in other areas. This is known as a deposition.

Unit Review Exercise

Dear learner; I hope you enjoyed reading the unit and doing the self-test questions. Now you are at the stage of completion of unit One. But, before moving to the next unit you are required to do 'these questions'. Hence, please try to do it carefully and properly.

Part I. For the following questions choose the best answer among the given alternatives for each.

1. Which of the following is NOT a major tectonic plate?
   A. African Plate C. Eurasian plate
   B. Antarctic plate D. Arabian plate
2. Which of the following rock types is most representative of the composition of the oceanic crust?
   A. Shale C. Schist E. Limestone
   B. Granite D. Basalt
3. Which of the following rock types is most representative of the composition of the continental crust?
   A. Shale C. Schist E. Limestone
   B. Granite D. Basalt
4. What is the wearing away or breaking down of rocks called?
   A. Deposition C. Glaciers
   B. Erosion D. Weathering
5. Which of the following is an indication of erosion?
   A. The wearing away of rocks, their transportation & deposition
   B. The breaking of rocks
   C. The dropping of sediment
   D. Movement of loose material down a slope
6. In which of the following climates will chemical weathering be most rapid?
   A. hot and dry C. cold and dry
   B. hot and humid D. cold and humid
7. Carbonic acid, the primary agent of chemical weathering is produced by_____ .
   A. carbon dioxide dissolving in rainwater B. plant roots
   C. bacteria that feed on plant and animal remains D. all of these
8. Caves are most likely to form in which of the following rock types?
   A. granite C. basalt
   B. limestone D. sandstone
9. Which of the processes is not an example of chemical weathering?
   A. dissolution of calcite C. splitting of a rock along a fracture
   B. breakdown of feldspar to form clay D. rusting of a nail
10. Which of the following factors would increase the rate of weathering?
   A. increasing rainfall
   B. increasing temperature
   C. increasing organic activity
   D. all of these

Answer key to Unit Review Exercise

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

References

Anderson, M. (2012). Introduction to Earth Science, Investigating Plate Tectonics Earthquakes, and Volcanos. New York: Britannica Education Publishing.

Bull, W. B. (2007). Tectonic Geomorphology of Mountains: A New Approach to Paleoseismology. Carlton, Victoria 3053: Blackwell Publishing Ltd Blackwell.

Cox, A., Brian, R., Cox, A., & UN, S. (1986). Plate Tectonics, How It Works. London: Blackwell Scientific Publications.

Dietrich, W. E., & Perron, J. T. (2006). The search for a topographic signature of life. Nature, 439(7075), 411-418.

Greeley, R., & Iversen, J. D. (1987). Wind as a geological process: on Earth, Mars, Venus and Titan (No. 4). CUP Archive.

Greene, M. T. (2015). Alfred Wegener: Science, exploration, and the theory of continental drift. JHU Press.

Wilson, J. T. (1963). Continental drift. Scientific American, 208(4), 86-103.

UNIT TWO
CLIMATE CHANGE

Unit Introduction

Dear learner; in the previous grade level modules you learned about climatic classification and regions of the world, the factors that influences the world climate and indigenous climatic classification of Ethiopia. The focus of this second unit is climate change. Climate change is one of the most significant environmental challenges facing humankind today. Though there are several arguments over the concept of climate change, scientifically speaking, there is no doubt about the existence of global warming and climate change. It is now time to find out what actions will be taken at the political and social spheres to make our world more resilient and fight climate change. Geography has much to contribute to understanding of the complex spatial dimensions of climate change, including the observed and anticipated geographical differentiation in potential impacts and vulnerability. Therefore, this unit addresses about basic concepts of climate change such as global climate change, cause and consequences of climate change, adaptation and mitigation strategies, international conventions and agreements on climate change and finally the climate resilient green economy of Ethiopia. Thus, concentrate on detail sections of the unit attempt to achieve the unit learning outcome set below.

Unit Contents

Unit Outcomes

By the time students complete this unit, they will be able to:

- explain the basic concepts of climate change;
- distinguish between natural and human induced climate changes;
- analyze trends in climate change in Ethiopia and the world at large;
- recognize the major climate change, causes, mitigation and adaptation strategies;
- explain the purpose and pillars of the Ethiopian Climate Change Resilient Green Economic Strategy; and
- assess the major international conventions and agreements in view of their aspirations and achievements so far.

The Required Study Time: 21 hours

Unit Learning Strategies

In the unit, the suggested learning strategies are:

- written brainstorming questions;
- Problem-solving method;
- individual project;
- report writing;
- observation;
- written activities;
- practical activities;
- self-test assessments;
- Activities; and
- Maps.

SECTION ONE
2.1. Basic Concepts of Climate Change

Section Overview

Dear learner, in this section you will learn about the concept of climate change. Climate change involves variation of major climatic elements. The following instance may explain this fact. The average temperature of the earth's atmosphere has risen by about 0.50C during the past 100 years. At the same time, mid latitude continents have grown wetter, while the tropics have generally become drier. Continuing climate change could alter ecosystems; drive species in to extinctions, impact human settlement, food production, and the distribution of disease.

Climate change is not unique to the twentieth century. The geological record of almost every locality provides evidence that past regional climates were different from those of today. It is clear that the Earth has had changes in its average temperature many times in the geological past before humans were present. Scientists initially tried to determine whether the warming was a natural phenomenon or the result of human activity. Several gases such as carbon dioxide, chlorofluorocarbons, methane and nitrous oxide are known as greenhouse gases because they let sunlight enter the atmosphere, but slow the loss of heat from the Earth's surface.

Section Learning Outcome

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

- define climate change; and
- describe the trends of climate change.

KEY TERMS:

- Climate Change,
- Global warming,
- Greenhouse gases,
- IPCC,

Please student make reflection on this question before reading the next descriptions.

1. What is the difference between climate and metrology?
2. What is global warming explain?
3. What is the example of global warming?
4. What is the difference between climate change and climate variability?
5. How can we explain climate change trends?

The average climate around the world is called global climate. When scientists talk about global climate change, they are talking about the global climate and a pattern of change that's happening over many years.

One of the most important trends that scientists look at is the average temperature of the Earth, which has been increasing for many years. This is called global warming. Rising global temperatures lead to other changes around the world, such as stronger hurricanes, melting glaciers, and the loss of wildlife habitats. This is because the Earth's air, water, and land are all interdependent and prone to the climate change. This means a change in one place can lead to other changes somewhere else. For example, when air temperatures rise, the oceans absorb more heat from the atmosphere and become warmer. Warmer oceans, in turn, can cause stronger storms as shown in (Figure 2:1)

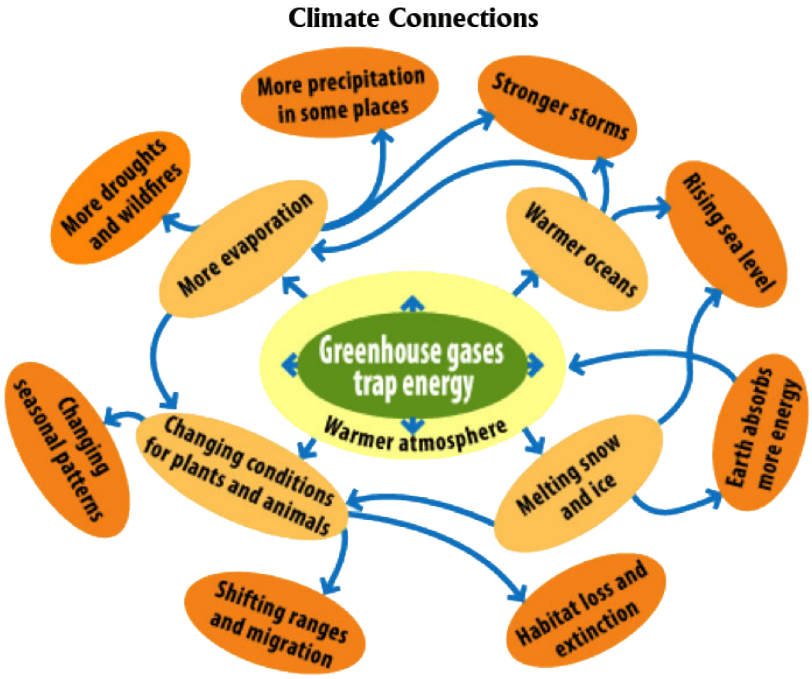


Figure 2:1 Global warming leading to a variety of changes.

According to Intergovernmental Panel on Climate Change (IPCC), Climate change refers to a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer.

In the minds of many, climate change is a relatively distant problem that simply implies that it will get hotter. Nevertheless, the consequences are much deeper and should be taken more seriously. [Students, what do you think about humans responsibility in this regard? Try to reflect on this question by referring to the figure 2.2 given below.

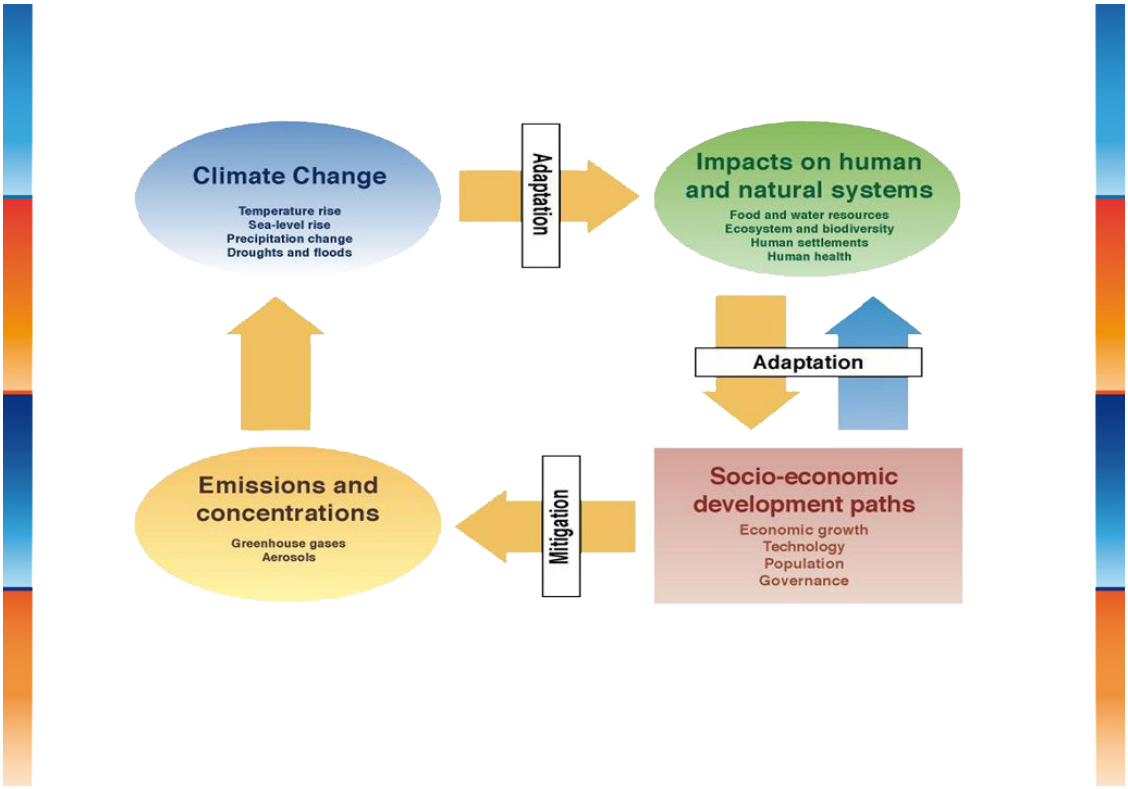


Figure 2.2: Climate change: an integrated frame-work.

Note: The yellow arrows show the cycle of cause and effect among the four quadrants in the figure; the blue arrow indicates the societal response to climate change impacts.

2.1.1 Trends in climate Change

Please student make reflection on these questions before reading the next descriptions.

Activity 2.1.a

1. What is UN framework for climate change?
2. What is the meaning of global land ocean temperature index?
3. How much has the temperature changed over the past decades?
4. What temperature changes are expected at the end of the 21st century?
5. What do you expect about the climatic condition in your locality in the next 10 or 20 years? Will the temperature and rainfall increase or decrease?

The Earth's climate has always changed and evolved. Some of these changes have been due to natural causes, but others can be attributed to human activities such as deforestation, atmospheric emissions from industry and transport, which resulted in the storage of gases and aerosols in the atmosphere. They are known as greenhouse gases (GHGs) because they trap heat and raise air temperatures near the ground, acting like a greenhouse on the surface of the planet.

The Intergovernmental Panel on Climate Change (IPCC) pointed out in its 2001 Third Assessment Report on the state of the global climate that an increasing body of observations gave a collective picture of a warming world and other changes in the climate system. The report documented that the 1990s had been the warmest decade worldwide, and 1998 the warmest year since instrumental records had begun in 1861.

The report also indicated that the twentieth century was likely to have been the warmest century in the last 1,000 years. Subsequently, the observed evidences revealed that most of the warming experienced over the past 50 years had resulted from human activities. Hence, the implication suggests, human influence will continue to change atmospheric composition throughout the twenty-first century.

Global warming has begun to affect the sea level, snow cover, ice sheets and rainfall. Shifts in regional patterns of climate marked by rising air temperatures are already affecting watersheds and ecosystems in many parts of the world.

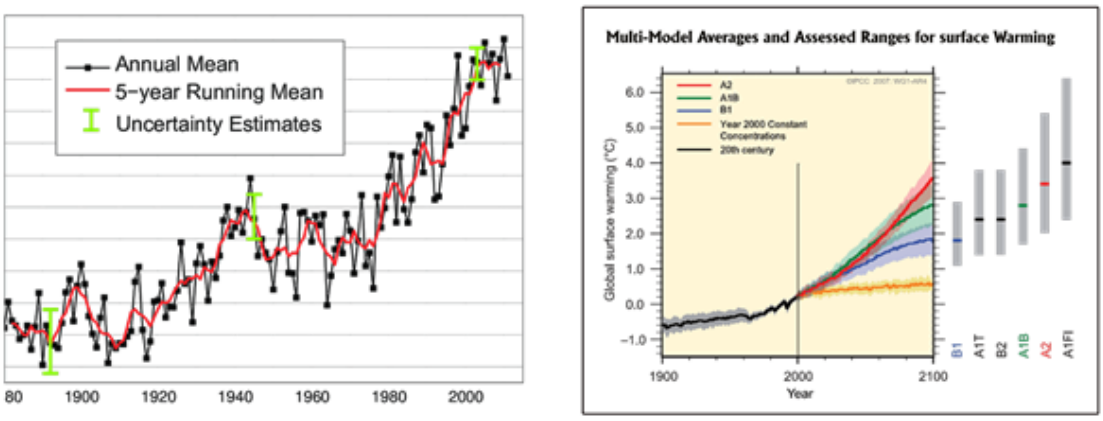


Figure 2.3 Global mean land and ocean temperature variation index, 1880 to present, with the base period 1951-1980.
Source: Meteorology Today, 2019

The average global surface temperature has warmed 0.8 0C in the past century and 0.6 0C in the past three decades. [Student, interrelate the lesson note you read and the graphs represented with figure 2.3 and interpret the information they portray]

The IPCC has projected that if greenhouse gas (GHG) emissions, the leading cause of climate change, continue to rise, the mean global temperatures will increase from 1.40 C to 5.80 C by the end of the 21st century.

Resource

Ahrens, C. D., & Henson, R. (2019). Meteorology Today an Introduction to Weather, Climate, and the Environment (12th Ed.). Boston: Cengage Learning, Inc. Unless.

Thomson, M. C., Ricardo, G., & Martin Beniston. (2008). Seasonal Forecasts, Climatic Change and Human Health. Springer.

Activity 2.1.b

1. Discuss climate change: what it is and how it differs from climate variability.
2. List some of its most noticeable effects.
3. What changes do you observe in your locality in relation to climate change?
4. Do you think any of Ethiopia's endangered plant and animal species still exist in your wereda and region?
5. Have patterns of temperature and rainfall changed during your lifetime or that of your parents or of the elders in your family?
6. Ask your parents and elderly relatives about temperature and rainfall changes in your locality? Have such changes been significant within their lifetimes? Within your lifetime, so far? Have such changes affected any of your lives? If so, how?
7. Consider any other changes in your locality that you think have resulted from climate change. Have you heard about any rivers, lakes or swampy areas in your locality that have shrunk in volume or even disappeared due to climate change? If so, write about it a report.

Self-test exercise 2.1

Dear learner; I hope you enjoyed reading the notes and doing the activities. I think you found them interesting and relevant. Now, attempt the questions I–II that are given below to evaluate how far you have understood the lesson you studied.

Part I

For questions 1-2, choose the best answer from the given alternatives (5 points)

1. Which of the following is important greenhouse gas?

A. Carbon dioxide(CO_2) C. Nitrous Oxide(N_2O)

B. Methane (CH_4), D. All of the above are answers

2. According to the Third Assessment Report of IPCC which decade had been the warmest decade worldwide?

A. 1990s C. 1920s

B. 1950s D.1970s

Part II

Answer questions 3-6 by writing 'True' for the correct statements or 'False' for the wrong statements (5 points).

3. The Earth's climate has always changed and evolved.
4. The Earth's air, water, and land are all interdependent and prone to climate change.
5. The year 1994 was the warmest year since instrumental records had begun.
6. The average climate around the world is called global climate.

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 alternatives 'Yes' or 'No'.

№	Items	Yes	No
1	define climate change?		
2	differentiate the climate variability and climate change?		
3	describe the trends of global average temperature ?		
4	explain the trends of global rainfall in the last century?		
5.	distinguish the important greenhouse gases?		

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.

Feedback to Activities in Section 1

Activity 2.1.a

1. The difference between climate and metrology is: A meteorologist's daily forecast focuses on weather. Climatologists, on the other hand, define climate as the average weather over a 30-year period and over a much larger geographic area.
2. Global warming is the long-term heating of Earth's surface observed since the pre-industrial period due to human activities, primarily fossil fuel burning, which increases heat-trapping greenhouse gas levels in Earth's atmosphere.
3. Example of global warming could be: Global temperatures rose about 1.8°F (1°C) from 1901 to 2020. Sea level rise has accelerated from 1.7 mm/year throughout most of the twentieth century to 3.2 mm/year since 1993. Glaciers are shrinking: average thickness of 30 well-studied glaciers has decreased more than 60 feet since 1980.
4. Climate change and climate variability: Climate variability includes short-term fluctuations around the average weather. Climate change is the change in long term averages of the daily weather and operates over decades or longer and is projected using increasingly sophisticated earth system models.
5. Climate change trends: According to NOAA's 2021 Annual Climate Report the combined land and ocean temperature has increased at an average rate of 0.14 degrees Fahrenheit (0. 08 degrees Celsius) per decade since 1880; however, the average rate of increase since 1981 has been more than twice as fast: 0.32 °F (0.18 °C) per decade.

Activity 2.1.b

Climate change is a long term change of weather conditions that cover many million years. Climate variability refers to the instable condition of the atmosphere leading to variations in weather and climatic conditions. Some of the effects include a rise sea level, shift of tropical zone, expansion of tropical diseases, and loss of biodiversity.

1. The UN Framework Convention on Climate Change (UNFCCC) sets out the basic legal framework and principles for international climate change cooperation with the aim of stabilizing atmospheric concentrations of greenhouse gases (GHGs) to avoid "dangerous anthropogenic interference with the climate system."
2. The meaning of global land ocean temperature index: Global land-ocean temperature indices combining 2-meter surface air temperature over land with sea surface temperatures (SST) 20 over oceans are commonly used to assess changes in the Earth's climate.
3. The temperature changed over the past decades: According to NOAA's 2021 Annual Climate Report the combined land and ocean temperature has increased at an average rate of 0.14 degrees Fahrenheit (0.08 degrees Celsius) per decade since 1880; however, the average rate of increase since 1981 has been more than twice as fast: 0.32 °F (0.18 °C) per decade.
4. The expected temperature changes at the end of the 21st century is: Increases in average global temperatures is expected to be within the range of 0.5°F to 8.6°F by 2100, with a likely increase of at least 2.7°F for all scenarios except the one representing the most aggressive mitigation of greenhouse gas emissions.

SECTION TWO
2. 2. Causes and Consequences of Climate Change

Section Overview

Dear learner, in this section we will learn about the causes and consequences of climate change. Climate change has many natural causes, such as:

- variations in the amount of solar radiation that come to the Earth's system,
- the position of the Earth relative to the Sun,
- the position of continents relative to the equator, and
- whether the continents are together or apart.

Smaller factors that are important over shorter time periods are volcanic eruptions and asteroid impacts. Human activities also increase greenhouse gas levels in the atmosphere. The dominant man made source of greenhouse gases is the burning of fossil fuels and biomass, deforestation, urbanization, and air pollution.

Section Learning Outcome

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

- describe the natural causes of climate change
- human induced causes of climate change
- identify the consequences of climate Change

KEY TERMS:

- Eccentricity,
- Climate variations,
- Milankovitch Theory,
- Incoming solar radiation

2.2. Causes of climate change

Please student make reflection on this question before reading the next descriptions.

1. What are the natural sources of climate change?
2. What are some examples of natural climate change?
3. What are the human induced causes of climate change?
4. What is the most common cause of climate change?
5. What activity of people in your area do you think negatively affect the climatic condition?

Student, did you imagine and generate ideas on how human activities attribute to the occurrences of climate changes. Note that one of the great environmental concerns of our time is the climate change now unfolding as a result of greenhouse gases being added to our atmosphere. Glaciers are melting, sea level is rising, precipitation is becoming more intense in many areas, and global temperature is increasing each decade. Climate change, whether driven by natural or human forcing, can lead to changes in the likelihood of the occurrence or strength of extreme weather and climate events or both.

The primary cause of climate changes over the last few decades is human (anthropogenic) activity, mainly the burning of fossil fuels.

Evidently climate has changed in the past, and nothing suggests that it will not continue to change, both globally and locally. As the urban environment changes, its climate differs from that of the region around it.

Sometimes the difference is striking, as when city nights are warmer than the nights of the outlying rural areas. Other times, the difference is subtle, as when a layer of smoke and haze covers a city.

IPCC has produced the world's most comprehensive reports on climate change for more than 25 years. It published in depth climate assessments in 1990, 1995, 2001, 2007, 2013, and again in 2021.
The 2013, Fifth Assessment Report, states that it is extremely likely that human influence has been the dominant cause of the observed warming since the mid twentieth century. In the report, "extremely likely" means a probability of at least 95 percent.

2.2.1 Climate Change Caused by Natural Events

What are the natural causes of climate change?

Dear student, attempt this question in your own first and then critically read the lesson note for in-depth understanding. There are three "external" causes of climate change. These are changes in:

1. Incoming solar radiation;
2. The composition of the atmosphere; and
3. The Earth's surface.

Natural phenomena can cause climate to change by all the three mechanisms, whereas human activities can change climate by the second and third mechanisms.
On the other hand, "internal" causes of climate change, manifested in terms of circulation patterns of the ocean and atmosphere, which redistribute energy within the climate system rather than altering the total amount of energy it holds.

Part of the complexity of the climate system is the intricate interrelationship of the elements involved. For example, if temperature changes, many other elements may be altered as well. The interactions among the atmosphere, the oceans, and the ice are extremely complex and the number of possible interactions among these systems is enormous. No climatic element within the system is isolated from the others, which is why the complete picture of the Earth's changing climate is not totally understood. With this in mind, we will first investigate how feedback systems work; then we will consider some of the current theories as to why the Earth's climate changes naturally.

Variations in the Earth's Orbit:

A variation in the Earth's orbit is another external cause of climate change that involves a change in the amount of solar radiation that reaches the Earth. A theory ascribing climatic changes to variations in the Earth's orbit is the Milankovitch theory, named after the name of astronomer Milutin Milankovitch, who first proposed the idea in the 1930s. The basic idea of this theory is that, as the Earth travels through space, three separate cyclic movements combine to produce variations in the amount of solar energy that reaches the Earth.

The Milankovitch cycles that combine to produce variations in solar radiation received at the Earth's surface include:

1. Changes in the shape (eccentricity) of the Earth's orbit about the sun.
2. Precession of the Earth's axis of rotation, or wobbling.
3. Changes in the tilt (obliquity) of the Earth's axis.

Variations in Solar Output

Solar energy measurements made by sophisticated instruments aboard satellites show that the sun's energy output (called brightness) varies slightly by a fraction of 1 percent with sunspot activity. Sunspots are huge magnetic storms on the sun that show up as cooler (darker) regions on the sun's surface. They occur in cycles, with the number and size reaching a maximum approximately every 11 years. The figure below illuminates better.

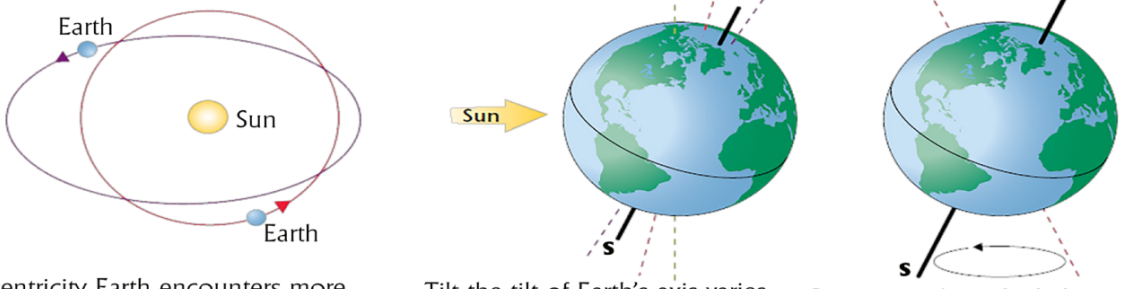


Figure 2:4 Milankovitch Cycle

During periods of maximum sunspots, the sun emits more energy (about 0.1 percent more) contrasted to periods of sunspot minimums. Evidently, the greater number of bright areas around the sunspots radiates more energy, which offsets the effect of the dark spots.

What are the Milankovitch Cycles?

Natural global warming, and cooling, are considered to be initiated by Milankovitch cycles. These orbital and axial variations influence the initiation of climate change in long-term natural cycles of 'ice ages' and 'warm periods' known as 'glacial' and 'interglacial' periods.

Atmospheric Particles

Microscopic liquid and solid particles (aerosols) that enter the atmosphere from both natural and human-induced sources can have an effect on climate. The effect of these particles have on the climate is exceedingly complex, and depends upon a number of factors, such as the particle's size, shape, color, chemical composition, and vertical distribution above the surface. Particles can enter the atmosphere in a variety of natural ways. For example, wildfires can produce abundant amounts of tiny smoke particles, and dust storms sweep tons of fine particles into the atmosphere. Flaming volcanoes can also release significant quantities of sulfur rich aerosols into the lower atmosphere. Although the effect these particles on the climate system is complex, the overall effect they have is to cool the surface of the earth by preventing sunlight from reaching the surface

Volcanic eruptions

Volcanic eruptions can have a major impact on climate. During volcanic eruptions, fine particles of ash and dust (as well as gases) can be ejected into the atmosphere. Scientists agree that the volcanic eruptions having the greatest impact on climate are those rich in sulfur gases. These gases, when ejected into the stratosphere, combine with water vapor in the presence of sunlight to produce tiny, reflective sulfuric acid particles that grow in size, forming a dense layer of haze. The haze may reside in the stratosphere for several years, absorbing and reflecting back to space a portion of the sun's incoming energy. The reflection of incoming sunlight by the haze tends to cool the air at Earth's surface, especially in the hemisphere where the eruption occurs. Dear student, take minutes and check your learning pace in terms of the learning outcomes set.

2. 2. 2 Human (Anthropogenic) Causes of Climate Change

Earlier in this section, we saw how variations in atmospheric CO2 may have contributed to changes in the global climate spanning thousands and even millions of years.

Today, we are modifying the chemistry and characteristics of the atmosphere by injecting into it vast quantities of particles and greenhouse gases without fully understanding the long-term consequences.

1. Aerosols Injected into the Lower Atmosphere

Dear student, in the previous section, we learned that tiny solid and liquid particles (aerosols) can enter the atmosphere from both human-induced and natural sources. The human-induced sources include emissions from factories, autos, trucks, aircraft, power plants, home furnaces and fireplaces, to name a few. Many aerosols are not injected directly into the atmosphere, but form when gases convert to particles. Some particles, such as sulfates and nitrates, mainly reflect incoming sunlight, whereas others, such as soot, readily absorb sunlight. Many of the particles that reduce the amount of sunlight reaching Earth's surface tend to cause a net cooling of the surface air during the day. All climate models predict that, as fossil fuels continue to spew greenhouse gases into the air, the climate will change and the Earth's surface will warm. But humans are changing the climate by other activities as well.

2. Land use changes

Modification of Earth's surface taking place right now could potentially be influencing the immediate climate of certain regions. For example, studies show that about half the rainfall in the Amazon River Basin is returned to the atmosphere through evaporation and through transpiration from the leaves of trees. Consequently, clearing large areas of tropical rain forests in South America to create open areas for farms and cattle ranges, as is happening now, will most likely cause a decrease in evaporative cooling. This decrease, in turn, could lead to a warming in that area at least several degrees Celsius. In turn, the reflectivity of the deforested area will change. Similar changes in albedo result from the overgrazing and excessive cultivation of grasslands in semi-arid regions, causing an increase in desert conditions (a process known as desertification).

3. Increasing Greenhouse Gases Emission

Carbon dioxide is one of the greenhouse gases that strongly absorbs infrared radiation and plays a major role in the warming of the lower atmosphere. Everything else being equal, the more CO2 in the atmosphere, the warmer the surface air is. We also know that CO2 has been increasing steadily in the atmosphere, primarily due to human activities, such as the burning of fossil fuels like coal, oil, and natural gas. Deforestation is also adding to this increase. Through the process of photosynthesis, the leaves of trees remove CO2 from the atmosphere. The CO2 is then stored in leaves, branches, and roots. When the trees are cut and burned, or left to decay, the CO2 goes back into the atmosphere.

Moreover, Nitrous Oxide (N2O) and Methane (CH4) are greenhouse gases that causes for climate change. These three gases differ in how they absorb energy (preventing it from escaping to space) and how long the gas stays (life time) in the atmosphere.

For example, CO2 stays for over 100 years while, the others- two gases last relatively for short time. NH4 causes 21 times as much warming as an equivalent mass of CO2 over 100 years.

Naturally, atmospheric GHGs are important to maintain life on earth. The role of water vapor, CO2 and other GHGs play keeping the earth's mean surface temperature higher than it otherwise would be. If the GHGs were absent earth's average atmospheric temperature would be 330C less. This affects all ecosystems on earth. While, the problem of GHGs effects are increasing in the amount of those gases in the atmosphere due to human causes that resulted for deviation from the natural or normal conditions.

4. Global Warming

We have discussed several times in this section that the Earth's atmosphere is in a warming trend that began around the turn of the twentieth century. This warming trend is real, as the average global surface air temperature since the late 1800s has risen by about 10 C. Moreover, the global average for each decade since the 1980s has been warmer than that of the preceding decade. There are many signs of increasing global warmth other than temperature readings. For example, the amount of water locked in the world's glaciers and ice sheets is steadily decreasing, and sea level is steadily rising.

Global warming might even be apparent where you live. Global warming in any given year, however, is small, and it only becomes significant when averaged over many years, such as decades. So, it is important not to base global warming on a specific weather event. The main indicators of global warming are shown in figure 2.5.

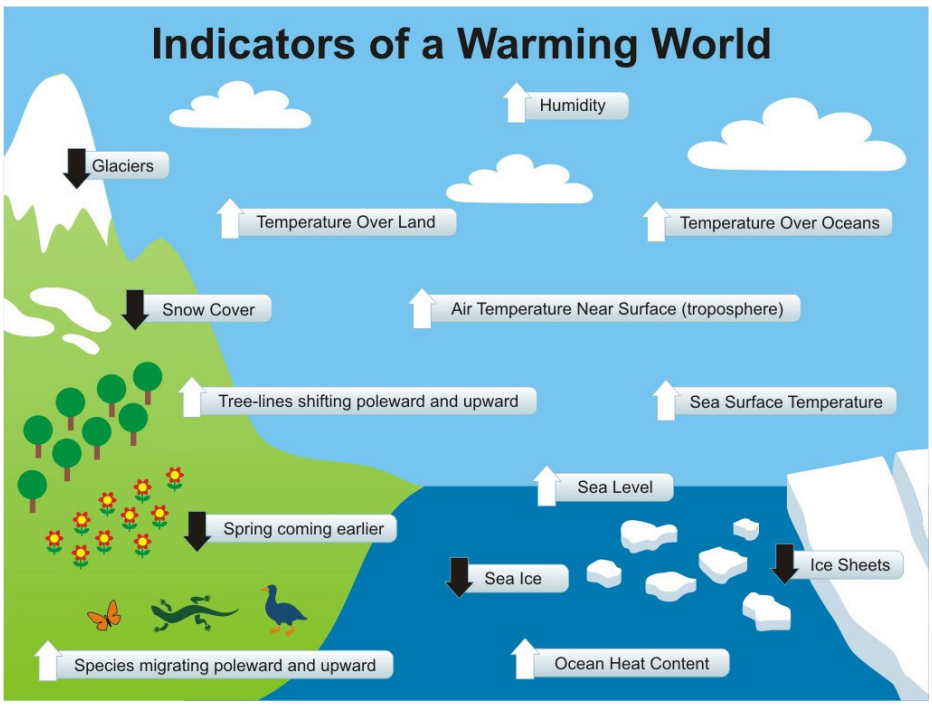


Figure 2:5 indicators of Global warming

What are the main causes of climate change?

Dear student, please identify the main components and related issues presented in figure 2.5 as well as the major causes of climate change analyze each in detail and summarize your understanding before starting the next content- list the Consequences of Climate Change as well.

2.2.3 Consequences of Climate Change

If the world continues to warm as predicted by climate models, where will most of the warming take place?

Student, contrast the point you made pertaining to the questions posed above to the explanations that follow. Climate models predict that land areas will warm more rapidly than the global average, particularly in the northern high latitudes in winter. We can see that the greatest surface warming for the period 2001 to 2006 tended to occur over landmasses in the high latitudes of the Northern Hemisphere, as experienced in Canada and Russia.

As high-latitude regions of the Northern Hemisphere continue to warm, modification of the land may actually enhance the warming. These changes in temperature will also affect people in many ways, of course, including direct effects on human health. In the lower latitude, there are more frequent droughts and unpredictable rainfall due to global warming. Predictions show that global warming will amplify current dangers and introduce new ones, seriously affecting people's ability to support themselves.

1. Precipitation

Changes in precipitation and drought may be just as important as changes in temperature over the coming decades. As with temperature, changes in precipitation will not be evenly distributed, as some areas will tend to get more precipitation and others less.

Since the middle of the twentieth century, precipitation has generally increased over the middle and high-latitude land areas of the Northern Hemisphere, while decreasing over some subtropical land areas. In many areas, there has also been an increase in the intensity of the heaviest precipitation events during the last 50 years or so.

The changes in precipitation adversely affect by placing added stress on agriculture. Even in places where average annual precipitation does not change, it is possible that rainfall and snowfall will be focused in more intense wet spells, with longer dry periods in between.

In many parts of the world, observations show that the heaviest one-day rainfall events are already becoming heavier. In addition, warming temperatures will tend to cause soil to dry out more quickly, exacerbating the impact of drought when it occurs.

2. Sea Level Rise

Another major consequence of climate change is an increase in sea level, as land-based ice sheets and glaciers retreat, the oceans continue to expand and get warm. During the twentieth century, average global sea level rose by about 17 cm. From 1900 to 2010, globally averaged sea level rose about 19 cm, with the pace accelerating from the 1990s onward. About half of that was a result of melting glaciers and ice sheets, with the other half produced by the expansion of oceans as they warm. Globally averaged sea level has risen about twice as quickly since1993, roughly 3.4 cm per decade, as it did during the twentieth century as a whole.

Sea level rise will be a growing issue in the coming decades for the many millions of people who live near coastlines around the world (see figure 2.6). Storm surges will occur atop a higher baseline water level. Rising ocean levels could also have a damaging influence on coastal ecosystems, such as coral reefs. In addition, coastal groundwater supplies might become contaminated with saltwater.

Figure 2.6 Rising Seas:

As sea ice and ice caps at both of the Earth's poles continue to melt at unprecedented rates, rising sea levels can put coastal and island communities like those in the Philippines at risk of flooding and water damage.

3. Effects on Polar Regions

In Polar Regions, areas of the world, rising temperatures produce complex interactions among temperature, precipitation, and wind patterns. If the warming in this region continues at its present rate, summer sea ice may, at times, shrink to cover less than 10 percent of the Arctic Ocean by the middle of this century, or even sooner.

Figure 2.7 Sea ice is frozen seawater that floats on the ocean surface, forming and melting with the polar seasons. Some persists year after year in the Arctic, providing vital habitat for wildlife such as polar bears.

4. Effects on ecosystems

Increasing levels of CO2 in a warmer world could have many other consequences. For, greater amounts of CO2 can be expected to act as a "fertilizer" for some plants, accelerating their growth, although this process can slow over time if water, nitrogen, and other nutrients were not plentiful enough to sustain the growth. In some ecosystems, certain plant species could become so dominant that others are eliminated.

In tropical areas, where many developing nations are located, the effects of climate change may actually decrease crop yield, whereas higher latitudes might benefit from a longer growing season and an earlier snowmelt. Extremely cold winters might become less numerous, with fewer bitter cold spells. However, wildfires may continue to become more prevalent during dry spells in forested high latitude areas.

Thus, while there will be some "winners" and some "losers," the most recent analyses suggest that the impact of climate change on agriculture and ecosystems may become increasingly negative by later in this century.

Climate-driven changes in species distributions affect human well-being both directly (for example, through emerging diseases and changes in food supply) and indirectly (by degrading ecosystem health), (see figure 2.8).

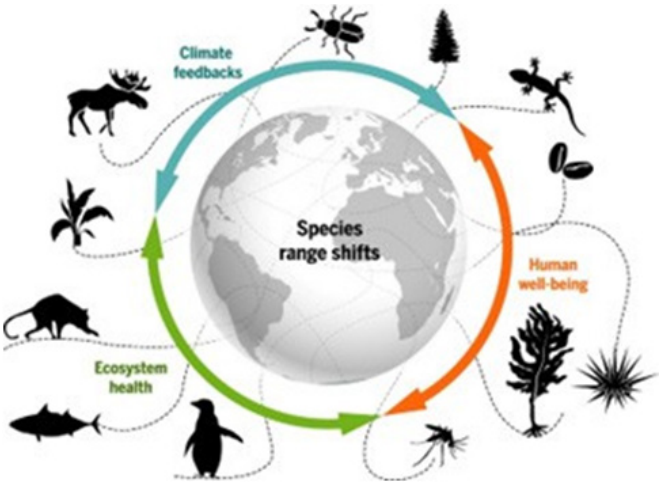


Figure 2.8 Interlinked climate change changes impact on species distributions and human wellbeing.

Dear leaner, how did you internalize the causes and consequences of climate change? Summarize your understanding points based on the question raised below. What are consequences of climate change?

Resource

Hardy, J. T. (2003). Climate Change Causes, Effects, And Solutions. Weinheim, Germany John: John Wiley & Sons Inc.

Malik, A. (2008). Causes of Climate Change. New Delhi: Rajat Publications.

Activity 2.2

1. Define global warming
2. Write three negative impacts of global warming on human beings.
3. What are the 5 main effects of climate change?
4. What are the causes of sea level rise?
5. What is the impact of climate change on ecosystems?

Self-test exercise 2.2

Dear learner; I hope you enjoyed reading the notes and doing the activities. I think you found them interesting and relevant. Now, attempt the questions that are given below to evaluate how far you have understood the lesson you studied.

Part I

For questions1-6, choose the best answer from the given alternatives.

1. The natural range of the atmospheric concentration of carbon dioxide over the last 800,000 years was_____ parts per million (ppm)?

A. 180 to 300 C. 280 to 400
B. 380 to 400 D. over 400

2.Since the middle of the twentieth century, precipitation in the northern hemisphere has generally _____

A. decreased over the middle latitude C. increased both over the middle and high latitudes
B. decreased over the high latitudes D. increased over some subtropical land areas

3.During the twentieth century, average global sea level rose by about

A. 71 cm C.17 cm
B. 92 cm D.21 cm

4.Carbon dioxide is one of a greenhouse gas that

A. strongly absorbs infrared radiation C. A and B
B. plays a major role in the warming of the lower atmosphere

5.Human activities can cause climate to change through changing

A. incoming solar radiation C. the Earth's surface
B. the composition of the atmosphere D. B and C

6.Sunspots:

A. are huge magnetic storms on the sun C. both A and B
B. occur in cycles D. none of these

Part II

Answer questions 1-5, by writing 'True' for the correct statements or 'False' for the wrong statements (5 points).

1. Climate-driven changes in species distributions affect human well-being both directly and indirectly.
2. The atmospheric concentration of carbon dioxide in 2005 as determined from ice cores was below the natural range.
3. Changes in precipitation and drought may be just as important as changes in temperature over the coming decades.
4. Globally averaged sea level has risen about twice as quickly since1993 as it did during the twentieth century as a whole.
5. Modification of Earth's surface taking place right now could potentially be influencing the immediate climate of certain regions.

Part III

Give short answers for the following 5 questions. (5 points)

1. What do we mean by "anthropogenic causes"?
2. What is the anthropogenic climate change?
3. What is the biggest contributor to anthropogenic climate change?
4. What is the effect of climate change in general?
5. What are the main impacts of climate change on Polar Regions?

Checklist

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

№	Items	Yes	No
1	describe the nature of climate change?		
2	list down human induced causes of climate change?		
3	identify the consequences of climate Change?		
4	explain human induced causes of climate change?		
5.	describe Milutin Milankovitch theory?		
6	discuss the effects of climate change on ecosystem?		
7	discuss the effects of climate change on human health?		

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.

Feedback to Activities in Section 2

Feedback to Activity 2. 1

1. The natural sources of climate change are: the natural causes like volcanic eruptions, ocean currents, the Earth's orbital changes, solar variations and internal variability.

2. Some examples the of natural climate change include: Over the course of Earth's existence, volcanic eruptions, fluctuations in solar radiation, tectonic shifts, and even small changes in our orbit have all had observable effects on planetary warming and cooling patterns.

3. The human induced causes of climate change are:

- Generating power
- Generating electricity and heat by burning fossil fuels causes a large chunk of global emissions
- Manufacturing goods
- Cutting down forests
- Using transportation
- Producing food
- Powering buildings
- Consuming too much.

4. The human activity is the main cause of climate change. People burn fossil fuels and convert land from forests to agriculture. Since the beginning of the Industrial Revolution, people have burned more and more fossil fuels and changed vast areas of land from forests to farmland.

5. The effects of climate change may actually decrease crop yield, whereas higher latitudes might benefit from a longer growing season and an earlier snowmelt. Extremely cold winters might become less numerous, with fewer bitter cold spells. However, wildfires may continue to become more prevalent during dry spells in forested high latitude areas.

Feedback to Activity 2.2

1. Global warming refers to an increase in the average of Earth's temperature that causes climate to change. Natural events and human influences are believed to be top contributions towards the increase in average temperatures. Global warming is a rise in the surface and atmospheric temperature of the earth that has changed various life forms on the earth. The issues that ascertain global warming are divided into two broad categories "natural" and "human influences" of global warming.
2. Human activities include industrial production, burning fossil fuel, mining, cattle rearing and deforestation. Industries, transportation such as cars, buses, trucks burn fuel to power machines, which eventually releases carbon dioxide and monoxide from the exhaust, leading to an increase in a temperature rise of Earth's atmosphere. Another contributor is the process mining the methane gas trapped below the earth escapes. Rearing cattle also causes the release of methane.

3. The main effects of climate change are: More frequent and intense drought, storms, heat waves, rising sea levels, melting glaciers and warming oceans can directly harm animals, destroy the places they live, and wreak havoc on people's livelihoods and communities.
4. Global sea levels are rising as a result of human-caused global warming, with recent rates being unprecedented over the past 2,500 years. Sea level rise is caused primarily by two factors related to global warming: the added water from melting ice sheets and glaciers and the expansion of seawater as it warms.

SECTION THREE
2.3. Adaptation and Mitigation Strategies to Climate Change

Section Overview

Dear learner, in this section we will try to look about the adaptation and mitigation strategies to climate change. The United Nations Framework Convention on Climate Change (UNFCCC) highlights two fundamental response strategies to climate change. These are adaptation and mitigation strategies to climate change. Mitigation seeks to limit climate change by reducing the emissions of greenhouse gases and by enhancing 'sink' opportunities, adaptation aims to alleviate the adverse impacts through a wide range of system specific actions.

Many definitions of adaptation are found in the literature. Definitions of adaptation vary from institution to institution, with distinctions often attributed to political differences and negotiations-related concerns.

The United Nations Framework Convention on Climate Change (UNFCCC) describes adaptation as the "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates, harm or exploits beneficial opportunities". According to Intergovernmental Panel on Climate Change, adaptation to climate change refers to, "adjustments in ecological, social or economic systems in response to actual or expected stimuli and their effects or impacts. This term refers to changes in processes, practices and structures to moderate potential damages or to benefit from opportunities associated with climate change". Depending on its timing, goal and motive of its implementation, adaptation can either be reactive or anticipatory, private or public, planned or autonomous. Adaptations can also be short/long term, localized or widespread. Accordingly, you are advised to be critical and thoughtful while studying the section content details.

Section Learning Outcomes

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

- elaborate the main adaptations and mitigations strategies to climate change;
- describe adaptation to climate change;
- define mitigation to climate change; and
- differentiate between mitigation and adaptation strategies

KEY TERMS:

- Adaptation,
- Mitigation,
- Strategies,
- Reactive,
- Anticipatory,
- Planned,
- Autonomous

What do we mean by adaptation to climate change? What are the common adaptation mechanisms used by peoples in your locality?

Student, try to reflect this question before the following description.

Climate change is one of the all-encompassing global environmental changes likely to have deleterious effects on natural and human systems, economies and infrastructure. The risks associated with it call for a broad spectrum of policy responses and strategies at the local, regional, national and global level.

The United Nations Framework Convention on Climate Change (UNFCCC) highlights two fundamental response strategies: mitigation and adaptation. While mitigation seeks to limit climate change by reducing the emissions of greenhouse gases and by enhancing 'sink' opportunities, adaptation aims to alleviate the adverse impacts through a wide-range of system-specific actions.

Although both mitigation and adaptation measures must be pursued to tackle the climate change problem and to create an effective and inclusive international climate change regime, more attention has been devoted to mitigation in the past, both in scientific research and policy debate.

Sensitivity to the issue of adaptation has grown over the last couple of years, particularly after the IPCC Third Assessment Report. Adaptation has now emerged as an urgent policy priority, prompting action both within and outside the climate change negotiations.

Climate Change Adaptation

Adaptation to climate change refers to, "adjustments in ecological, social or economic systems in response to actual or expected stimuli and their effects or impacts. This term refers to changes in processes, practices and structures to moderate potential damages or to benefit from opportunities associated with climate change.

The most commonly identified adaptation strategies in Ethiopia include soil conservation, terracing, water harvesting, crop diversification, changing crop planting date, planting trees and irrigation. Dear learner what additional adaptation methods you have known from your lived experience? You may list these and relate them to the one in figure 2.9.

Figure 2.9: Climate change Adaptation using irrigation and planting trees.

Types of Adaptation

Depending on its timing, goal and motive of its implementation, adaptation can either be reactive or anticipatory, private or public, planned or autonomous. Adaptations can also be short/long term, localized or widespread (IPCC 2001).

In unmanaged natural systems, adaptation is autonomous and reactive, and is the means by which species respond to changed conditions.

Reactive or Anticipatory Adaptation

Reactive adaptation is the one that takes place after the initial impacts of climate change have occurred. Anticipatory adaptation takes place before impacts become apparent. In natural systems, there is no anticipatory adaptation.

Private or Public Adaptation

The distinction is based on whether adaptation is motivated by private (individual) households and companies or public interest (government).

Planned or Autonomous Adaptation

Planned adaptation is consequence of deliberate policy decision, based on the awareness that conditions have changed or are expected to change and that some form of action is required to maintain a desired state. Autonomous adaptation involves changes that systems will undergo in response to changing climate irrespective of any policy, plan or decision

Climate change Mitigation

Mitigation refers to avoiding and reducing emission of heat trapping greenhouse gases in to the atmosphere to prevent the planet from warming to more extreme temperatures. For example, reducing source of heat trapping greenhouse gases the burning of fossil fuels for electricity, heat or transport and enhancing the sinks that accumulate and store these gases (such as the oceans, forests and soil.

Figure 2.10: Climate change mitigation (Forests as sinks and wind power as source of green energy).

Student, be focused on the main concepts and issues you studied up to now and appraise your learning achievement.

Resource

Mera, G. A. (2018). Drought and Its Impacts in Ethiopia. Weather and Climate Extremes, 22(September), 24–35. Https://Doi.Org/10.1016/J.Wace.2018.10.002

Roggema, R. (2009). Adaptation to Climate Change: A Spatial Challenge. London & New York: Springer Science Business.

Activity 2.3

Give short answer to the following questions.

1. What is the difference between adaptation and mitigation to climate change?
2. What is planned or autonomous adaptation?
3. What is Anticipatory adaptation?
4. What is Reactive adaptation?

Self-test exercise 2. 3

1. For the following questions Choose the correct alternative answers.

1. What is a feasible method to reduce the release of the greenhouse gases without decreasing the production of these gases?

A. Mitigation C. Resilience
B. Adaptation D. Exposure

2. The type of adaptation that takes place after the initial impacts of climate change has occurred is:

A. Anticipatory C. Planned
B. Reactive D. Autonomous

3. Which one of the following countries had an intention to withdraw from the Paris Agreement in mid-2017?

A. United States of America C. China
B. Russia D. France

4. Which of the following is important greenhouse gas?

A. Carbon dioxide B. Methane C. Nitrous Oxide D. All

5. According to the Third Assessment Report of IPCC which decade had been the warmest decade worldwide?

A.1990s B.1950s C. 1920s D.1970s

Checklist

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

№	Items	Yes	No
1	define what we mean by adaptations to climate change?		
2	describe adaptation strategies of climate change?		
3	define mitigation to climate change?		
4	differentiate between mitigation and adaptation strategies?		
5.	compare the main adaptation and mitigation strategies to climate change?		
6	give local examples of adaptation to climate change?		
7	differentiate planned or autonomous adaptation?		
8	differentiate Private or public adaptation?		
9	compare reactive or anticipatory adaptation?		

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 proceed to the following exercise.

Feedback to Activities in Section 3

Activity 2.3

1. Mitigation seeks to limit climate change by reducing the emissions of greenhouse gases and by enhancing 'sink' opportunities, adaptation aims to alleviate the adverse impacts through a wide-range of system-specific actions. Adaptation to climate change refers to, "adjustments in ecological, social or economic systems in response to actual or expected stimuli and their effects or impacts.
2. Planned adaptation is the consequence of deliberate policy decision, based on the awareness that conditions have changed or are expected to change and that some form of action is required to maintain a desired state. Autonomous adaptation involves changes that systems will undergo in response to changing climate irrespective of any policy, plan or decision.
3. Anticipatory adaptation refers to action that is taken in advance of impacts becoming observable, whereas reactive adaptation is applied after observing initial impacts of climate change.
4. Reactive Adaptation is that undertaken in response to an effect of climate change that has already been experienced.

SECTION FOUR

2.4. International Conventions and Agreements on Climate Change and Climate Resilient Green Economy of Ethiopia

Section Overview

Dear student, this section focuses on the major international conventions and agreements of Climate Change in view of their strengths and limitations. Then, we will try to look at the climate resilient green economy of Ethiopia. Humans are altering the Earth's climate. The problem is global. The greenhouse emissions of one country impact all countries. The solution to such a global problem can only come through international cooperation. Cooperative efforts to solve the problem are under way. However, modern economies depend on fossil-fuel energy, and reducing this dependence and greenhouse gas (GHG) emissions is likely to take considerable time. Also, policy makers, even if they agree on the severity of the problem, often disagree on the best approach to solve the problem. Dear student, recognize the learning outcome and then try to concentrate on the main agreements that follow.

Section Learning Outcomes

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

- analyze the major international conventions and agreements in view of their strengths and limitations;
- explain the current status of International Conventions and Agreements on Climate Change.
- evaluate the pillars of climate resilient green economy of Ethiopia
- Identify the main pillars of the climate resilient green economy of Ethiopia?

KEY TERMS

- Toronto Conference,
- Kyoto Protocol,
- Buenos Aires Plan of Action,
- Marrakesh Accords

2.4.1 International Conventions and Agreements on Climate Change

Dear learner, keep in mind the purposes and the importance of the known international convention and agreements on climate change while reading the following note. The First World Climate Conference (1979) identified climate change as an urgent world problem and issued a declaration calling on governments to anticipate and guard against potential climate hazards. A World Climate Programme was set up, directed by the World Meteorological Organization (WMO), the United Nations Environment Programme (UNEP) and the International Council of Scientific Unions (ICSU). Several intergovernmental conferences on climate change followed.

Activity 2.4.a

Please student try to make reflection on this question before reading the next descriptions.

1. What are the common aims of the international conventions and agreements on climate change?
2. Why conventions and agreements on climate change is needed at global scale?
3. What are the main important points of the Kyoto Protocol?
4. What are the main important points of the Toronto Conference?
5. What do we mean the Paris agreement on climate change?

The Toronto Conference on the Changing Atmosphere (1988) advanced public debate, when more than 340 participants from 46 countries all recommended developing a comprehensive global framework convention to protect the atmosphere. Following a proposal by Malta, the United Nations General Assembly addressed climate change for the first time by adopting Resolution 43/53. This recognized that "climate change is a common concern of mankind, since climate is an essential condition which sustains life on earth", and determined that "necessary and timely action should be taken to deal with climate change within a global frame- work ..." The WMO and UNEP established the Intergovernmental Panel on Climate Change (IPCC), to assess the magnitude and timing of changes, estimate their impacts and present strategies for how to respond. Toronto Conference on the Changing Atmosphere

The IPCC published the First Assessment Report on the state of the global climate (1990), which had a potent effect on policy makers and on public opinion. It became the main basis for negotiations under the United Nations General Assembly on a climate change convention, beginning in late 1990.

The IPCC finalized its Second Assessment Report concluded that there was indeed a discernible human influence on global climate that posed hazards to human and economic development. It recommended cost-effective steps, consistent with sustainable development and designed to provide "no regrets" safeguards against such risks.

What is the main aim of the Toronto Conference?

COP 6 (2001) resumed in Bonn in late July and reached an outline agreement the so called Bonn Agreements – on an emissions trading system, on a Clean Development Mechanism (CDM), on rules for accounting for emissions reductions from carbon "sinks" and on a compliance regime. It also outlined a package of financial and technological support to help developing countries contribute to global action on climate change and address its adverse effects. Detailed legal texts based on these decisions were on the negotiating table at COP 7, held in Marrakesh in late 2001. COP 7 adopted the respective decisions, the so-called Marrakesh Accords.

COP 8 (2002), held in New Delhi in November, was the first session after the negotiations under the BAPA had been completed. It marked a new phase of negotiations as the focus shifted to implementation of the Marrakesh Accords and to Convention issues. COP 8 adopted the Delhi Ministerial Declaration on Climate Change and Sustainable Development as well as the New Delhi work programme on education, training and public awareness.

What is the difference between the Montreal Protocol and the Kyoto Protocol?

The Montreal Protocol is so named because it was initially signed in Montreal on 16 September 1987. To date, the Montreal Protocol is the only United Nations treaty that every country in the world has ratified.

The Kyoto Protocol (2005) came into force on 16 February. The first Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (COP/MOP 1) was held with COP 11 in Montreal in November and December. It was one of the most successful to date, with an important political breakthrough being the decision by Parties to start a dialogue on strategic long term cooperative action. In 2006 of a total United Nations membership of 191 nations, 189 countries and the European Community have joined the Convention (and 164 countries and the European Community have joined the Kyoto Protocol). It is therefore clear that the Convention is one of the most universally supported international agreements in existence.

The Kyoto Protocol was adopted in 1997 and put into force in February 2005. The Protocol set mandatory targets for reducing greenhouse gas emissions in countries that adopt the plan. Although the percent by which each country was to reduce its emissions varies, the overall goal was to reduce greenhouse gas emissions in developed countries by at least 5 percent below existing 1990 levels during the five-year period of 2008 through 2012. For the industrialized nations that participated in the Kyoto Protocol, emissions expected to be dropped by more than 22 percent.

However, the United States did not ratify the protocol, and many developing nations such as China were not required to carry out emission reductions, since they had been responsible for only a small part of the accumulated CO2 up to that point. As a result, the global total of greenhouse gas emissions actually increased by more than 25 percent from 1990 to 2012.

In short, the Kyoto Protocol operationalizes the United Nations Framework Convention on Climate Change by committing industrialized countries and economies in transition to limit and reduce greenhouse gases (GHG) emissions in accordance with agreed individual targets.

The Kyoto Protocol has been followed by the Paris Agreement, which was introduced in 2015 and adopted by virtually every one of the world's nations. Under this agreement, each nation set voluntary targets for reducing emissions and will report their progress on a regular basis. In mid-2017, the United States announced its intention to withdraw from the Paris Agreement. The current regime is trying to reconsider it again.

In addition, several cities and countries, including Costa Rica, Iceland, and Norway, have pledged to become carbon neutral meaning that all of their greenhouse gas emissions would be offset by activities such as planting trees, so that the country ends up with no net emissions. Many global businesses are also striving to become carbon neutral. This does not necessarily mean that collective response strategies that are effective and efficient have been introduced.

The cutting down on the emissions of greenhouse gases and pollutants has several potentially positive benefits. These are, it:

- Could slow down the enhancement of Earth's greenhouse effect,
- Reduce global warming,
- Reduce acid rain,
- Diminish haze,
- Slow the production of photochemical smog, and
- Produce significant health benefits.

The most obvious way to limit global warming is to reduce greenhouse gas emissions by reducing the use of fossil fuels. Burning natural gas produces less carbon dioxide than burning oil and coal.

Thus, to fight climate change, we must first reduce our greenhouse gases (GHG) emissions. To accomplish this, the first step is to embrace renewable energy that are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat, and avoid creating energy by the burning of fossil fuels. Student, what similar example can be cited in your locality? Recall and reflect on the effort being made to reduce greenhouse gases from your experience.

The most obvious way to limit global warming is to reduce greenhouse gas emissions by reducing the use of fossil fuels. Burning natural gas produces less carbon dioxide than burning oil and coal.

Thus, to fight climate change, we must first reduce our greenhouse gases (GHG) emissions. To accomplish this, the first step is to embrace renewable energy that are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat, and avoid creating energy by the burning of fossil fuels

For this to happen, we should start to create a worldwide culture of sustainable development, where the energy is used wisely and efficiently, where a circular economy is a strong bet, as well as durable and eco-friendly products. We need to choose responsibly the products we buy because our demand as consumers influences what we are supplied with.

The Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius.

The Kyoto Protocol was an international treaty which extended the 1992 United Nations Framework Convention on Climate Change that commits state parties to reduce greenhouse gas emissions, based on the scientific consensus that global warming is occurring and that human-made CO_2 emissions are driving it.

2.4.2 Pillars of Climate Resilient Green Economy of Ethiopia

What are the pillars of the climate resilient green economy of Ethiopia?
What should be done to make the economy resilient?

Student, identify the main intents of these question and try to answer them, so that you will be prepared for the next content substance study.

Ethiopia's plan is to follow a green growth path that fosters development and sustainability. The Climate Resilient Green Economy (CRGE) strategy follows a sectoral approach. Initially it identified and prioritized 60 initiatives that would help the country reach its development goals while emitting less GHG emissions. Ethiopia's green economy plan is based on four pillars discussed below:

i. Improving crop and livestock production practices for higher farmer in come and food security while reducing emissions.

This pillar recognizes that agriculture will remain a core sector of the economy that provides employment to the majority of the Ethiopian population. Traditional economic development could deliver the required growth required in this sector, but at a cost. The CRGE strategy, however, prioritizes initiatives that limit soil-based emissions from agriculture and limits pressure on forests by limiting expansion of land under cultivation. The strategy also prioritizes initiatives that increase the resource efficiency and productivity of the livestock sector. The prioritized initiatives in the livestock sector have offered the combined benefit of economic growth support, by increasing pastoralists' income and limiting emissions.

ii. Protecting and re-establishing forests for their economic and ecosystem services including carbon stocks.

This pillar recognizes that in order to support continued growth in economic and eco-system services as well as growth of the GDP, deforestation and forest degradation should be reversed. The CRGE initiative has prioritized strategies to reduce demand for fuel wood, and increase afforestation, reforestation, and forest management to increase carbon sequestration in forests and woodlands as well as the promotion of area closure, which would result in increased storage of carbon in Ethiopian forests.

iii. Expanding electricity generation from renewable sources of energy for domestic and regional markets:

This pillar recognizes electricity as a fundamental enabler of modern economic development for powering cities, fuelling industrial activity and pumping irrigation water for agriculture. Ethiopia which needs to expand its electricity supply at a rate of 14% per annum is endowed in natural resources which can meet this demand.

In particular, its plan is to exploit its vast potential for hydro, geothermal, solar and wind power all of which would deliver electricity at virtually zero GHG emissions. It is worth highlighting here that the generation of clean energy also allows for green development of other sectors of the economy. There is also potential that the projected supply will surpass domestic demand, which offers a possibility of exporting its clean energy to neighboring countries.

iv. Leapfrogging to modern and energy- efficient technologies in transport, industrial sectors and buildings:

This pillar recognizes the opportunity to gear development of key sectors including transport, and industrial sub-sectors like cement, textile, leather and fertilizer industries, to contribute to the sustainable development pathway. The Ethiopian government aims to promote among other initiatives energy efficiency and the usage of alternative fuels in these subsectors. For the transportation sector, in particular, the strategy introduces initiatives that include introduction of stricter fuel efficiency standards, construction of an electric rail network powered by renew- able energy, improvement of modern transport.

What are the four pillars of Ethiopia's green economy plan?

The preceding section pointed out how Government of the Federal Democratic Republic of Ethiopia has integrated climate change objectives in broader national plans and policies through the Climate Resilient Green Economy strategy to prepare and protect the country from the adverse effects of climate change and to build a green economy that will help realize the country's national development ambition of reaching middle income status before 2025. Thus, the CRGE Strategy complements the current homegrown economic reform 6th pillar, which aims to set Ethiopia on a path to become a middle-income country by 2025. Dear student, now try to do the self-test exercises.

Resource

National Metrology Agency of Ethiopia, http://www.ethiomet.gov.et/
The Intergovernmental Panel on Climate Change (IPCC), https://www.ipcc.ch/

Activity 2.4.b

Give Short Answer for the following questions.

1. What are NDCs in climate change?
2. What is IPCC?
3. What is greenhouse effect?
4. What are the four greenhouse gasses?

Self-test exercise 2.4

Dear learner; I hope you enjoyed reading the notes and doing the activities. I think you found them interesting and relevant. Now, attempt the questions that are given below to evaluate how far you have understood the lesson you studied.

Part I

For questions 1-4, choose the best answer from the given alternatives for each question.

1. Which one of the following is not the benefit of cutting down the emissions of greenhouse gases and pollutants?

A. Reduced global warming C. Increased haze
B. Reduced acid rain D. Increasing health

2. The IPCC First Assessment Report on the state of the global climate was published in_____.

A. 1990 C. 1985
B. 1977 D. 200

3. In Ethiopian green economy plan, forests are protected due to their_____

A. economic services C. carbon stocks
B. ecosystem services D. All of these are answers

4. Which of the world Country had an intention to withdraw from the Paris Agreement in mid-2017?

A. United States of America B. Russia C. China D. France

Part II

Answer questions 5-9, by writing 'True' for the correct statements or False' for the wrong statements.

5. Many global businesses are striving to become carbon neutral.
6. The global total greenhouse gas emissions decreased by more than 25 percent from 1990 to 2012 due to the Kyoto Protocol.
7. The Kyoto Protocol was adopted in 1997 and put into force in February 2005.
8. The evident way to limit global warming is to increase greenhouse gas emissions.
9. Burning natural gas produces more carbon dioxide than burning oil and coal.

Checklist

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

№	Items	Yes	No
1	explain the current status of International conventions on Climate Change.		
2	analyse the major international conventions and agreements on climate change		
3	discuss the strength and limitations of International agreements on Climate Change		
4	evaluate the pillars of climate resilient green economy of Ethiopia		
5.	indicate what should be done to make the economy resilient?		

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

Feedback to Activities in section 4

Activity 2.4 a

1. The ultimate objective of the Convention on climate change is to stabilize greenhouse gas concentrations "at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system."
2. The international agreement on climate change provides a pathway forward to limit temperature rise to well below 2 degrees, maybe even 1.5 o c.
3. The Kyoto Protocol operationalizes the United Nations Framework Convention on Climate Change by committing industrialized countries and economies in transition to limit and reduce greenhouse gases (GHG) emissions in accordance with agreed individual targets. The Convention itself only asks those countries to adopt policies and measures on mitigation and to report periodically.
4. The Toronto Conference on the Changing Atmosphere is for Global Security, the 300 participants—including policy makers, international scientists, non-governmental and governmental organizations, and United Nations organizations—issued a warning at the conclusion of the conference that humans had unintentionally triggered uncontrolled changes to the atmosphere that if left unchecked could ultimately lead to "consequences could be second only to a global nuclear war."
5. The Paris Agreement is a legally binding treaty adopted by 196 countries at the climate change conference in Paris in 2015 (known as COP 21). The main goal of the agreement is to cut global greenhouse gases in order to limit global temperature increases as close as possible to 1.5 degrees Celsius.

Activity 2.4 b

1. Nationally determined contributions (NDCs) are at the heart of the Paris Agreement and the achievement of its long-term goals. NDCs embody efforts by each country to reduce national emissions and adapt to the impacts of climate change.
2. IPCC stands for Intergovernmental Panel on Climate Change. The IPCC is the scientific group assembled by the United Nations to monitor and assess all global science related to climate change.
3. The greenhouse effect is the way in which heat is trapped close to Earth's surface by “greenhouse gases.” These heat-trapping gases can be thought of as a blanket wrapped around Earth, keeping the planet toastier than it would be without them.
4. The Earth has a natural greenhouse effect due to trace amounts of water vapour (H2O), carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O) in the atmosphere.

Unit Summary

Different parts of the world have different climates. According to Intergovernmental Panel on Climate Change (IPCC), Climate change refers to a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change, whether driven by natural or human forcing, can lead to changes in the likelihood of the occurrence or strength of extreme weather and climate events or both. The primary cause of climate changes over the last few decades is human (anthropogenic) activity, mainly the burning of fossil fuels. The risks of climate change is associated with it call for a broad spectrum of policy responses and strategies at the local, regional, national and global level. The United Nations Framework Convention on Climate Change (UNFCCC) highlights two fundamental response strategies: mitigation and adaptation. While mitigation seeks to limit climate change by reducing the emissions of greenhouse gases and by enhancing 'sink' opportunities, adaptation aims to alleviate the adverse impacts through a wide-range of system-specific actions. The most commonly identified adaptation strategies in Ethiopia include soil conservation, terracing, water harvesting, crop diversification, changing crop planting date, planting trees and irrigation.

Unit two review exercise

Dear learner; I hope you enjoyed reading the unit and doing the self-test questions. Now you are at the stage of completion of unit Two. But, before moving to the next unit you are required to do 'unit review exercise. Hence, please try to do it carefully and properly. Choose the correct alternative answers for the following questions

1. Which of the following is indicative of greenhouse effect?
   A. Certain gases in the atmosphere trap heat and warm the Earth
   B. Life on Earth 'exhales' gas that warms up the atmosphere
   C. The tilt of the Earth changes the amount of solar energy the Earth receives
   D. The Sun is putting out more radiant energy over time
2. Which of the following activities is the least contributor of greenhouse gases?
   A. Deforestation
   B. Electricity generation
   C. Industry
   D. Tourism
   E. Transportation
   F. Agriculture
3. How much has CO2 in the atmosphere increased since the Industrial Revolution?
   A. 11 percent
   B. 49 percent
   C. 62 percent
   D. None of these
4. How much has the global average temperature changed since the Industrial Revolution?
   A. Cooler by 0.1 degree C (0.2 degree F)
   B. The temperature has gone up and down, but remains overall the same
   C. Warmer by 0.1 degree C (0.2 degree F)
   D. Warmer by more than 1 degree C (2.1 degrees F)
   E. Warmer by almost 2 degrees C (3.6 degrees F)
5. How does the rate of today's warming compare to previous episodes of rapid climate change on Earth?
   A. Today's climate warming is about as fast as the temperature swings that have happened in Earth's past.
   B. Past changes in the climate have been faster than the changes we're seeing today.
   C. Today, the Earth's climate is changing much faster than it has changed in the past.
   D. None of these
6. If we remove the human impacts of greenhouse gas emissions, what might the climate be doing today, on its own?
   A. Slight warming
   B. Strong warming
   C. No change
   D. Slight cooling
   E. Strong cooling

7. Which nation has the most responsibility for the greenhouse gases that are currently residing in the atmosphere?

A. China C. Russia E. Saudi Arabia

B. USA D. European Union

8.How long does CO2 remain in the atmosphere?

A. CO2 washes out of the atmosphere seasonally.

B. CO2 remains in the atmosphere for 5-10 years.

C. CO2 remains in the atmosphere for up to 200 years, or more.

D. None of these

9. If we stopped burning fossil fuels today, what would happen to the climate?

A. Earth's average temperature would continue to rise.

B. Temperatures would continue to warm, and then begin to cool down in 100 years or more.

C. Temperatures would fluctuate, but stay the same on average.

D. Temperatures would stop increasing once greenhouse gas concentrations stopped increasing.

10. What is the primary cause of the overall rising trend in CO2 in the atmosphere?

A. The increase in CO2 is caused by burning of fossil fuels

B. CO2 is increasing because we are coming out of an ice age

C. As human population grows, people exhale more CO2

D. CO2 is released by the oceans as they warm

Answer Key to Unit Review exercise

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

Reference

Ahrens, C. D., & Henson, R. (2019). Meteorology Today an Introduction to Weather, Climate, and the Environment (12th Ed.). Boston: Cengage Learning, Inc. Unless.

Goldman, C. R., Kumagai, M., & Robarts, R. D. (2013). Climatic Change and Global Warming Of Inland Waters. Wiley-Blackwell.

Hardy, J. T. (2003). Climate Change Causes, Effects, And Solutions. Weinheim, Germany John: John Wiley & Sons Inc.

Malik, A. (2008). Causes of Climate Change. New Delhi: Rajat Publications.

Mera, G. A. (2018). Drought and Its Impacts in Ethiopia. Weather and Climate Extremes, 22(September), 24–35. Https://Doi.Org/10.1016/J.Wace.2018.10.002

Roggema, R. (2009). Adaptation to Climate Change: A Spatial Challenge. London & New York: Springer Science Business.

Thomson, M. C., Ricardo, G., & Martin Beniston. (2008). Seasonal Forecasts, Climatic Change and Human Health. Springer.

UNIT THREE

ISSUES IN SUSTAINABLE DEVELOPMENT I: MANAGEMENT OF CONFLICT OVER RESOURCES

Unit Introduction

Dear learner, in grade eleven you learned about natural resources and conflicts over resources. The unit 3 of grade 12 is a continuation of unit three of grade eleven, and it focuses on management of conflict over resources. The management of land and other natural resources is one of the most critical challenges developing countries face today. The exploitation of high-value natural resources, including oil, gas, minerals and timber has often been cited as a key factor in causing, increasing or sustaining violent conflicts around the globe. Furthermore, increasing competition over diminishing renewable resources, such as land and water, are on the rise. This is being further aggravated by environmental degradation, population growth and climate change. The mismanagement of land and natural resources is contributing to new conflicts and obstructing the peaceful resolution of existing ones. Thus, this unit deals with the issues of management of conflict over resources in line with sustainable use of resources.

Unit Contents

3.1. The Concept of Sustainable Development
3.2. Resource Use Policies and Related Conflicts
3.3. Governance of Natural Resources
3.4. Indigenous Conflict Resolution Practices

Unit Outcomes

By the time students complete this unit, they will be able to:

- recognize the meaning of sustainable development;
- identify the main focuses, goals and principles of sustainable development;
- explain the principles and characteristics of good governance; and
- examine the problem of land management and policy of Ethiopia.

The Required Study Time: 19 hours

Unit Learning Strategies

In the unit, the suggested learning strategies are:

- written brainstorming questions;
- problem-solving method;
- individual project;
- report writing;
- observation;
- written activities;
- practical activities;
- self-test assessments;
- activities; and maps.

SECTION ONE
3.1 The Concept of Sustainable Development

Section Overview

Dear learner, in this section we will try to consider Sustainable Development and related concepts. Sustainable development is the idea that the future should be a better and healthier than the present. Sustainable development requires an understanding of the natural world and the human social world as being not so much 'connected' as one and the same. Sustainable development is a process that requires us to view our lives as elements of a larger entity. It requires a holistic way of looking at the world and human life. It requires recognition that other people may not see things like this at all, and will have different perceptions, values, philosophies, aims and ambitions. It requires an understanding that the world is multi-faceted, fragmented and complete. This may not be easy to grasp at first, but it is a way of looking at the world and one which increasingly makes sense. Sustainable development is a whole package of change towards a better quality of life. To ensure this in a sustainable manner, environmental protection should be an integral part of the development process. Thus, dear student, recognize the learning outcomes and issue highlighted, and continue reading the sections that follow.

Section Learning Outcomes

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

- explain the concept of sustainable development;
- identify the main focuses, goals and principles of sustainable development;
- examine some of the resource use policies and related conflicts;
- identify the shortcoming of the notion of Sustainable Development
- examine the performance and integration of the Sustainable Development goals in Ethiopia.

KEY TERMS:

- sustainable development,
- sustainable development goal,
- Growth and transportation plan (GTP),
- Agenda 21st

3.1.1 The concept of Sustainable Development

Student, what do we mean by sustainable development?

The concept of "Sustainable Development" has emerged as one of the development paradigms that have given rise to a particularly rich literature, policies and programs by a wide range of international and national governmental and NGOs.

The first United Nations Conference on Environment and Development (UNCED) held in Stockholm in 1972 (known as the Brundtland Report), introduced the notion of "eco development" and led to the establishment of UNEP with the mission "to provide leadership and encourage partnership in caring for the environment by inspiring, informing, and enabling nations and peoples to improve their quality of life without compromising that of future generations"

The second UNCED held in Nairobi, Kenya in 1987 introduced the idea of "sustainable development".

The third conference held in Rio de Janeiro in 1992 (known as the Earth Summit), further developed "Agenda 21" that highlighted the connection between poverty and underdevelopment on the one hand, and the connection between environmental protection and natural resource management on the other.

Agenda 21 states in its Principle 1 that "human beings, the centre of concern for sustainable development, are entitled to a healthy and productive life in harmony with nature".
The fourth conference known as the "World Summit on Sustainable Development" was held in Johannesburg, South Africa in 2002. This summit placed much more emphasis on the social and economic aspects of sustainable development.

While many and confusing definitions of sustainable development abound, others state that "a development path is sustainable if total welfare does not decline along the path". Critical to this definition is a realization that sufficient welfare functions through consumption, environmental quality, social equity, and other factors to the quality of life. This definition is broad enough to capture the essence of a pattern of resource use that aims to meet human needs while preserving the natural resources. This is necessary so that these needs can be met not only in the present, but also for generations to come, intergenerational equity so to speak.

Sustainable development as a concept puts the relationship between economic growth and the environment at its core. The term was first used in 1987 by the World Commission on Environment and Development. It is also known as the Brundtland Commission. In the commission's report, "Our Common Future," sustainable development has been defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs".
It is clear that this definition is rooted in a systems thinking as it stresses the three interdependent and mutually reinforcing pillars of sustainable development: economic development, social development, and environmental sustainability. Dear learner, from your experience, how do you interrelate the three major pillars represented in figure 3.1? Try to check what meaning you derive from the illustration, and then move on reading the lesson note of the section.

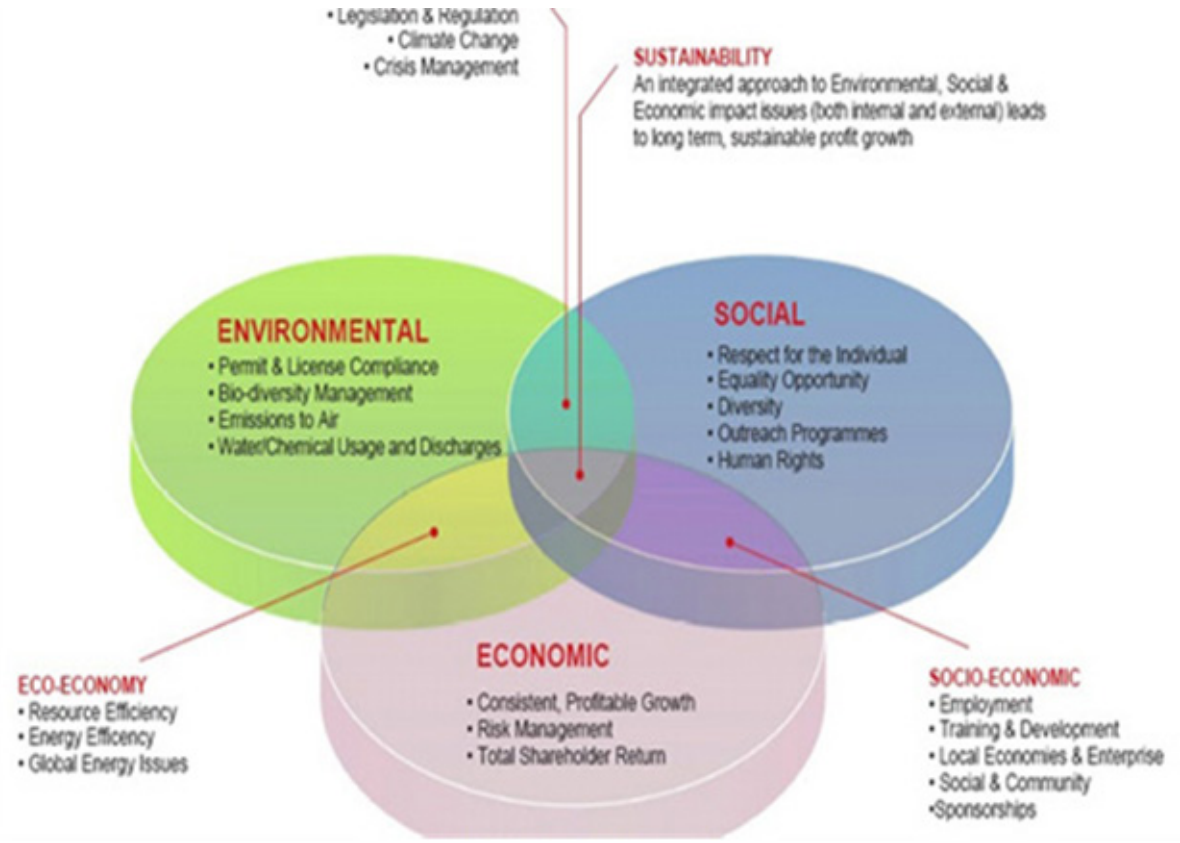


Figure 3.1 Nested Pillars of Sustainable Development

Dear student, what are the pillars of sustainable development?

Sustainable development aims to bring the three components together in a balanced way, as three interconnected or nested rings. The nested rings approach insists that the economy is dependent on society and the environment. Human and economic activities take place within the environment and the society, which depend on and have an impact on the environment. A key issue for sustainable development is, therefore, the integration of different dimensions of sustainability, taking a holistic view and overcoming barriers between disciplines, ideologies and sectors.

The three essential dimensions of sustainable development are:

i. Economic: an economically sustainable system must be able to produce goods and services on a continuing basis, to maintain manageable levels of government and external debt, and avoid extreme sectoral imbalances that damage agricultural and/or industrial production.

ii. Environmental: an environmentally sustainable system must maintain a stable re- source base and avoid overexploitation of non-renewable resource systems, including maintenance of biodiversity, atmospheric stability and ecosystems services not always looked upon as economic resources.

iii. Social: a socially sustainable system must achieve fairness in distribution and opportunity among all persons with adequate provision of such social services as health, education and gender equity. The social dimension focuses on reconciliation of environment and development, and governance related to provision of social services.

3.1.2 The Sustainable Development Goals (SDGs)

What are the goals of sustainable development?

Student, as you might have imagined; the sustainable development goals (SDGs), also known as the global goals, were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, all people enjoy peace and prosperity, and ensure that by 2030. The 17 SDGs are integrated, they recognize that action in one area will affect outcomes in others, and that development must balance social, economic and environmental sustainability. Countries have committed to prioritize progress for those who are furthest behind.

The SDGs are designed to end poverty, hunger, AIDS, and discrimination against women and girls. The creativity, knowhow, technology and financial resources from all society are necessary to achieve the SDGs in every context.

The 2030 SDG Agenda comprises 17 goals and 169 targets. The goals are:

1. No Poverty
2. Zero Hunger
3. Good Health and Well-Being
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Affordable and Clean Energy
8. Decent Work and Economic Growth
9. Industry, Innovation and Infrastructure
10. Reduced Inequalities
11. Sustainable Cities and Communities
12. Responsible Consumption and Production
13. Climate Action
14. Life below Water
15. Life on Land
16. Peace, Justice and Strong Institutions
17. Partnerships for the Goals.

Dear learner, what is your understanding about these goals, targets and their attainability? Reflect on this in terms and the responsibility expected of all world nations.

3.1.3 Integration and performance of the SDGs in the Ethiopian National Development Frameworks

Dear student, how can we integrate SDGs to Ethiopian national development frameworks?

Integration of the SDGs in the Ethiopian National Development Frameworks
In light of implementing the 2030 Sustainable Development Agenda, the FDRE appreciates the meaningful contribution of the SDGs to Ethiopia's aspirations to eradicate poverty and bring about prosperity for its people. The SDG's integration into the GTP II was, therefore, made possible by taking into account principal directions from GTP II. Integrated with GTP II, SDGs were implemented across the nation in 2015/16 fiscal year and progresses have been registered. This was made possible through ensuring:

1. universal (inclusive) access to equitable and quality education (SDG 4).
2. availability and sustainable management of water and sanitation for all (SDG-6).
3. access to affordable & reliable energy for all (SDG-7)

Performance of the SDGs in Ethiopia: The national and sectoral policies and strategies of the FDRE focused on eradication of poverty and implementation of development interventions that would have returns satisfying all the nation-wide demands/needs while ensuring inter-generational equity. In this regard;

i. The Climate-Resilient-Green-Economy strategy (CRGE-strategy) has been implemented,
ii. The Paris Agreement on climate change has also been implemented, and
iii. National Policy and strategy on disaster prevention and management has been implemented across the nation.

In order to achieve the 2030 SDGs, national development priorities have been identified in the GTP II which is the first 5 years-phase (2015/16-2019/20). As the country made wide governance reform after 2018 the GTP plan was also adopted into homegrown economic reform. The new 10 year development plan of 2021-2030 is also contemplating the SDG main pillars. These include:

- Ensuring the agricultural development sector remains the mainstay of the nation's accelerated economic development;
- Expediting change in the economic structure of the nation by transforming the manufacturing industry development;
- Enhancing the economy to its full economic capacity through increased focus on competitiveness, efficiency, productivity and quality;
- Correcting the imbalance between overall demand and supply;
- Fostering the development of the construction industry and projects' management capacity;
- Institutionalizing urban administration and management compatible with the accelerated urbanization, industrialization and structural changes in the economy;

- Creating enabling environment for the transformation of domestic investors;
- Providing support to human resources development through building technologic capacity;
- Building climate resilient green economy and
- Eliminating rent-seeking behaviors and ensuring the predominance of developmental frame of mind.

3.1.4 Shortcoming of the notion of Sustainable Development

Student, what is the Shortcoming of the notion of Sustainable Development?

The Planetary Project criticism of the concept of sustainable development develops in the following directions:

- The incorrectness of the term "sustainable development" and its internal logical contradiction. The narrowness of the term and the provocative tendency to confine global problems to the environmental context. Many scholars, politicians, social activists and industrialists believe that environmental protection issues cover the entire sustainable development strategy.
- The controversial character of several methods used by the concept of sustainable development. The diversity in understanding the goals of sustainable development, naturally arising from the different worldviews of the participants implementing a new civilization model, and countries and people representing cultural, social and political diversity. Without doubt, the concept of sustainable development goals is aimed at creating a just and balanced world design. Thus, in any case, both the critics and followers of the concept of sustainable development are united in believing that transition to sustainable development requires dramatic transformation of the current civilization, the core of which is the environmentalisation of all major human activities.

Resource

Arora, N. K., Fatima, T., Mishra, I., Verma, M., Mishra, J., & Mishra, V. (2018). Environmental Sustainability: Challenges and Viable Solutions. Environmental Sustainability. Singapore. Https://Doi.Org/10.1007/S42398-018-00038-W

ogers, P. P., Jalal, K. F., & Boyd, J. A. (2008). An Introduction to Sustainable Development. London: Glen Educational Foundation, Inc.

Sloep, Peter B. And Blowers, A. (2005). Environmental Policy in an International Context: Environmental Problems as Conflicts of Interest. London: Elsevier.

Activity 3.1

Discuss when and how the SDGs adopted by UN as s a universal call for action to end poverty?

Feedback to Activity 3.1

The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by the United Nations in 2015 as a universal call for action to end poverty, protect the planet, and ensure that by 2030 all people shall enjoy peace and prosperity The 17 SDGs are integrated; they recognize that action in one area will affect outcomes in the other places, and that development must balance social, economic and environmental sustainability.

Self-test exercise 3.1

Dear learner; I hope you enjoyed reading the notes and doing the activities. I think you found them interesting and relevant. Now, attempt the questions that are given below to evaluate how far you have understood the lesson you studied.

Part I

For questions 1-8, choose the best answer from the given alternatives.

1. Which of the following statements is correct about achieving sustainable development?
   A. Sustainable development can be achieved by restricting the usage of renewable resources
   B. Sustainable development can be achieved by controlling the growth rate of world's population
   C. Sustainable development can be achieved by controlling the menace of pollution
   D. All of the above
2. Which of the following statements is true?
   A. Economic growth is the modern concept for development
   B. Political growth is the modern concept for development
   C. Sustainable growth is the modern concept for development
   D. Social growth is the modern concept for development
3. Which of the following is true about the environment?
   A. The environment includes only biotic factors
   B. The environment includes only abiotic factors
   C. The environment includes both biotic and abiotic factors
   D. The environment includes neither biotic nor abiotic factors
4. When was the term 'Sustainable Development' came into existence?
   A. 1987 C. 1978
   B. 1980 D. 1992
5. Social, economical, and ecological equity is the necessary condition for achieving:
   A. Social Development C. Sustainable Development
   B. Economical Development D. Ecological Development
6. The maximum number of individuals that can be supported by a given environment is called:
   A. Biotic potential C. Environmental resistance
   B. Carrying capacity D. Population size
7. The first step towards sustainable development was taken at?
   A. Stockholm Conference C. San Francisco Conference
   B. Bangkok Conference D. All of the above
8. UNCED stands for:
   A. United Nations Conference on Environment and Development
   B. United Nations Conference on Economical Development
   C. United Nations Confederation on Environment and Development
   D. United Nations Confederation on Economy and Development

Part II

Answer the following questions (9-11) by giving short answers

9. What do we mean by sustainable development?
10. What are SDGs (Sustainable Development Goals)?
11. What are the three dimensions of sustainable development?

Dear learner; thank you for attempting the questions. I hope you have written the answers to the questions. Please compare your answers with the feedback given below.

Answer Key: Self-test exercise 3.1

Part I. 1. D 2. C 3. C 4. B 5. C 6. B 7. A 8. A

Part II

1. Sustainable Development is defined as a sort of development that helps to meet the needs of the present generation without, however, compromising the ability of the future generations to meet their own needs.
2. The Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including poverty, inequality, climate change, environmental degradation, peace and justice.
3. The three essential dimensions of sustainable development are:
    i. Economic: an economically sustainable system must be able to produce goods and services on a continuing basis, to maintain manageable levels of government and external debt, and avoid extreme sectoral imbalances that damage agricultural and/or industrial production.
    ii. Environmental: an environmentally sustainable system must maintain a stable re- source base and avoid overexploitation of non-renewable resource systems, including maintenance of biodiversity, atmospheric stability and ecosystems services not always looked upon as economic resources.
    iii. Social: a socially sustainable system must achieve fairness in distribution and opportunity among all persons with adequate provision of such social services as health, education and gender equity. The social dimension focuses on reconciliation of environment and development, and governance related to provision of social services.

Checklist

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

№	Items	Yes	No
1	explain the concept of sustainable development?		
2	elaborate the different dimensions of sustainable development?		
3	discuss the progresses for achieving sustainable development goals globally and in your local context?		
4	identify the goals of sustainable development?		
5.	explain how SDGs are integrated into the national plan?		

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 section.

SECTION TWO
3.2. Resource use policies and related conflicts

Section Overview

Dear learner, this section focuses on resource use policies and related conflicts. Resource disputes often involve uneven geographic patterns of resource distribution that can be particularly salient when they occur along ethnic, religious, or linguistic lines. Tensions between competing livelihood groups over scarce natural resources often occur in seasonal cycles, which can escalate into violent outcomes following sudden shocks or stresses to the system. Natural resources can play a number of different roles in the generation and escalation of tensions between stakeholders, ranging from triggering and intensifying conflicts to prolonging them. Resource conflicts can involve a wide range of actors and stakeholders, including nation states, local governments, ethnic groups, communities, civil society organizations, and private companies. Natural resources frequently play a key role in the broader political economy, often reinforcing the power of elite actors. Resource disputes are sometimes associated with significant power imbalances and asymmetries between the parties (e.g., international corporations versus local communities, or lack of formal representation of a specific livelihood group in a decision making process). In many situations, natural resources are governed by a combination of customary and statutory institutions, or hybrid political orders. Conflicts over renewable resources are essentially political issues concerning: who should have access to and control over resources? Dear student, recognize the learning outcomes and issue highlighted and continue reading the sections that follow.

Section Learning Outcomes

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

- examine conflicts over resources in your localities along with approaches to address them; and
- analyze the main derives of conflict over renewable resources.

KEY TERMS:

- Resource conflict,
- Transboundary,
- Conflict over resource access,
- derives of Conflict,
- Poor Governance,

3.2.1 Categories of resource conflicts

Dear learner, how can we categorize resource conflicts?

Resource conflicts are typically categorized according to the primary resource involved and to the main conflict driver. Of course, many conflicts involve the interplay of more than one type of resource. Indeed, in the majority of cases, one or more of the following drivers are at play: These are conflicts over:

- resource ownership;
- resource access;
- decision making associated with resource management; and
- distribution of resource revenues.

Dear student, what are the unique characteristics of natural resource conflicts?

The scarcity or abundance of a specific natural resource fundamentally influences the conflict dynamics at play and the mediation opportunities available. Many resources are influenced by a range of natural and social factors leading to a high level of complexity and uncertainty in their availability, quality, and value. Resource disputes often involve uneven geographic patterns of resource distribution that can be particularly salient when they occur along ethnic, religious, or linguistic lines.

Natural resources frequently play a key role in the broader political economy, often reinforcing the power of elite actors. Resource disputes are sometimes associated with significant power imbalances and asymmetries between the parties (e.g., international corporations versus local communities, or lack of formal representation of a specific livelihood group in a decision making process). In many situations, natural resources are governed by a combination of customary and statutory institutions, or hybrid political orders.

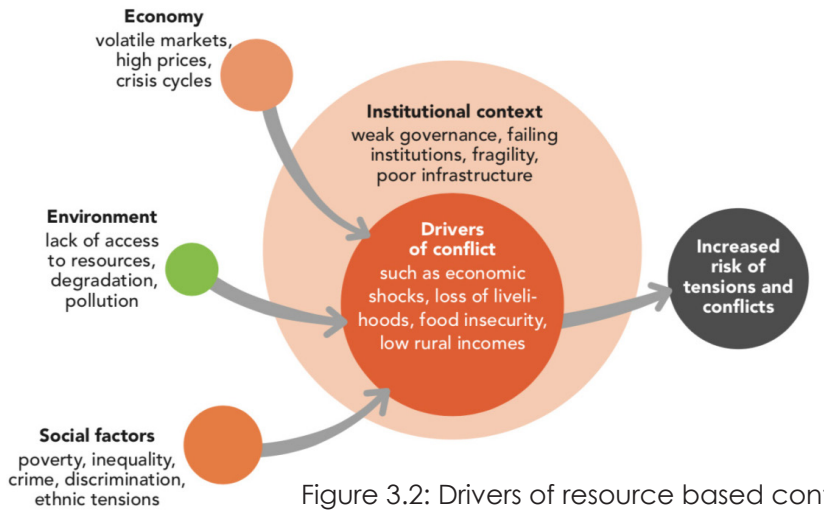


Figure 3.2: Drivers of resource based conflict

3.2.2 The drivers of resource based conflicts

Dear student, what are the drivers of resource based conflicts?

Conflicts over renewable resources are essentially political issues concerning who should have access to and control over the resources? Whose views should count in identifying and prioritizing issues and problems, and, desirable management goals and rates of use? These key political questions can become sources of tension and division, based on the competing interests of different individuals, groups or countries. Such conflicts can occur at the local, national and transboundary levels as well as involve multiple stakeholders including communities, private sector actors, civil society organizations, local authorities and national governments.

Student, what is the root causes of conflicts as to your understanding?

In broad terms, conflicts are caused by disputes between parties involving one or more of the following root causes: These are:

Beliefs: Different principles, values and ideologies on what is right or wrong and how the world should be organized;

Interests: Competition between different users to capture or protect specific re- sources; Information: Relates to the level of common understanding of the issue, including the lack of interpretation of or assessment of information;

Relationships: Poor communication, misunderstandings, conflict history and lack of trust between the parties; and,

Procedures: Types of decision-making procedures and concerns about the fairness of their outcomes.

While competing interests or opposing beliefs lie at the heart of any conflict, these also interact with the level of available information, the previous conflict history, the level of trust between the parties, and the prevailing system of decision-making.

These factors of conflicts over natural resources can occur at many different levels at the local, subnational, national and transboundary levels and interact with larger political, economic or security stress factors and vulnerabilities.

Student, what are the main drivers of conflict over natural resources?

There are three main drivers of conflict over natural resources. These are:

1. Competition over increasingly scarce renewable resources;
2. Poor governance of renewable natural resources and the environment; and
3. Transboundary natural resource dynamics and pressures.

These are briefly discussed as follows:

1. Competition over increasingly scarce renewable resources

Student, what do we mean by resource scarcity"?

The concept of "resource scarcity" describes a situation where the supply of renewable resources is not sufficient to meet the local demand. Increased scarcity of renewable natural resources that are needed to sustain livelihoods can increase competition between user groups or between economic sectors. Social responses to rising competition can include migration, technological innovation, cooperation and violent conflict.

There are three main causes for increasing resource scarcity working separately or in combination: These are:

i. Demand-induced scarcity;
ii. Supply-induced scarcity; and
iii. Structurally induced scarcity.

Demand-induced scarcity arises when demand for a specific renewable resource increases, and cannot be met by the existing supply. While a resource such as water or cropland may initially meet all local needs, population growth, increases in consumption rates, and/or the use of new technologies can reduce the per capita availability of the resource over time.

Supply-induced scarcity occurs when environmental degradation, natural variation or a breakdown in delivery infrastructure constrains or reduces the total supply of a specific resource. As the supply of natural resources is reduced, options for pursuing productive livelihood strategies are undermined, creating competition between livelihood groups that are difficult to resolve.

Structural scarcity occurs when different groups in a society face unequal resource access. While structural scarcity can be caused by poor NRM, it can also exist even in a well-functioning governance structure, as a result of different land use decisions and tradeoffs.

2. Poor governance of renewable natural resources

Dear student, what do we mean by governance of natural resources?

Governance of natural resources and the environment refers to the institutions, policies and processes that are established to regulate their management, ownership, allocation, use and protection.

In general terms, there are four types of grievances that lead to poor resource and environmental management. These are:

i.The first one is an unclear, overlapping or poor enforcement of resource rights and laws. In many countries, land and renewable natural resources are regulated under a combination of statutory, customary, informal and religious forms of tenure. Disagreements regarding these 'rules' as well as uncertainty over resource rights are often at the heart of conflict. The 'rules' of resource governance vary from country to country, and even within countries. In many developing countries, it is common to find renewable natural resources, including land, regulated under statutory, customary, informal and religious forms of tenure.

In many cases, conflicts occur either because specific groups have no rights to the resources on which they depend for their livelihood, or no feasible way to exercise the rights they do have. Similarly, conflict can occur when institutional jurisdictions, mandates or resource management laws are unclear, overlapping or contradictory. A lack of state capacity to extend its presence and authority into rural areas in order to enforce laws and resolve disputes is often a key cause of poor NRM.

ii. The second is discriminatory policies, rights and laws that marginalize specific groups. When one group controls access to renewable resources to the detriment of others, natural resource dependent communities are often marginalized.

Violence can occur as individuals and groups seek greater or more fair and equitable access to key resources. The struggle for increased equity can become linked to the recognition of identity, status and political rights, making conflict resolution even more difficult.

iii. The third is unequal distribution of benefits and burdens from development projects. Extractive industries, industrial sites or major infrastructure projects can provide multiple benefits to local communities as well as seriously degrade, exhaust or pollute renewable natural resources and become a major source of grievance.

The environmental impacts of development projects can create tensions if communities are not compensated for the damage, and do not receive a share of the development benefits, financial or otherwise.

iv. The last is lack of public participation and transparency in decision-making. Natural resource policies and interventions are often made by the state, in conjunction with private sector actors, without the active participation of affected communities or sufficient transparency and consultation with stakeholders.

Where communities and stakeholders are poorly engaged or excluded from the decision making process over renewable natural resources, they are likely to oppose any related decisions and outcomes.

3. Transboundary natural resource dynamics and pressures

Dear student, what do we mean by transboundary natural resource conflicts?

The challenges of managing renewable natural resources often extend beyond national borders. This is particularly the case for water, wildlife, fisheries and air quality. Similarly, risks to renewable resources from waste management, pollution, climate change and disasters are often transboundary in nature.

While states have in accordance with the UN Charter and the principles of international law the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, they also have the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states. Furthermore, Principle 2 of the Rio Declaration refers to the issues of sharing in the use and management of resources that move across international borders. Yet, transboundary dynamics are often beyond the capacity of a single sovereign state to manage unilaterally, requiring cooperation and co-management with neighboring countries.

There are four main types of transboundary dynamics and pressures that can cause conflicts over renewable natural resources. These are:

i. First, when the transboundary natural resources, such as water or fisheries are shared between countries, conflicts can arise when one country consumes the resource at higher rates than another, and violates agreed allocations or demonstrates inflexibility when faced with natural variation. This is often linked to existing power and political economy dynamics, as well as with the bargaining power associated with their geographic location (upstream/downstream).

ii. Second, when the quality or quantity of transboundary natural resources found in one country are negatively impacted by infrastructure, industrial development or changes in land use in another country. In particular, pollution generated in one country can easily cross national borders, creating health risks in another. Similarly, changes in land use in one country, including high levels of deforestation and soil erosion, can heighten vulnerabilities to natural hazards in another.

iii. Third, while national borders define the sovereign boundary of states, these are often not respected by pastoralists that migrate on a seasonal basis along traditional routes, based on the availability of natural resources, such as water and grazing land. Similarly, wildlife populations commonly migrate across national boundaries, shifting economic opportunities from one country to another. Both situations can be important sources of conflict as user groups face increasing competition and lose their livelihoods. This in turn may result in the loss of indigenous communities and their cultural and spiritual heritage.

iv. Fourth one, of the emerging threats to the natural resource base of countries comes from illicit activities and criminal groups operating on a global and transboundary basis. Illicit extraction and trade of natural resources deprive resource benefits of local communities which can lead to conflict. Dear learner, take time and summarize your understanding about the key contents you covered up to now, importantly be guided by the focusing question posed at interval.

Student, how many transboundary rivers are there in the world? Can you give examples from different continents? Are they the stimulus for co-operation or conflict?

At present, there are 263 rivers that either cross, or demarcate, international boundaries. To date, shared water resources have more often been the stimulus for co-operation than for conflict. Various studies indicate that cooperative interactions between riparian states over the past fifty years have outnumbered conflictive interactions by more than two-to-one. Since 1948, the historical record documents only 37 incidents of acute conflicts (i.e., those involving violence) over water (30 of these events were between Israel and one or another of its neighbors, the last of which occurred in 1970), while during that same period, approximately 295 international water agreements were negotiated and signed.

However, there are important qualifiers to this finding. They go on to observe that 158 of the world's 263 international basins lack any type of cooperative management framework, and that of the 106 basins with water institutions, approximately assisting in the design of co-management plans and institutions. Among these are:

- Iran and Iraq to resolve tensions over the development and conservation of the transboundary Mesopotamian marshlands;
- Iran and Afghanistan to address the degradation and co-management of the Sistan basin;
- Sudan and South Sudan to facilitate coordinated management
- Palestinian Authority and Israel to address water and waste management issues.

3.2.3 Conflict Prevention Strategies

Student, are there conflict prevention strategies in your locality?

Conflict prevention refers to the set of approaches, methods and mechanisms used to avoid, minimize, resolve and contain conflict in order to prevent a further escalation to violence.

Where natural resources are a direct source of conflict, or a contributing factor in a larger conflict context, prevention strategies must take into account the complex inter-relationships between causes, potential impacts and possible interventions. The way that conflicts over natural resources become politicized within the broader conflict and political context is also essential to consider. In all cases, conflicts over renewable resources interact with existing political, socioeconomic and security tensions and stress factors, requiring a response on multiple levels, including technical, political and institutional responses.

In other words, there is no "quick fix" to the problem. The "technical side" of NRM cannot be addressed in isolation from the institutional and governance aspects, which together are the main determinants of how users relate to each other, and how competing interests are resolved. Appropriate interventions depend on the mix of conflict drivers, underlying vulnerabilities, livelihood responses, political processes, existing governance capacities and the level of conflict intensity. This could be achieved by implementing sustainable livelihoods and reduce vulnerability to resource scarcity.

Student, what are the components of sustainable livelihoods framework?

The sustainable livelihoods framework has been adopted by a number of UN agencies and donors to understand how to reduce poverty at the household level. Sustainable livelihoods framework is a method to understand how livelihood strategies in a specific area compete for the same limited resources, together with the social assets and institutions that are available to prevent conflict.

The sustainable livelihoods framework can be used to inform conflict prevention programmes in three main ways:

First, it can help practitioners understand how changes in the availability of specific natural resources can impact livelihoods and lead to competition.

Second, it can help identify the social assets, coping mechanisms and institutions that are utilized to respond to shocks and resolve disputes over scarce resources.

Third, the sustainable livelihoods framework can help to identify specific interventions that can be undertaken to expand livelihood opportunities, reduce vulnerabilities from increasing resource scarcity, and provide access to dispute resolution. A major strength of the SL approach is that it does not perceive people as vulnerable and helpless, but as dynamic actors able to adapt to trends and cope with shocks.

The sustainable livelihoods approach does not offer a simple solution to the challenge of declining resource access and availability. However, it represents a useful approach to thinking through the problem, by providing a framework that facilitates coherent and structured discussion of differing perspectives.

The sustainable livelihoods approach draws attention to the assets people have rather than what they do not have; the cross sectorial nature of livelihood strategies; to the vulnerability context; and to the role of policies, processes and institutions. By encouraging local people to think about a broad range of livelihood outcomes, potential conflicts can be explicitly discussed and prevented.

Resource

Yasmi, Y., Schanz, H., & Salim, A. (2006). Manifestation of conflict escalation in natural resource management. environmental science & policy, 9(6), 538-546.

Dimelu, M. U., Salifu, E. D., & Igbokwe, E. M. (2016). Resource use conflict in agrarian communities, management and challenges: A case of farmer-herdsmen conflict in Kogi State, Nigeria. Journal of Rural Studies, 46, 147-154.

Stepanova, O., & Bruckmeier, K. (2013). Resource use conflicts and urban–rural resource use dynamics in Swedish coastal landscapes: comparison and synthesis. Journal of Environmental Policy & Planning, 15(4), 467-492

Activity 3.2

Dear student, what are the main governance challenges that lie at the root of conflicts over natural resources?

Feedback to Activity 3.2

The main governance challenges that lie at the root of conflicts over natural resources include:

i. Unclear, overlapping or poor enforcement of resource rights and laws;
ii. Discriminatory policies, rights and laws that marginalize specific groups;
iii. Unequal distribution of benefits and burdens from development projects; and,
iv. Lack of public participation and transparency in decision-making.

Self-test exercise 3.2

Dear learner; I hope you enjoyed reading the notes and doing the activities. I think you found them interesting and relevant. Now, attempt the questions I–III that is given below to evaluate how far you have understood the lesson you studied.

Part I

For questions 1-2, choose the best answer from the given alternatives.

1. A type of conflict that arises when people disagree over what data is relevant is_____.
   A. information conflicts C. interest conflicts
   B. values conflicts D. relationship conflicts
2. One of the following may not be a top solution for the water crisis?
   A. Old Conservation Technologies. D. Rain Water Harvesting.
   B. Community Governance and Partnerships. E. Recycle Wastewater.
   C. Improve Irrigation and Agriculture Water Use.

Part II

Answer questions 3-6 by writing 'True' for the correct statements or 'False' for the wrong statements.

3. The sustainable livelihoods approach offers a simple solution to the challenge of declining resource access and availability.
4. Conflict prevention refers to the set of approaches used to resolve conflict.
5. To date, shared water resources have more often been the stimulus for conflict than for co-operation.
6. Structural scarcity occurs when different groups in a society face unequal resource access.

Part III

Give short answer for the following questions

7. What is conflict in resource use?
8. What are examples of conflict resources?
9. What are the 4 types of conflicts?
10. What are the challenges facing transboundary resources?
11. Give an example of transboundary resources?
12. What are some examples of transboundary water conflicts?

Dear learner; thank you for attempting the activity questions. I hope you have written the answers to the questions. Please compare your answers with the feedback given below.

Answer Key for the Self-test exercise 3. 2

Part I

1. A 2. A Part II 3. False 4. True 5. False 6.True

Part III

7. Natural resource conflicts are disagreements and disputes over access to, control over and use of natural resources. They can be useful in helping a community to clarify interests and needs and in reducing possible injustices or inequities in resource distribution.
8. The examples of conflict resources are from water to gold, farmland to forests, the earth's resources often fuel human conflict. An individual fights with his neighbor over property while a whole community combats a corporation mining in their area.
9. The opposing force created, the conflict within the story generally comes in four basic types: Conflict with the self, Conflict with others, Conflict with the environment and Conflict with the supernatural.
10. The existing challenges to the management of transboundary natural resources will undoubtedly be exacerbated by climate change. The variability in river flows, erratic precipitation levels, increasing temperatures and sea level rise will impact the sustainable use of these resources.
11. There are various transboundary natural resources located within the territorial boundaries of Kenya that are shared with other states. These include lakes, mountains, rivers and river basins, aquifers, wildlife etc.
12. The examples of transboundary water conflicts include the 1994 Israel-Jordan and 1959 Egypt-Sudan treaties.

Checklist

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

№	Items	Yes	No
1	examine conflicts over resources in you localities along with approaches to address them?		
2	analyze the main derives of conflict over renewable resources?		
3	apply the principles of good natural resource governance in your locality?		

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 section.

SECTION THREE
3.3. Governance of Natural Resources

Section Overview

Dear student, natural resource governance refers to the norms, institutions and processes that determine how power and responsibilities over natural resources are exercised, how decisions are taken, and how citizens participate in and benefit from the management of natural resources. Natural resource governance is increasingly contentious in view of the over-exploitation of natural resources, the environmental degradation that results from excessive farming and mining, and the destruction of livelihoods in localities where such exploitation takes place.

In sum, natural resource governance should embody principles that promote environmental sustainability and recognize the tenure rights and cultural integrity of the communities concerned. To this end, the operational aspects of natural resource governance should foster bottom-up consensus-oriented decision making among multiple stakeholders, premised on trust, shared commitment and common understanding. Dear student, recognize the learning outcomes and issue highlighted and continue reading the sections that follow.

Section Learning Outcomes

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

- explain the principles and characteristics of governance of natural resources;
- appreciate the local indigenous way of protecting natural resource; and
- examine the main principles of good natural resource governance.

KEY TERMS

- Good governance,
- Indigenous communities,
- Social equity,
- Discriminatory policies,
- Unequal distribution

3.3.1 The concept of natural resource governance

Dear student, what is meant by natural resource governance?

Natural resource governance refers to the norms, institutions and processes that determine how power and responsibilities over natural resources are exercised, how decisions are taken, and how citizens – women, men, indigenous peoples and local communities participate in and benefit from the management of natural resources.

Natural resource governance is increasingly contentious in view of the over exploitation of natural resources, the environmental degradation that results from excessive farming and mining, and the destruction of livelihoods in localities where such exploitation takes place.

Dear student, can we improve our natural resource governance?

Improving natural resource governance, including securing rights and sharing power and responsibilities, can benefit both people and biodiversity, e.g. through improved ecosystem health and human wellbeing.

Land use debates, especially in the arena of conservation, wildlife protection and sustainable development, revolve strongly around natural resource governance because the prioritization, allocation and management of resources exert a direct impact on the environment and its inhabitants.

Implicit in such debates is the call for exploitation of natural resources to be carried out in a manner/extent that, "meets the needs of the present without compromising the ability of the future generation to meet their own needs".

Dear students, according to your perspective, can exploitation of natural resources affect the Indigenous communities?

Indigenous communities are particularly affected by exploitation of natural resources such as monoculture farming, industrial fishing, logging, mining and dam construction. This is why a central feature of natural resource governance pertains to indigenous self-determination and tenure rights. Unfortunately, the national legal frameworks of many countries have yet to accord the indigenous people sufficient recognition of their customary lands and the stewardship of their environments.

Dear student, are there international laws that endorse indigenous self-determination and self-governance?

This is despite the existence of international conventions that advocate indigenous self-determination and self-governance. For example, Article 10 of the UN Declaration on the Rights of Indigenous Peoples (UNDRIP) states that indigenous peoples should not be forcibly removed from their lands; and where relocation takes place, it must be with the free, prior and informed consent of the indigenous peoples concerned, coupled with fair and just compensation (United Nations, 2007).

Similarly, the Convention on Biological Diversity (CBD) recognises that communities are inextricably linked to their territories, and that the preservation of traditional knowledge is crucial to conservation and biological diversity.

It can be observed that access to justice are important in the protection of the rights of indigenous groups and any community affected by exploitation of natural resources or competing land use. An effective natural resource governance framework should provide the proper administrative or legal avenues of redress to the communities concerned.

In the context of environmental protection, Article 1 of the Aarhus Convention or the UN Economic Commission for Europe (UNECE) Convention on access to information, public participation in decision-making and access to justice in environmental matters advances three pillars of public participation, namely:

i. The right of access to information,
ii. Public participation in decision-making and
iii. iAccess to justice, as a means to empower communities in the protection of their own environments.

3.3.2 Principles of Good Natural Resource Governance

Dear student, what principles govern natural resources governance?

Natural resource governance should embody principles that:

- promote environmental sustainability; and
- recognize the tenure rights and cultural integrity of the communities concerned.
- foster bottom-up consensus oriented, decision making among multiple stakeholders, and
- premised on trust, shared commitment and common understanding.

Student, what is the relation between sustainable development and good governance? Reflect this question before you proceed to the following sub-section.

3.3.3 The main challenges of governance over natural resources conflicts

Dear student, what are the challenges of good natural resource governance? As has seen above, good governance is one of the fundamental preconditions for a sustainable development.

However, it is challenging to distil common principles of good natural resource governance where multiple stakeholders function at different levels, interacting with culturally diverse communities, against the background of dissimilar geographical landscapes. Factionalism and the consequent competition and clash in priorities are the problems of governance framework in any sector.

Robust laws, institutions, policies and processes can help reduce the vulnerability of populations to renewable resource scarcity, resolve disputes between competing interests and prevent conflicts over resource access, ownership, control and management. It is impossible to prescribe ideal forms of institutions, policies and processes that could effectively manage natural resources and systematically resolve disputes. Given that conflicts over renewable natural resources are highly context dependent, no two governance solutions are ever the same.

There are four main governance challenges at the root of conflicts over natural resources: These are:

i. Unclear, overlapping or poor enforcement of resource rights and laws;
ii. Discriminatory policies, rights and laws that marginalize specific groups;
iii. Unequal distribution of benefits and burdens from development projects; and
iv. Lack of public participation and transparency in decision-making.

As a result, improving the basic governance of renewable natural resources to prevent conflict generally involves five types of interventions. These are:

1. There must be legal and institutional changes to clarify resource rights, responsibilities, laws and institutional mandates. This includes clearly recognizing and respecting the rights of poor and marginalized people who are directly dependent on natural resources.
2. equitable resource access should be a priority of public policy at the national level, and one of the outcomes of development programmes.
3. conducting environmental and social impact assessments for all major development projects, including infrastructure, industrial sites, and major extractive industries.
4. public participation in decision-making and resource management. Community-based and collaborative management approaches are often used as a solution.
5. unexpected impacts on renewable resources can emerge as a normal part of the development process.

Resource

Busse, M., & Gröning, S. (2013). The resource curse revisited: governance and natural resources. Public choice, 154, 1-20.

Fischer, A., Petersen, L., Feldkoetter, C., & Huppert, W. (2007). Sustainable governance of natural resources and institutional change–an analytical framework. Public Administration and Development: The International Journal of Management Research and Practice, 27(2), 123-137.

Mejía Acosta, A. (2013). The impact and effectiveness of accountability and transparency initiatives: The governance of natural resources. Development Policy Review, 31, s89-s105.

Activity 3.3

1. Compare and contrast the indigenous conflict resolution mechanism and the formal legal systems in achieving sustainable peace and its preference, in pastoral areas of Ethiopia.

Feedback to Activity 3.3

1. The formal legal systems have several weak points such as inaccessibility of the formal court system and the lengthy process to achieve justice. Indigenous conflict resolution and management, on the contrary lead to win-win situations as it takes into account the interest of every party. The disputants acknowledge that they have something to gain and something to lose in the end. Especially, in inter-clan conflict cases, the government legal institutions are regarded as auxiliaries to the local mediation involving elders.

Self-test exercise 3.3

Dear learner; I hope you enjoyed reading the notes and doing the activities. I think you found them interesting and relevant. Now, attempt the questions that are given below to evaluate how far you have understood the lesson you studied.

Part I

For questions 1-7, choose the best answer from the given alternatives

1. Which one of these is a type of scarcity that occurs when different groups in a society face unequal resource access?
   A. Supply-induced scarcity C. Demand-induced scarcity
   B. Structural scarcity D. None of these
2. Which one of the following is an indicator of good governance of natural resources?
   A. Discriminatory policies C. Unequal distribution of benefits
   B. Laws that marginalize specific groups D. Public participation and transparency
3. The social dimension of sustainable development focuses on:
   A. Governance related provision
   B. Maintaining a stable resource base
   C. Avoiding overexploitation of non-renewable resources
   D. Avoidance of extreme sectorial imbalances. E. All of the above
4. Which one of the following is different from the others?
   A. Water B. Coal C. Natural Vegetation D. Soil
5. One of the following could be the cause of conflict over natural resources:
   A. Information B. Interest C. Beliefs D. All
6. Which one of the following is not among the main drivers of conflict over natural resources?
   A. Resource scarcity C. Transboundary resource
   B. Poor governance D. None of these are answer
7. Which of the following is the problem of governance framework in any sector?
   A. Factionalism C. competition
   B. clash in priorities D. All of these are answers

Part II

Answer questions 8-10 by writing 'True' for the correct statements or 'False' for the wrong statements.

8. Conflicts over renewable natural resources are highly context dependent.
9. Governance of renewable natural resources refers to the institutions, policies and processes established to regulate their use and protection.
10. Good governance is one of the fundamental preconditions for a sustainable development.

Answer Key Self-test exercise 3.2

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

Checklist

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

№	Items	Yes	No
1	explain the principles and characteristics of governance of natural resources;		
2	appreciate the local indigenous way of protecting natural resource; and		
3	identify the main principles of good natural resource governance.		

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 section.

SECTION FOUR

3.4. Indigenous Conflict Resolution Practices

Section Overview

Dear student, the processes of conflict management in contemporary Africa have been highly centralized with an overemphasis on the role of the modern court; although, such systems may not provide adequate response to the conflicts associated with territorial and natural resource competition, particularly in the utilization of rangeland resources. Many scholars reported the effectiveness of customary institutions in improving access to grazing commons for different users when there is variation in resource conditions across space at a given time, which will in turn reduce tension. As a result, student you are advised to focus on key concepts and issues of the section and construct your understanding.

Section Learning Outcomes

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

- discuss the unique values and limitations of indigenous approaches used to address conflict over resources.

KEY TERMS

- Indigenous,
- Conflict resolution,
- Shimagle 'elders',
- T'eer, Gadaa,
- Mada'a,
- Ogaz,
- Abba Gadda,
- Kedo Abba.

4.1.1 Indigenous conflict resolution mechanisms

Dear student, what do we mean by indigenous conflict resolution? What type of conflict resolution is known in your locality?

Societies world-wide have long used indigenous mechanisms to prevent and resolve conflicts. In every community, systems of indigenous conflict resolution often based on community customs, familial relationships, or embedded in institutional practices run alongside the formal state sanctioned processes. In a society where the majority of the populace is poor with widespread illiteracy culminating in lack of access to justice and the high cost and scarcity of lawyers, traditional conflict resolution stands out as the best method of conflict resolution.

Dear student, what types of indigenous conflict resolution mechanisms are there in your locality?

In Ethiopia, many rural and village communities do not refer complaints to the police or prosecuting authorities, but instead deal with them using indigenous tribal processes. To this end, people practice various indigenous conflict resolution mechanisms.

These indigenous conflict resolution mechanisms are deeply rooted in culture and traditions of different ethnic groups. The practices are therefore associated with the cultural norms and values of the peoples and gain their legitimacy from the community values instead of the state. Besides, due to the multiethnic composition of the country, indigenous conflict resolution mechanisms of Ethiopia are different from ethnic group to ethnic group. As a result, they do not have uniform application all over the country.

In the ancient days and most especially under the Fetha Negast [law of the kings], conflicts between individuals or communities were encouraged to be settled amicably at local level. Shimagle 'elders' or people appointed on adhoc basis to settle disputes played an important role in resolving conflicts. Even today, these mechanisms are widely practiced among the various ethnic groups to settle various conflicts and many other problems. Figure 3.3 shows that elders in the community in Sidama, Ethiopia, and Northern Kenya are looking for a solution to a conflict over land, pasture, and water supplies.

Figure 3.4: Traditional resource conflict resolution vis-à-vis Formal systems (Sidama and North Kenya Ethiopia from up and down, respectively)

For instance, the institutions of Gadaa among the Oromo, the Shimagle by the Amhara and other ethnic groups are used to resolve conflicts. Moreover, even after passing through the procedures and penalties in the criminal court, in some parts of Ethiopia people use the indigenous conflict resolution mechanism for reconciliation and to reduce the acts of revenge.

The pastoral community including the pastoralists of Ethiopia has well developed conflict resolution mechanism that involves elders and clan leaders to solve disputes in the context of traditional law. The T'eer of Somali, Gadaa system of Oromo and Mada'a of Afar are some of the indigenous conflict resolution and management systems which are governed by an unwritten law that is transmitted from generation to generation orally.

Although, there have been some minor differences in their practice and implementation, the Somali, Borana and Afar pastoralists do have their own indigenous institutions led by Ogaz, Abba Gadda and Kedo Abba, respectively. These pastoral communities have two types of law, the conflict resolution laws that concern intra-ethnic group disputes, and laws concerning interethnic group disputes.

In Afar, the conflicts between different clans are managed by the Mada'a based on their customary law and elders. Elders, of the Madd'a, not representing members in disputes are selected from different clans. The decisions by the council of elders are effective due to the tradition of forgiveness, respect for elders, and the transfer of resources as compensation

Madaa was able to effectively manage conflicts between the Afar people and some of their neighbors in the past.

All Oromo clans have common indigenous conflict resolution mechanisms in which 'Gumma' is the known one. Gumma is a conflict resolution technique related to killing, particularly unintentional killing of an individual from other or within the same clan. It helps to avoid grievances and revenge that often follow such a killing.

In the case of the Somalis, there is a well-developed, relatively well-structured conflict management mechanism, where the guurti elders act as judges and jury, and their decisions are largely adhered to and respected by the community. The customary law of the Somali is exercised by the well-experienced elders, and the governing unit is the guurti (the council of elders). The institutions that elders developed are generally respected because elders are seen as trustworthy and knowledgeable people in the community, and are believed to make rational decisions. In addition to solving the conflicts, the elders take measure to prevent conflict through monitoring and punishing individuals who plan to trigger it and through pushing clans to respect the inter clan agreement in place.

Even though different studies underline the importance of indigenous conflict resolution mechanism in achieving sustainable peace and its preference in pastoral areas of the country, indigenous institutions are regarded as an alternative to the formal legal system. Dear student, what similarities and differences did you noted among the Indigenous conflict resolution mechanisms presented above and others you have known in your locality? Furthermore how do you contrast them to the formal legal system? Reflect on these and relate to the lesson notes and relevant reference sources for more meaningful comprehension.

Student, what the difference between Indigenous conflict resolution and formal court system?

The formal legal systems have several weak points such as inaccessibility of the formal court system in the pastoral areas and the lengthy process to achieve justice. There are also instances where the formal legal system returns the cases to be seen by the elders' council, showing that indigenous conflict management and resolution mechanism bridges the gap created by the formal system. Formal conflict resolutions base themselves on a fixed code of law, and are hence unlikely to consider long standing social and economic relations among community members. Besides, government legal set ups often culminate in a zero sum outcome (winner-takes-all) because the main purpose is to serve justice through imposed agreements. They never target reconciliation and peaceful coexistence.

Indigenous conflict resolution and management, on the contrary lead to win-win situations as it takes into account the interest of every party. The disputants acknowledge that they have something to gain and something to lose in the end. Especially, in inter-clan conflict cases, the government legal institutions are regarded as auxiliaries to the local mediation involving elders. Therefore, it is crucial to understand Ethiopian society's potential and actual conflicts in their social context so that the norms, values and beliefs, fears and suspicions, interests and needs, attitudes and actions, relationships and networks are properly taken into account. Dear student, what is the advantage of Indigenous conflict resolution over the formal court system? Reflect this question and then proceed to the next description.

4.1.2 The UN Declaration on the Rights of Indigenous Peoples

Student, as to your knowledge, are there international laws regarding indigenous peoples' rights?

Student, try to analyze and internalize the prevailing laws pertinent to Indigenous Peoples based the information provided next. The Declaration, adopted by the United Nations General Assembly in 2007, makes direct reference to indigenous peoples' rights to land and self-determination – the two issues at the heart of most conflicts affecting indigenous peoples – besides other articles related to violence and conflict resolution.

Article 7: Recognizes that indigenous peoples have the collective right to live in freedom, peace and security as distinct peoples and shall not be subjected to any act of genocide or any other act of violence, including forcibly removing children of the group to another group.
Article 30: Asks states to undertake effective consultations with the indigenous peoples concerned, through appropriate procedures and in particular through their representative institutions, prior to using their lands or territories for military activities.

Article 32: States that indigenous people have the right to determine and develop priorities and strategies for the development or use of their lands or territories and other resources.
Article 40: States that indigenous people have the right to access to and prompt decision through just and fair procedures for the resolution of conflicts and disputes with states or other parties, as well as to effective remedies for all infringements of their individual and collective rights. Learner, this is a stage where you need to assess your own learning progress by recalling the main concepts and issues of the section. So revise focusing on core conceptual matters and issues, construct and refine your understanding.

Resource

Brock-Utne, B. (2001, February). Indigenous conflict resolution in Africa. In A draft presented to week-end seminar on Indigenous Solutions to Conflicts held at the University of Oslo, Institute of Educational Research (pp. 23-24).

Mengesha, A. D., Yesuf, S. S., & Gebre, T. (2015). Indigenous conflict resolution mechanisms among the Kembata society. American Journal of Educational Research, 3(2), 225-242.

Activity 3.4

1.Compare and contrast the indigenous conflict resolution mechanism and the formal legal systems in achieving sustainable peace and its preference, in pastoral areas of Ethiopia.

Feedback to Activity 3.4

The formal legal systems have several weak points such as inaccessibility of the formal court system and the lengthy process to achieve justice. Indigenous conflict resolution and management, on the contrary lead to win-win situations as it takes into account the interest of every party. The disputants acknowledge that they have something to gain and something to lose in the end. Especially, in inter-clan conflict cases, the government legal institutions are regarded as auxiliaries to the local mediation involving elders.

Self-test Exercise 3.4

Dear learner; I hope you enjoyed reading the notes and doing the activities. I think you found them interesting and relevant. Now, attempt the questions that are given below to evaluate how far you have understood the lesson you studied.

Part I

For questions 1-6, match the items in Column B with items in Column A

No	Column A		Column B
1	T'eer	A	Gurage Community
2	Mada'a	B	Oromo Community
3	Ogaz	C	Somali Community
4	Abba Gadda	D	Afar Community
5	Shimagle	E	Amhara Community
6	Gumma	F	Adare Community

Part II

Answer questions 1-7 by writing 'True' for the correct statements or 'False' for the wrong statements (5 points).

1. Societies world-wide have long used indigenous mechanisms to prevent and resolve conflicts.
2. In every community, indigenous conflict resolution run instead of the formal state sanctioned processes.
3. The indigenous conflict resolution mechanisms of Ethiopia are different from ethnic group to ethnic group.
4. Formal conflict resolutions consider long standing social and economic relations among community members.
5. Indigenous conflict resolution and management lead to win-win situations as it takes into account the interest of every party.
6. Gumma is a conflict resolution technique related to killing.
7. In Afar, the conflicts between different clans are managed by the Mada'a based on their customary law and elders.

Answer Key Self-test exercise 3.4

Part I

1. C 2. D 3.C 4. B 5.E 6.B

Part II

1. True 2. False 3. True 4. False 5.True 6.True 7. True

Checklist

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

№	Items	Yes	No
1	explain the principles and characteristics of governance of natural resources?		
2	appreciate the local indigenous way of protecting natural resource?		
3	discuss the unique values and limitations of indigenous approaches used to address conflict over resources		
	identify the local indigenous practices to solve problems in different communities 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 section.

Unit Summary

When poorly managed, distributed or controlled in an unfair or unequal manner, natural resources can be a major driver of conflict or instability. There are three main drivers of conflict over natural resources. These are:

1. Competition over increasingly scarce renewable resources;
2. Poor governance of renewable natural resources and the environment; and
3. Transboundary natural resource dynamics and pressures.

Conflict prevention refers to the set of approaches, methods and mechanisms used to avoid, minimize, resolve and contain conflict in order to prevent a further escalation to violence. Where natural resources are a direct source of conflict, or a contributing factor in a larger conflict context, prevention strategies must take into account the complex inter-relationships between causes, potential impacts and possible interventions.

Natural resource governance refers to the norms, institutions and processes that determine how power and responsibilities over natural resources are exercised, how decisions are taken, and how citizens – women, men, indigenous peoples and local communities participate in and benefit from the management of natural resources. Natural resource governance should embody principles that promote environmental sustainability and recognize the tenure rights and cultural integrity of the communities concerned. The operational aspects of natural resource governance should foster bottom-up consensus oriented decision making among multiple stakeholders, premised on trust, shared commitment and common understanding. Societies world-wide have long used indigenous mechanisms to prevent and resolve conflicts. In a society where the majority of the populace is poor with widespread illiteracy culminating in lack of access to justice and the high cost and scarcity of lawyers, traditional conflict resolution stands out as the best method of conflict resolution. In Ethiopia, people practice various indigenous conflict resolution mechanisms. These indigenous conflict resolution mechanisms are deeply rooted in culture and traditions of different ethnic groups. The T'eer of Somali, Gadaa system of Oromo and Mada'a of Afar are some of the indigenous conflict resolution and management systems which are governed by an unwritten law that is transmitted from generation to generation orally.

References

Arora, N. K., Fatima, T., Mishra, I., Verma, M., Mishra, J., & Mishra, V. (2018). Environmental Sustainability: Challenges and Viable Solutions. Environmental Sustainability. Singapore. Https://Doi.Org/10.1007/S42398-018-00038-W

Brock-Utne, B. (2001, February). Indigenous conflict resolution in Africa. In A draft presented to week-end seminar on Indigenous Solutions to Conflicts held at the University of Oslo, Institute of Educational Research (pp. 23-24).

Busse, M., & Gröning, S. (2013). The resource curse revisited: governance and natural resources. Public choice, 154, 1-20.

Dimelu, M. U., Salifu, E. D., & Igbokwe, E. M. (2016). Resource use conflict in agrarian communities, management and challenges: A case of farmer-herdsmen conflict in Kogi State, Nigeria. Journal of Rural Studies, 46, 147-154.

Fischer, A., Petersen, L., Feldkoetter, C., & Huppert, W. (2007). Sustainable governance of natural resources and institutional change–an analytical framework. Public Administration and Development: The International Journal of Management Research and Practice, 27(2), 123-137.

Mejía Acosta, A. (2013). The impact and effectiveness of accountability and transparency initiatives: The governance of natural resources. Development Policy Review, 31, s89-s105.

Mengesha, A. D., Yesuf, S. S., & Gebre, T. (2015). Indigenous conflict resolution mechanisms among the Kembata society. American Journal of Educational Research, 3(2), 225-242.

Rogers, P. P., Jalal, K. F., & Boyd, J. A. (2008). An Introduction to Sustainable Development. London: Glen Educational Foundation, Inc.

Sloep, Peter B. And Blowers, A. (2005). Environmental Policy in an International Context: Environmental Problems as Conflicts of Interest. London: Elsevier.

Stepanova, O., & Bruckmeier, K. (2013). Resource use conflicts and urban–rural resource use dynamics in Swedish coastal landscapes: comparison and synthesis. Journal of Environmental Policy & Planning, 15(4), 467-492.

Yasmi, Y., Schanz, H., & Salim, A. (2006). Manifestation of conflict escalation in natural resource management. environmental science & policy, 9(6), 538-546.

UNIT FOUR
ISSUES IN SUSTAINABLE DEVELOPMENT II: POPULATION POLICIES, PROGRAMS AND THE ENVIRONMENT

Unit Introduction

Population is one of the critical factors that affect the socio-economic development and environmental protection activities of societies and countries. Geography is one of the fields that studies issues related to the human population of the world. The study of population provides the necessary information needed for appropriate planning of socio-economic development and environmental protection programs. It also provides significant tools for governments, helping them to formulate and implement appropriate policies and strategies that help to address population-related problems. Especially for developing nations of the world where population has been growing very rapidly, population studies are essential for formulating population policies. These policies seek to bring changes in the size, trends of growth, composition, and distribution of population in order to achieve their socioeconomic and environmental objectives. This unit; therefore, specifically addresses topics, such as theories on population growth and development, population policies, relationship between population and socio-economic development, population and environmental health, and measures taken to curb growth of population. Thus, student, recognize the learning outcomes and issue highlighted and continue reading the sections that follow.

Unit Contents

Unit Outcomes

By the time students complete this unit, they will be able to:

- identity major population growth and development theories;
- analyze the impact of population policies on population growth;
- relate population growth to socio- economic development and environmental health;
- recommend strategies aimed at balancing population growth with environmental resources

The Required Study Time: 17 hours

Unit Learning Strategies

In the unit, the suggested learning strategies are:

- written brainstorming questions;
- Problem-solving method;
- individual project;
- report writing;
- observation;
- written activities;
- practical activities;
- self-test assessments;
- Activities; and
- Maps.

SECTION ONE

4.1 Theories on Population Growth and Development

Section Overview

Dear students, in this section you will learn about the theories of population growth and development. Various scholars have developed different theories that explain the relationships between population growth and social, economic and environmental aspects of the world. Based on their optimistic or pessimistic views regarding population growth, such theories are grouped into two: Conservative (pessimistic) population theories and Radical (optimistic) population theories. Malthus and his disciples hold a pessimistic view of population growth. Their perspective on population and resources has had a profound effect on the way population policy is formulated, especially in the developing world. On the other hand, other scholars have optimistic views of population growth. They do not consider population growth to be a problem. In fact, they believe that it is a very useful economic resource if used properly. These scholars are known as anti- Malthusians. Marx, a German philosopher, was among opponents of Malthus who developed the anti-Malthusian population theory called the "surplus population theory". Boserup was a Danish economist who developed another anti-Malthusian population theory called "theory on population and agriculture". She thought that, as the size of population increases, it results in technological innovations and advancement. Student, concentrate on core-contents and try to connect to your prior experience for further comprehension.

Section Learning Outcomes

After completing this section, you will be able to:

- explain theories on population growth and development
- compare the difference between conservative and radical theories of population and development.

KEY TERMS

- Conservative theories,
- Radical Theories,
- Neo-Malthusian,
- Positive checks,
- Preventive checks

What is the contribution of Malthus in population growth?

What is the major role of Neo-Malthusian theory in contemporary population growth debate? Dear student, make reflection on these questions before reading the next descriptions.

Conservative versus Radical Theories: Population size and change play such a fundamental role in human societies that they have been the subject of theorizing for millennia. Most religious traditions have had something to say on these matters, as did many of the leading figures of the ancient world.

4.1.1 Conservative Theories

a. Malthusian Theory

Dear learner, relate the idea you hold based on the question raised earlier to the details of the lesson note presented next. Thomas Malthus (1776-1834)- Clergyman, Demographer and Economist maintained the idea that there is a natural law of population growth in which food production increases only linearly (1, 2, 3, 4, 5…etc.) and population rises geometrically (1, 2, 4, 8, 16, 32, …etc.). Therefore, population growth tends to outstrip food supply resulting in poverty and hunger – (a situation often described as the Malthus's crisis). In his 'Essay on the Principle of Population, Malthus (1798) wrote "the cause to which I allude is the constant tendency in all animated life to increase beyond the nourishment prepared for it".

Malthus suggested that a number of 'checks' would serve to keep the population at a level of subsistence (i.e., food supply ceiling). These, are the 'preventive checks' and the 'positive checks'.

Preventive Checks: The key preventive check suggested by Malthus was one of 'moral restraint'. Men should attempt to marry late in life as this would give rise to fewer or smaller families.

Positive Checks: The positive check, according to Malthus, includes every cause which in any degree contributes to shorten the natural duration of human life. These are diverse and range from poor living and working conditions that might lower resistance to disease, as well as disease itself, wars and famines.

Malthus's pessimistic view of population suggests that human suffering and misery is inevitable, essentially due to population levels exceeding food availability. Malthus believe that the main cause of high population growth rates lies in the fast breeding of the lower classes that need to adhere to a preventive check.

b. Neo-Malthusianism

One of the most commonly held views in contemporary thinking on population is Neo-Malthusianism as derived from the arguments of Malthus.

The Neo-Malthusians' view follows the thinking of Malthus in that population growth is considered the main cause of poverty. However, unlike Malthus, they see birth control as a means of checking this growth.

Not only do Neo-Malthusians believe that a reduction in population will reduce social problems and alleviate human suffering, but they also see such steps leading to economic growth and improvements in living conditions.

An essential feature of the Neo-Malthusian argument, therefore, is the belief that the size of the population is the main cause of limitations to development, particularly in the less developed countries and that high population growth leads to high natural resource depletion and causes environmental degradation.

This demographic deterministic view of poverty, underlie most debate and discussions on population since the 1960s. It is the 'people versus resources' viewpoint held by many academics, demographers and commentators who all believe that there are too many people for the available resources.

The beginning of the report on the US president's 1972 Commission on Population Growth and the American future reads; "... what does this nation stand for and where is it going? At some point in the future, the finite earth will not satisfactorily accommodate more human beings – nor will the United States… It is both proper and our best interest to participate fully in world-wide search for the good life, which must include the eventual stabilization of our numbers".

Neo-Malthusians see the rapid rates of population growth in the developing countries resulting in widespread poverty, economic stagnation, environmental destruction, rapid urbanization, unemployment and political instability.

Like Malthus, the Neo-Malthusians see the problem resting with the poor who produce more children, because of their ignorance and lack of foresight. The solution, therefore, lies in persuading (or forcing if needs be) the poor to have fewer children.

It is against this background that the implementation and promotion of family planning programmes by international development agencies gained popularity as an efficient and cost-effective way to tackle the problems of development.

Evidence of Malthus and Neo-Malthusian predictions: Neo-Malthusians would argue that the recurrent famine in countries such as Ethiopia and Somalia is proof of a positive check on population growth.

Critics

Critics of Malthusian and Neo-Malthusian perspective on population have argued that the demographic deterministic view of poverty is fundamentally defective.

First, Neo-Malthusian arguments divert attention from the social and economic causes of poverty. Like Malthus, they simply blame human reproduction.

The structure of underdevelopment is ignored, with the reproductive customs of developing countries people considered the main cause of their poverty.

Second, some critics argue that for those who saw the lower classes as a burden to society; Malthus and Neo-Malthusian view provides a perfect excuse not to improve their living conditions. They maintain that it is the failure of successive development strategies to bring about any appreciable improvement in the living conditions of the majority of the people of the world that needs to be discussed and not the productive habits of the poor.

Third, contrary to Malthusian and Neo-Malthusian predictions, world food production has increased more rapidly than that of population. The fact that many countries have stores suggest that it is the distribution of food resources, rather than a lack of, that is the key issue.

Fourth, many developing nations are now challenging the Malthusian and Neo-Malthusian perspectives on population and reclaiming their right to identify for themselves what they perceived their particular population problems are and how to resolve them without pressure from external agencies.

Fifth, there is a growing realization amongst development experts that population growth is NOT the cause of the development problems of the developing countries, but rather a symptom of the problems. New understanding and explanation of fertility rates in economically poor communities suggests that poor people may have many children for logical reasons, such as their economic value, and not just because they are backward looking.

Sixth, both Malthusian and Neo-Malthusian views on population in relation to development are ethnocentric in nature. They both, implicitly, evaluate the reproductive behavior of people in the developing countries by criteria specific to western Europeans. When the rich nations suffer economic difficulties such as rising unemployment, these are treated as purely economic issues. However when a developing country experiences obstacles to economic growth, then population pressure is often cited as the cause.

The Malthusian and Neo-Malthusian view has dominated academic discussion and debate on population since the early 1800s. Their perspective on population and resources has had a profound effect on the way population policy is formulated, especially in the developing world.

It has helped in the formulation and implementation of family planning programmes, and helped highlight concern over development problems.

However, the Neo-Malthusian approach which essentially argues for direct population control measures alongside development policies is filled with many difficulties. Not only does it divert academic attention away from arguably the most fundamental causes of poverty in the Third World, it also ignores the unequal distribution of global resources.

At best, it fails to address the excessive pattern of resource consumption and waste by the 20% of the world's population who consume 80% of the earth's resources and instead blame the poor for being poor and for having large families. Student, what meaning you derive from the above discussion? Reflect on this and get prepared for next lesson point.

4.1.2 Radical Theories

a. Ester Boserup's Hypothesis

Ester Boserup - a Danish Economists offered an entirely different view on population resource debate. In her book 'The Conditions of Agricultural Growth' published in 1965, Boserup took an empirical approach to the relationship between population growth and food production rather than Malthus's deductive approach (i.e., reasoned by calculations).

Unlike Malthus, she believes that population growth is a major factor determining agricultural developments. According to her, 'population growth stimulates innovation and development in agriculture' thus causing an increase in food production. This is summed up by the following phrase '...Necessity is the mother of invention'. This suggests that an increase in population provides a major incentive for ways to be found to increase food production.

Boserup's main argument can be summarised as follows:

1. There is a connection between population and technology. Population change is one of the determinants of technological change, and technological change is a determinant of demographic change.
2. The increase in population pressure stimulates changes in the agricultural system.
3. Rising population leads to intensification of farming methods in order to produce the extra food for the extra numbers.
4. The pressure to change agricultural production by modifying farming techniques and frequencies with which a plot of land is cultivated come from demand for increased food production
5. The sustained growth of population and agricultural output has secondary effects, which will set off a genuine process of economic growth. All parts of the world have experienced these changes owing to the increase in population density.

The conclusion from Boserup's hypothesis is that population growth naturally leads to development rather than being a hindrance to it. Boserup's idea is based upon field studies in SE Asia, and she developed her idea under a number of assumptions.

Critics of Ester Boserup's Hypothesis

Boserup's idea has been criticised for having a rather weak economic basis and her idea applies only to the agricultural production of mainly the developing world where the number of people depends on agriculture. As an area becomes more industraialised and developed, conditions of inadequate food production are much more likely to result in out-migration rather than agricultural innovation.

Her theory, according to some critics, fails to discuss the most recent technological innovations in the highly industrailised societies. Her idea also lacks any universal appeal because it is based on the assumption of an unsophisticated economies and 'closed' communities. In reality, communities are not closed instead; there is constant in- and out-migration. Relatively few communities, if any, operate closed systems producing food only to meet their own requirements. So, it is generally difficult to test her ideas.

Boserup's hypothesis gives no consideration to the qualitative aspects of diet and nutrition. Through the changes in agricultural techniques suggested by Boserup, it is possible that out- put may increase but the overall quality of diet and nutrition may decline.

Another criticism of Boserup's hypothesis relates to the time that the agricultural adaptation would take place. The innovation in agriculture cannot be presumed to occur immediately. If the population growth is rapid, it may overwhelm the agricultural system in the process of adjustment such that the necessary adjustments do not have time to occur.

It is clear that certain types of fragile environment cannot support excessive numbers of people. In such cases, population pressure may not lead to technological innovation as Boserup suggested.

In spite of Boserup's hypothesis, two major food problems persist in the world today - massive surpluses in the developed world and famine, starvation and shortage in the developing world. It appears, therefore, that it is not the level of resources which is the main cause of concern but the inability to share and distribute available resources equitably amongst the world's population.

b. Julian Simon - The 'Ultimate Resource' Theory

Julian Simon (1932-1997), a US economist and statistician, made a significant contribution to the population versus resources debate. Unlike Malthus and Neo-Malthusians, Simon presents a radical optimistic theory to the whole debate.

Simon believes that population growth is not necessarily a bad thing, suggesting the ultimate resource is the people. He believes people are able to innovate to sustain themselves. According to Simon, "the most important benefit of population size and growth is the increase it brings to the stock of useful knowledge. Minds matter economically as much as or more than hands or mouths".

Simon believes that despite claims by neo-Malthusians that natural resources are finite with population growth, natural resources are not finite in any economic sense, which is why their cost can continue to fall.

In spite of the 'doom and gloom' of the Malthusian theory, Simon suggested the world food production has increased in both developed and developing countries since the World War II. According to him, the overall trend from 1948-1979 shows there has been an increase in food production per person.

Simon believes that food shortages and famines are caused by politics as the political regime of a country affects food production. According to Simon, any country that gives farmers a free market in food and labor secure property rights in the land and a political system that ensures these freedoms in the future will soon flush with food with an ever diminishing proportion of its workforce required to produce food.

Simon blames the West for destroying the developing countries farmers despite the assistance they give the developing countries in terms of technical shipments of food, by giving subsidies to their own farmers which raise food production artificially and hence reduce the world prices.

Simon believes that subsidies to Western farmers go hand in hand with the policies of African governments which steal from their farmers by forcing them to accept below market prices. Student, do you think if subsidies are given for the developing countries' farmers will raise food production of their countries? Reply this question before you proceed to the Marxian perspective.

c. The Marxian Perspective

Karl Marx (1818-1883) maintained that poverty and resource depletion is not a consequence of population growth but of unequal distribution of resources between classes.

Where ownership of and control over resources is confined to a capitalist or land owning class, potential always exists for poverty and hunger. Peasants and working poor have very little bargaining power compared to landlords and capitalists hence poverty and hunger results.

According to Marx, capitalism creates surplus population through: physical separation of producers (peasants, artisans, workers) by landowners from their means of production (land, machinery, tools etc.)

He also suggests that the destruction of traditional methods of farming and production through mechanization and changes in land usage and tenure are ways the capitalist rich class makes the working class poor. The result is the total reliance on wage labor by the poor to acquire means of consumption (food, clothing, shelter, etc.). According to Marx, poverty occurs, not because of overpopulation, but rather through lack of access to means of gaining subsistence. Dear student, we hope that you are engaged in reading and progressing well in understanding the lesson content covered so far. Accordingly, in order to check the extent of your understanding, consciously attempt the following activity.

Resource

Barrett, R.Hazel (1992). Population Geography. Oliver & Boyd, Edinburgh.
Beaujeu- Garnier, J (1966) Geography of Population Longmans: London
Bogue, D. (1972) Principles of Demography New York.
Borrie, W.D. (1970) The Growth and Control of World Population. London:Wetdenfeld and Nicolson.

Activity 4.1

1. Explain how the Malthusian and Anti-Malthusian population theories vary regarding their views about population growth.
2. Among Malthusian and Anti-Malthusian population theories, which one is most related to the current population policy of Ethiopia? Justify your reasons.
3. According to Boserup, how does population growth bring positive consequences?
4. As suggested by Malthus, what are the two possible ways by which rapid population growth can be controlled?

Checklist

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

№	Items	Yes	No
1	explain theories on population growth and development?		
2	compare the difference between conservative and radical theories of population and development?		
3	identify the critics of conservative theory?		
4	discuss the Marxian Perspective?		
5	explain the 'Ultimate Resource' Theory of Julian Simon?		

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 section.

Self-test Exercises 4.1

Part I

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

1. Julian Simon believes that food shortages and famines are caused by population growth.
2. Karl Marx assumes that poverty and resource depletion is a consequence of population growth.
3. Malthusian and Neo-Malthusian perspective on population and resources has had a profound effect on the way population policy is formulated.
4. Boserup's hypothesis gives due consideration to the qualitative aspects of diet and nutrition.
5. Neo-Malthusian arguments divert attention from the social and economic causes of poverty.

Part II

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

1. Which one of the following theorists believes that capitalism creates surplus of population through physical separation of producers from their means of production?

A. Thomas Malthus C. Ester Boserup
B. Karl Marx D. Julian Simon

2. Famines and wars according to Malthus, are:

A. Positive checks C. Both positive and Preventive checks
B. Preventive checks D. None of these are answers

3. Neo-Malthusians believe that a reduction in population will:

A. increase social problems C. reduce economic growth
B. alleviate human suffering D. decrease living conditions

4. Which of the following views on population is criticized due to its ethnocentric nature?

A. Malthusian C. Marxian
B. Neo-Malthusian D. A & B are the correct answers

5. Which of the following was considered by Malthus as the positive check of population?

A. Late marriage C. Famines
B. Wars D. All except A

Part III. Match the theoreticians in column B with views under column A.

No	Column A		Column B
1	"minds matter economically as much as or more than hands or mouths"	A	Thomas Malthus
2	natural resources are not finite in any economic sense, which is why their cost can continue to fall	B	Karl Marx
3	'...necessity is the mother of invention'.	C	Ester Boserup
4	criticized for it gives no consideration to the qualitative aspects of diet and nutrition	D	Julian Simon

No	Column A		Column B
5	the main cause of high population growth rates lies in the fast breeding of the lower classes	A	Thomas Malthus
6	Preventive and positive checks	B	Karl Marx
7	blames the West for destroying the developing countries farmers	C	Ester Boserup
8	criticized for the fact that world food production has increased more rapidly than that of population.	D	Julian Simon

SECTION TWO
4.2. Population Policies

Section Overview

In this lesson, you will learn the meaning and significance of population policy in general, and the two broad categories of population policy in particular. A population policy is a policy formulated and implemented by a government in response to concerns related to population growth in relation to economic, social, cultural, political, and demographic conditions of the country. It mainly addresses population related problems in a country. The population policies of countries can broadly be categorized into two as anti-natalist and pro-natalist policies. An anti-natalist population policy is a policy that seeks to lower fertility rates in particular and the rates of population growth in general. In contrast, a pro-natalist population policy is one that seeks to increase fertility rates in particular, and population growth rates in general. Dear student, after recognizing the learning outcome, try to do the questions that follow.

Section Learning Outcomes

After completing this section, you will be able to:

- analyze the effectiveness of population policies in developing countries;
- examine the different population policies used by different countries;
- analyze measures taken to curb the growth rate of population; and
- Identify the different examples of population control from various cultures.

KEY TERMS

- Anti-natal,
- Pro-natal,
- Policy,
- Family planning,
- Contraceptives

4.2.1 Concept of population policy

What is a population policy?
Why is population policy formulated in a country? What are the major categories of population policy? Reply this questions before you focus on the following note.

A population policy is a policy that is formulated and implemented by a government in order to plan and control population growth, spatial distribution and structure based on the economic, social, cultural, political, and demographic conditions of the country. It is needed mainly to address population- related problems in a country.

A population policy reflects the fact that while individual women and families ultimately control fertility, the state can play a pivotal role in providing or prohibiting access to reproductive health, family planning and other resources associated with fertility behavior. These influences of the state and their policies can directly target fertility or more indirectly shape the broader relational contexts of fertility geographies.

The population policies of countries can be broadly categorized into two groups as: anti-natalist and pro-natalist policies. The difference between these policies is described below.

4.2.2 Pro-natalist population policies

What are the major characteristics of a pro-natalist policy?
Which countries implement a pro-natalist policy?

Student, did you try the questions? Compare what you noted and the lesson description given next. Pro-natalist population policy seeks to increase fertility rates, in particular, and population growth rates, in general. Pro-natalists seek to incentivize increased fertility. They have a long historical pedigree and have been adopted by numerous countries, notwithstanding the civil liberties issues they can raise. While no single policy appears most effective, such policies do appear to influence fertility rates.

Within Europe, some countries (notably Germany, France, Sweden, Italy and Spain) had pro-natalist policies in place as early as the 1930s but by the turn of the present century around 88 countries provided incentives for women to have children.

In general, besides explicit exhortation and propaganda, pro-natalism is usually expressed in policies embracing welfare issues. It comes through, for example, in schemes that facilitate women leaving the paid labor force, grant mothers significant maternity pay, or provide substantial support for child caring mothers. For example, the French government worked to increase birth rates through such measures as the 1939 Family Code, provision of social and family benefits such as birth premiums, loans to young married couples, and housing subsidies.

Many policies and the socio-cultural environments they support work more indirectly in promoting fertility than explicit pro-natalist policies. For example, acknowledging factors linked to fertility, governments may seek to ensure greater equality within the workplace and a reduction of the burden of family work responsibilities by creating more flexible working hours, child care assistance, tax incentives, family allowances or low cost housing loans. Such policies can make having a child more economically feasible; highly relevant when noting the high average "cost" of raising a child. In support of this, an Austrian study found increases in parental leave increased fertility.

Pro-natalist policies may also be motivated by concerns about dependency consequences of an ageing society of low fertility. As noted, earlier governments may respond through facilitating immigration. Since much of the world's population is still young, working-age immigrants from the developing countries, in particular, can potentially provide both needed workers for countries with declining populations as well as increased fertility rates on account of their demographic concentration within the child-bearing years. Such policies, however, are likely to be extremely politically sensitive.

4.2.3 Anti-natalist population policies

What are the major characteristics of an anti-natalist policy? Which countries of the world implement an anti-natalist policy?

Anti-natalist population policy seeks to lower fertility rates, in particular, and population growth rates, in general. Countries may enact anti-natalist policies designed to reduce fertility. In fact, some countries have alternated between pro- and anti-natalist policies. The most well-known anti-natalist attempt to reduce fertility has been China's "one child" policy. When the country breakdown the campaign to promote birth control in the 1950s saw China's TFR shoot up to over 6.0 by the early 1960s.

4.2.4 Measures taken to curb the growth rate of population

What do we mean by effective population control methods?

In response to the fear of population growing out of hand and outgripping available resources as predicted by Malthus, there had been a number of national, regional and international initiatives aimed at slowing down the world fast-growing population. In the 1970s, so great was the concern over the world's population expansion that a World Population Conference was held in Bucharest (1974), in which 136 countries agreed to a World Population Plan of Action. This plan highlighted the need "...to introduce family planning programmes and to reduce rates of population growth in order to conserve resources and improve standards of living", particularly in the less developed countries. Ever since the Bucharest conference, the link between population growth and development has become even more direct.

In 1994, there was an International Conference on Population and Development in Cairo which aimed at "linking population more effectively to core development agendas". Global population is increasing by about 1.5 percent per year, a growth rate (should it persist) that in less than half a century will double the number of people who live on the planet.

On the other hand, modern medical techniques are producing life extension but not healthy life extension, and we are seeing numbers of old and chronically sick or disabled elderly people in increasingly longer economically unproductive retirements, who need consequentially increasing numbers of younger people to support them.

The ability of the Earth to sustain the human population, posed by Malthus over 200 years ago, is a serious question. Dependence on finite resources for energy and water is already threatening international stability. Potentially exponential population growth can only make matters worse. Improving economic development in the most populous countries of the developing world is leading to changing patterns of demand, as people seek more affluent lifestyles. Food and energy demands are increasing faster than had been predicted. Air quality resulting from over-rapid industrialization is becoming a major problem that will have major public health effects. The likely determinants of climate change, usually attributed to the developed nations, are now spread throughout the developing world, making the ability of nations to achieve the targets signed-up to at Kyoto unlikely to be achieved.

In 1994 the United Nations Population Information Network (POPIN) organised an International Conference of Parliamentarians on Population and Development (ICPPD) in Cairo. There was a shift in thinking recognised at Cairo, towards viewing population from a more humane and equitable perspective. The consensus document that was produced recognises that consumption in wealthy countries and rapid population growth in poor countries put pressure on the natural environment, both locally and globally.

Rather than simply equating population policy with family planning, the new thinking is that population growth should be stabilized and development enhanced by attacking some of the roots of the problem: by improving women's access to education, health care, and economic and political decisions.

Today, more than half of all developing countries have national population policies, and about 130 national governments subsidize family planning services. When polled by the UN in 1994, 91 percent of the countries that lacked national population policies stated that they intended to formulate them in the near future, reflecting a rising global commitment to population-related concerns. But national policy statements do not necessarily translate into program implementation.

The most important population control methods are indicated on table 4.1. Student based on your experience, which method is more important? Reflect this question before you focus on the methods of family planning.

Table: 4.1. The most important Population control methods

Rank	Population Control Methods
1	Child Tax
2	Contraception
3	Infant Mortality Decrease
4	One-child policies
5	Family planning

Contraception: is the most popular population control method in the world. It is a method used to birth control. Some of the methods are shown on figure 4.1

Figure 4.1: Contraceptive Methods

Infant mortality decrease: High infant mortality is one of the reasons most parents, especially in developing countries, have many children. Such parents want to ensure that at least some of their children survive to adulthood. It is hypothesized that if child mortality is reduced, fertility reduction will eventually follow, with the net effect being lower population growth. The rate of infant mortality can be reduced by pregnant mothers frequently visiting clinics, access to quality food, and access to healthcare service before, during, and after birth.

One child policy: The one-child policy was an official initiative of the Chinese central government that was implemented in the late 1970s and early 1980s. The initiative's goal was to prohibit the vast majority of family units in the country from having more than one child each. The policy's implementation was justified by the need to slow China's massive population increase. It was announced in late 2015 that the program's execution would end in early 2016.

Family Planning: the idea of family planning highly related to access to safe, voluntary means of planning a family that is taken as human right issue. Family planning is central to gender equality and women's empowerment, and it is a key factor in reducing poverty.

Yet in developing regions, women who want to avoid pregnancy are not using safe and effective family planning methods. This is because of lack of access to information or services and lack of support from their partners or communities. This threatens their ability to build a better future for themselves, their families and their communities.

China has operated a one-child policy for a number of years, enforced though a system of fines, relaxed after mass bereavements such as Sichuan Earthquake; the focus of China on population control helped to provide a better health service for women and a reduction in the risks of death and injury associated with pregnancy. At family planning offices, women receive free contraception and pre-natal classes.

India has greatly increased food production per head over last 20 years, making it better placed to absorb higher numbers. The country's most recent approach to population issues focuses on the advancement of women economically, academically, and socially, as independent women are more likely to have small families.

Africa: birth rates in Africa are the highest in the world. By the year 2050, twenty percent of the world's population will live on the African continent. That will be almost two thousand million people, up from eight hundred fifty-five million people today. Especially large population growth is expected in Nigeria, Ethiopia and the Democratic Republic of Congo.

Other countries likely to have major growth include Burkina Faso, Mali, Niger, Somalia and Uganda. Kenya was the first country in sub-Saharan Africa to view runaway population growth as a serious impediment to economic prosperity, and it became the first, in the late 1960s, to begin developing a national family-planning campaign. The country's official population policy calls for matching population size with available resources, yet leaves decisions on family size up to individual families.

As recently as 1970, Africa was essentially self-sufficient in food. What fostered a breakdown in the continent's ability to feed itself has been a decline of nearly 1 percent per year in per capita grain production since 1968 - in part due to an annual population growth for the continent approaching 3 percent.

The root cause of Africa's crisis is population growth faster than any other continent in history, widespread soil erosion and desertification, and a failure by African governments to adequately support agriculture.

The Millennium Development Goals (MDGs), committed to by all 191 United Nations member states, are rooted in the concept of sustainable development. Although 2007 (midway) reports indicated that programs are under way, unfortunately many countries are unlikely to reach their goals due to high levels of poverty.

The population is often considered as a source of economic, military, and political strength. However, overpopulation is considered as a threat to the environment and resources. Thus, population growth is a factor that can be managed. Human population planning is a means of intentionally controlling the human population growth rate. The practice may involve increasing or reducing the rate of human population growth. Although population control is largely supported by many people, some of the methods used have been contested. Some religious groups are against the use of contraceptives and other population control methods.

Beyond explicit anti-natalist policies, other nominally non-demographic state initiatives may reduce fertility. From a gender perspective especially, access to family planning resources through state-sponsored programs is critical. Besides contraceptive provision, such programs typically involve media resources and propaganda that promote small families, women's rights and reproductive health. Student, reflect the on the following activities to check your learning pace in terms of the learning outcomes set.

Resource

Homby, W.F. & Jones, M. (1991). Settlement Geography, Cambridge University Press, Cambridge.

Parnwell, Mike (1993). Population Movements and the Third World. Routlledge: London.

Trewartha, G.T. (1953). A Case for Population Geography. Annals of Association of American Geographers, pp: 71-79.

Activity 4.2

1. What is pro-natalist population policy?
2. What is anti-natalist population policy?
3. What are the common measures taken by countries to manage the growth of population?

Checklist

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

№	Items	Yes	No
1	analyze the effectiveness of population policies in developing countries?		
2	examine the different population policies used by different countries?		
3	Analyze measures taken to curb the growth rate of population?		
4	identify the different population control method from various cultures?		

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 section.

Self-test Exercises 4.2

Part I

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

1. The population of a country is often considered as a source of military and political strength.
2. Overpopulation is considered as a threat to the environment and resources.
3. Human population planning is a means of intentionally controlling the human population growth rate.
4. Africa has the lowest birth rate in the world.
5. High infant mortality is one of the reasons most parents, especially in developing countries, have many children.

Part II

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

1. The most popular population control method in the world is:

A. Child Tax C. Infant Mortality Decrease
B. Contraception D. One-child policies

2. The country which became the first in sub-Saharan Africa, to begin developing a national family-planning campaign is:

A. Kenya C. Uganda
B. Ethiopia D. Ruanda E. Burkina Faso

3. An official population control method of the Chinese central government that was implemented in the late 1970s and early 1980s was:

A. One-child policy C. Contraception
B. Infant Mortality Decrease D. Child Tax

4.Pro-natalist population policy is a policy which seeks to:

A. increase fertility rates C. motivate low fertility
B. decrease population growth rates D. All of these are answers

5. A population policy reflects the fact that _____ ultimately control fertility?

A. individual women C. both individual women and families
B. families ultimately D. the state

SECTION THREE

4.3 The Relationship between Population and Socio-economic Development

Section Overview

This section deals with the relationship between Population and Socio-economic Development. The concept of economic growth and development are terms that are used to show the economic conditions of societies. While economic growth refers to the rate at which the economy is growing in quantitative terms, economic development stands for the overall standard of living of the population and its welfare. Dear learner, you are expected to recognize and reflect on guiding questions, to deepen your understanding.

Section Learning Outcomes

After completing this section, you will be able to:

- explain the link between population growth and socio-economic development;
- differentiate the environmental implications of population growth;
- identify the widely used measures of economic development;
- investigate the limitations of economic development; and
- examine the social indicators of development.

KEY TERMS

- Economic development,
- Per-capita income,
- Standard of living,
- Gross Domestic Product.

4.3.1. The Concept of Development

What is development? What are the elements of development?

Dear learner, note that the above questions are intended to encourage you for further reading and understanding; hence, focus accordingly while reading the lessons note following this. Development is a difficult concept to define. The term development means different things to different people. The possible definitions include a wide range of elements (Figure 4.2):

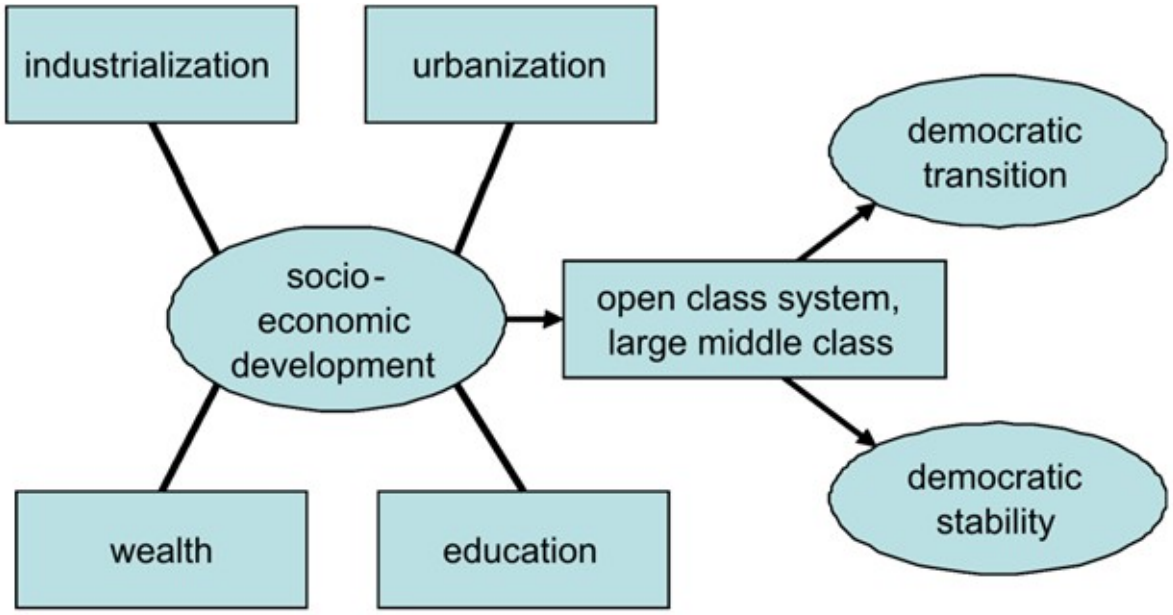


Figure 4.2: Elements of development

What do you understand from Figure 4.2?
How do you relate development with the terms noted in each box of Figure 4.2?

Student, reflect on these questions before you proceed to the next sub-section. Furthermore, try to relate the terms in Figure 4.2 to your local context.

Despite the complexity of the issue, we have some definitions that can go well with the term development. Development is a process by which members of a society increase their personal and institutional capacities to mobilize and manage resources to produce sustainable improvements in their quality of life.

Development represents the whole package of change by which an entire social system moves away from a condition of life perceived as unsatisfactory towards a situation or condition of life that is materially and spiritually better.

Development in any society must have at least the following three objectives:

- to increase the availability and widen the distribution of basic life sustaining goods, such as food, shelter, health services and clothing.
- to raise living standards and levels of income, employment, education and attention to cultural and human values.
- to expand the range of economic and social choices.

What should be done to accomplish the above objectives?

Generally, economic development strategies should give due attention to increasing the productive capacities of human wealth and the health of the environment. This is done by concentrating on the following:

- Making sure that the nation has a labor force that is ready to work, hardworking and energetic.
- Improving the skill and the ability of the working force.
- Ensuring the human labor force has adequate medical care (in order to maintain its productiveness).

Improving the supply, multiplication and distribution of modern and environmentally friendly technology and other inputs.
In addition, in order to ensure sustainable development attention must be given to the environment.

4.3. 2. Measures and Indicators of Development

What is the most common indicator of development? Reflect this question before you read the following note.

Indicators of development are measures of development in a given country. The most common indicators used to measure countries development are:
the Gross Domestic Product (GDP), the Per-Capita Income; and the Standard of Living of a certain population.

a. Gross Domestic Product (GDP)

The GDP is a measure of the market value of commodities. It is the total value of currently produced final goods and services within a country's borders, usually in a year, irrespective of who owns the outputs. In developing countries, the GDP is not only low, but it is also dominated by primary commodities. On the other hand, secondary and tertiary economic activities contribute to the biggest shares to the GDP in the developed countries.
The GNP is the total value of goods and services produced by a country in a year, including incomes secured from abroad, through varied activities.

b.Per-Capita Income

Per capita income or total income measures the average income earned per person in a given area in a specified year. It is calculated by dividing the country's total income by its total population. Per capita income is national income divided by population size. Of course as a measure of peoples' quality of life, it is indicative of their standard of living.
In the same way as the GDP, per-capita income for developed countries is very high and growing. This is the result of ever-increasing GDPs that are based on diversified urban industrial and commercial economies. Developing countries, on the other hand, have low per-capita incomes, whose bases are primary economy that lack diversification.

c. Standard of Living

Standard of living is the level of income, comforts and services available, generally applied to a society or location, rather than to an individual. Standard of living is relevant because it is considered to contribute to an individual's quality of life. Standard of living is perhaps the best measure of the quality of life of a given society. It is directly related to both the GDP and per-capita income. This is because, as the latter get higher, the former improves, and vice versa.

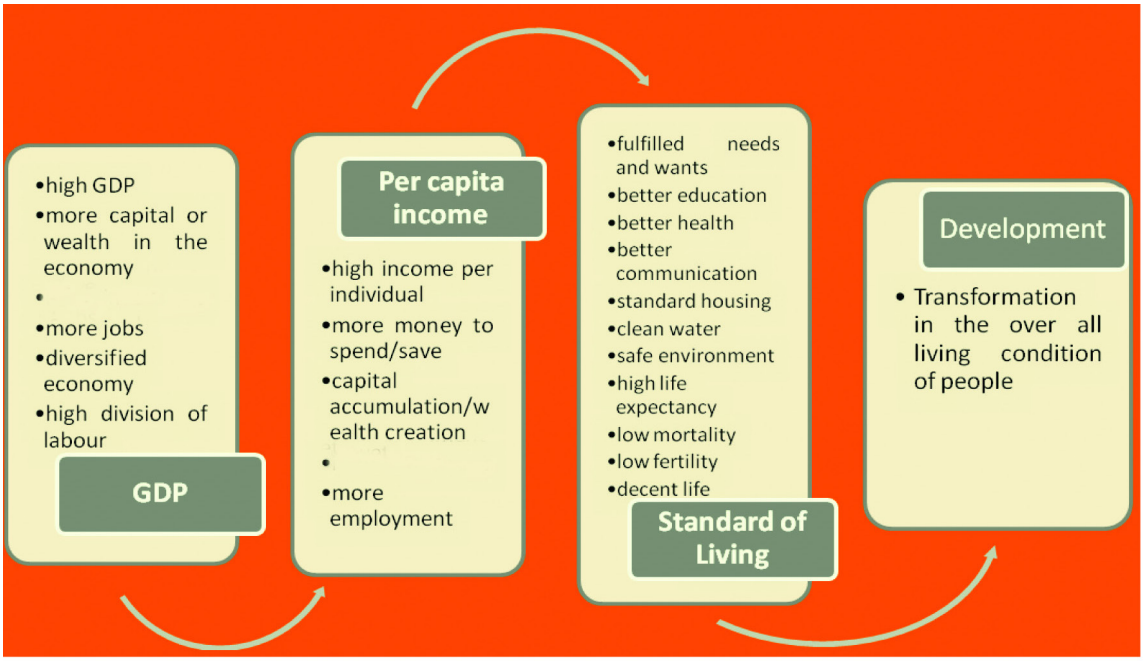


Figure 4.3: The major indicators of Development

Developed countries have high and constantly growing living standards, while people of the developing world are characterized by low living standards. Based on the above and other indicators of development, countries of the world can be classified and named in different ways such as rich/poor, developed/developing, north/south, first/second world, and more developed/less developed world. Also, using current development status as a criterion, they can be grouped as: developed, less developed and least developed.

The developed countries are the world's richest nations. This is because their economy is urban-based, industrial and specialized in commercial activities, supported by sophisticated technology and infrastructure (Table 4.2). Less developed countries include the bulk of the world's countries, which are found in Africa, Latin America, and Asia. They have traditional economic systems, largely based on agriculture, mining or a combination of both.

Table: 4.2. The richest nations of the world

Country	GDP per capita income	Adult literacy (%)	Annual population growth rate	Life expectancy (years) (2020)	Urban population (%)
USA	63,206.50	No Data	0.57	80	83
Japan	40,193.30	No Data	-0.37	88	92
France	39,037.10	No Data	0.24	85	81
Norway	67,329.70	No Data	0.84	85	83
Germany	46,252.70	No Data	-0.02	83	77
Canada	43,258.30	No Data	0.84	84	82

Country	GDP per capita income	Adult literacy (%)	Annual population growth rate	Life expectancy (years) (2020)	Urban population (%)
UK	41,059.20	No Data	0.43	83	84
Switzerland	87,100.40	No Data	0.67	85	74
Italy	31,770.00	99.2 (2018)	0.17	85	71

The least developed countries, as their name implies, are the poorest nations of the world. By all standards, these countries have the most backward economic and social systems. Hence, mass poverty is a common feature of the majority of the populations of these countries (Table 4.3).

Table: 4.3. Least developed countries

Country	GDP per capita income ($US) 1 (2021)	Adult literacy (%) (2) (2019)	Annual population growth rate (%)	Life expectancy (years)	Urban population (%) (5) (2020)
Afghanistan	461		2.31	65	26
Angola	1798	71	3.22	61	67
Bangladesh	1957	74.6	0.95	73	38
Benin	1277	42	2.68	62	48
Bhutan	3306	68.5(2018)	1.03	72	42
Burkina Faso	809	41	2.82	62	31
Burundi	252	85	3.01	62	14
Central African Republic	479	37	1.97	54	42
Chad	674	40	2.95	55	24
Comoros	1371	58	2.13	65	29
Democratic Republic of the Congo	529	63	3.10	61	46
Eritrea	581	76.5(2018)	1.69	67	36
Ethiopia	812	49	2.49	67	22
Gambia	779	55	2.88	62	63
Guinea	1044	30	2.73	62	37
Guinea-Bissau	668	59	2.38	59	44

The above mentioned are the common types of measurements, which were used in many literatures. To construct comprehensive indices, it is necessary to incorporate economic, human, social, environmental and other related representative indicators. Based on this the following list of broader concern of development are designated.

These indicators may be broadly categorized as:

1. Indicators of economic development
2. Indicators of social development
3. Health and related indicators

Economic Indicators: these are the major type economic measures used at the macro level. Some of these indicators are:

1.GDP/GNP per capita
2. Growth rate of GDP
3. Growth rate of different sector of the economy

Social development refers to the institutions of societies through which development is enhanced: the 'soft' dimensions of development, often invisible and difficult to measure.

The commonly used indicators of social development include:

1. Social capital- Institutions = formal and informal social norms,
2. Discrimination,
3. Exclusion,
4. Female and male literacy rate,
5. Enrollment ratio of girls to boys,
6. Percentage of population living below poverty line, and
7. Percentage of population with access to sanitation.

Health and other demographic indicators are:

1. Life expectancy at birth,
2. Infant mortality rate,
3. Child mortality rate,
4. Maternal mortality ratio, and
5. Percentage of children who are under weight.

There are many more indicators depending on the context of study.

Factors of Economic Development

The successful development of a country is not easy and not only the duty of the people in the society. It combines many factors for the success.

Economic factors

i. The natural resources: Natural resources mean everything that occur naturally and which can be useful for living and feeding human's need. Natural resources of a country consist of things that happen naturally in the country. They facilitate the country to develop itself.

ii. Capital expenditure: The capital is an essential factor for economic development in both its size and forms. It is obvious that if a country has more cumulative capital and uses it efficiently for its society and economy, it makes the country gain more advantages than that which lacks the capital.

iii. Technology: The technology in the production is the measurement on the progress of the production. Therefore, technology is the main factor in the expansion of the production which affects the gross national economy of a country, and plays a role in the development of the economy.

Non-economic factors

The society: under this factor we have the following components:

i. The labor force: It is not a simple resource but capital which is called "human capital". It is the most important in the economic development which is planned, implemented and beneficially received by human.
ii. The Social value: Value of the people in a society comprises social, ethical and political values. It facilitates the rapid development of the economy and makes more progress on the development.
iii. The religion and Tradition: Although any religion teaches people for good doing, it also has an impact on the value of people in society which may possibly contribute or block the socio-economy development.
iv. The Political stability: A country of political stability has no antagonistic conflict, no controversy between countries. People contribute to the government policies. These facilitate the development because the domestic and international investors are interested in the investment which in turn provides the jobs for the people bringing incomes to the country. Student; from your perspective, what is the responsibility of the people living both in developed world and developing world to regulate their development, and minimize the living status prevailing the two groups? Reflect on this before moving to the next lesson.

4.3.3 Social implications of population growth

What are the social implications of rapid population growth?

Rapid population growth in less developed countries is linked to many problems:

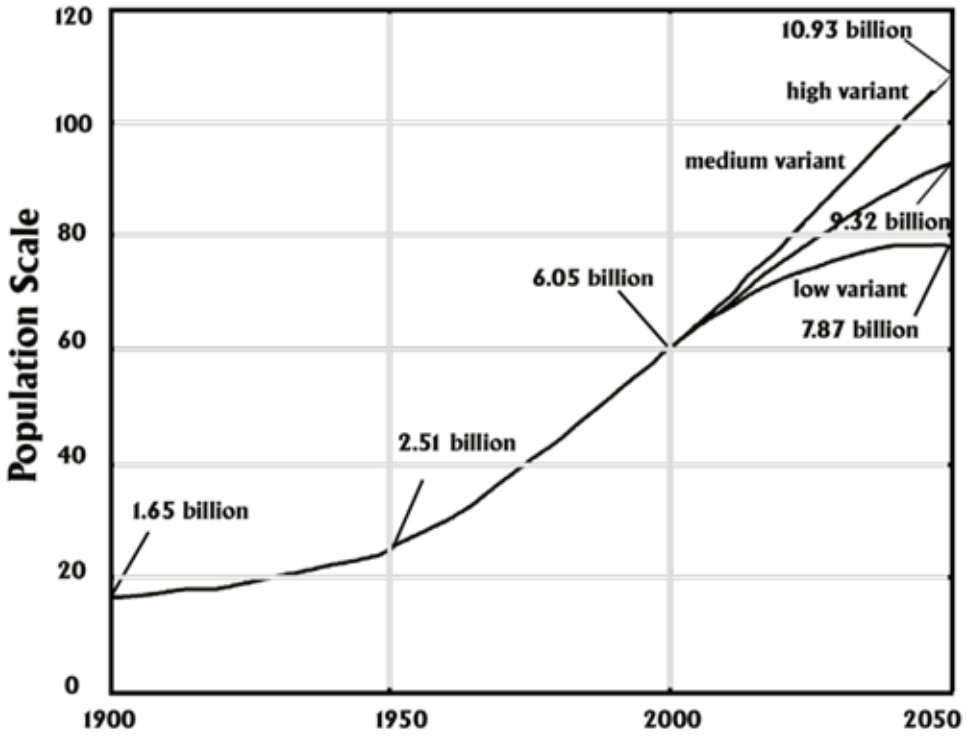


Figure 4.3: Estimated and projected population of the world

Rapid population growth may intensify the hunger problem in the most rapidly growing countries. Population growth can reduce or eliminate food production gains resulting from modernization of farming. Population pressures may also encourage practices, such as over irrigation and overuse of crop lands, which undermine the capacity to feed larger numbers. In some cases population growth is quite directly related to a social problem because it increases the absolute numbers whose needs must be met. For example some less developed countries have made enormous progress in increasing the percentage of children enrolled in school. However, because of population growth during the same period, the number of children who are not enrolled in school also increased because there were insufficient resources to meet the growing need.

Similar observations could be made about jobs and employment, housing, sanitation and other human needs such as water supply, transportation, energy requirement etc. These problems are compounded when large numbers migrate from rural to urban areas and increase the burden placed on already inadequate supplies and services.

The relationship between population growth and environmental degradation may appear to be rather straight forward. More people demand more resources and generate more waste. Clearly, one of the challenges of a growing population is the mere presence of so many people sharing a limited number of resources strains the environment.

Resource

Breese,G.(1965)Urbanization in Newly Developing Countries, New Jersey

Carr, Michael (1997). New patterns: processes and change in Human Geography, Thomas Nelson and sons, UK

Habitat (UNCHS) (1992) People, Settlements Environment and Development, Nairobi

Trewarth, G.T, et al. (1957). Elements of Geography: Physical and Cultural. McGraw Hill Book Company,

Activity 4.3

1. Discuss the concept of development?
2. What are the objectives of development?
3. What is social development?
4. What are the major indicators of social development?

Checklist

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

№	Items	Yes	No
1	explain the link between population growth and socio-economic development?		
2	differentiate the economic and environmental implications of population growth?		
3	explain the relationship and effects of health on development		
4	distinguish the widely used measures of economic development?		
5	investigate the limitations of economic development?		
6	examine the social indicators of development?		

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 section.

Self-test Exercises 4.3

Part I

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

1. Rapid population growth may intensify the hunger problem in the most rapidly growing countries.
2. Gross National Product is perhaps the best measure of the quality of life of a given society.
3. The GDP is a measure of the market value of commodities.

Part II

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

1. Which one of the following is economic factor of development?

A. labor force C. Political stability
B. religion and Tradition D. Technology

2. Which of the following is not among the commonly used indicators of Social development?

A. Growth rate of GDP C. Exclusion E. Enrollment ratio of girls to boys
B. Discrimination D. Female and male literacy rate

3.Which of the following country has the least GDP per capita?

A. Burundi C. Angola
B. Ethiopia D. Burkina Faso

4. Which of the following country has the highest proportion of urban population?

A. Italy C. Japan
B. Germany D. Switzerland

5. The best measure of the quality of life of a given society is perhaps:

A. Standard of living C. Per capita income
B. GDP D. None of these are answers

SECTION FOUR

4.4. Relationship between Population and Environmental Health

Section Overview

Environmental health is the branch of public health that focuses on the relationships between people and their environment; promotes human health and well-being; and fosters healthy and safe communities. Environmental health programs are often cost-effective, reduce health care costs, and improve productivity, reducing the significant economic burden of disease in addition to improving the length and quality of people's lives. Dear student, recognize the learning outcomes and issues highlighted and continue reading the sections that follow.

Section Learning Outcomes

After completing this section, you will be able to

- explain the relationship between population and environmental health
- describe the global essence of environmental health
- discuss the principles related to environmental health

KEY TERMS

- Ecosystem resilience,
- Environmental discrimination,
- Environmental health,
- Biosafety

1. What do we mean by environmental health?
2. How can the disruption of the environment result in the disruption of human's health?
3. What are environmental health intervention models?

4.4.1. Concept of Environmental Health

Environmental health can be defined as the interconnection between people and their environment

> Environmental health comprises those aspects of human health, including quality of life, that are determined by physical, biological, social, and psychosocial factors in the environment. It also refers to the theory and practice of assessing, correcting, controlling, and preventing those factors in the environment that can potentially affect adversely the health of present and future generations.

One of the drivers of the integration of environmental health issues into the overarching notion of sustainable development has been the UN Agenda 21, agreed by governments at the 1992 UN Earth Summit. Chapter 6 of Agenda 21 specifically addresses health issues, with five key target areas all of which related directly to environmental health priorities. These target areas are:

1. Meeting primary health care needs, particularly in rural areas;
2. Controlling communicable diseases;
3. Protecting vulnerable groups;
4. Meeting the urban health challenge; and
5. Reducing health risks from environmental pollution.

The global MDGs and SDGs have given due attention to environmental health in many of their goals and targets. Sustainable Development and SDGs reflect the common understanding that a healthy environment is integral to the full enjoyment of basic human rights, including the rights to life, health, food, water and sanitation, and quality of life.

4.4.2. Environmental Health Intervention Models

Basic requirements for a healthy environment are clean air; safe and sufficient water; safe and adequate food; safe and peaceful settlements; and stable global environment. There are 3 different models used to achieve the environmental health outcomes.

The first is Clinical Model where by interventions focus on treating disease which has already occurred in the population. In most cases, it is an expensive and difficult situation. The second model is, Public Health Model, where attempts are made to control disease-causing agents which might already have infested the environment and created public health problems. The third model is the Environmental Stewardship Model which tries to address environmental problems from human activities and natural processes (Figure 4.6.) Each of the above models has its own advantages and limitations.

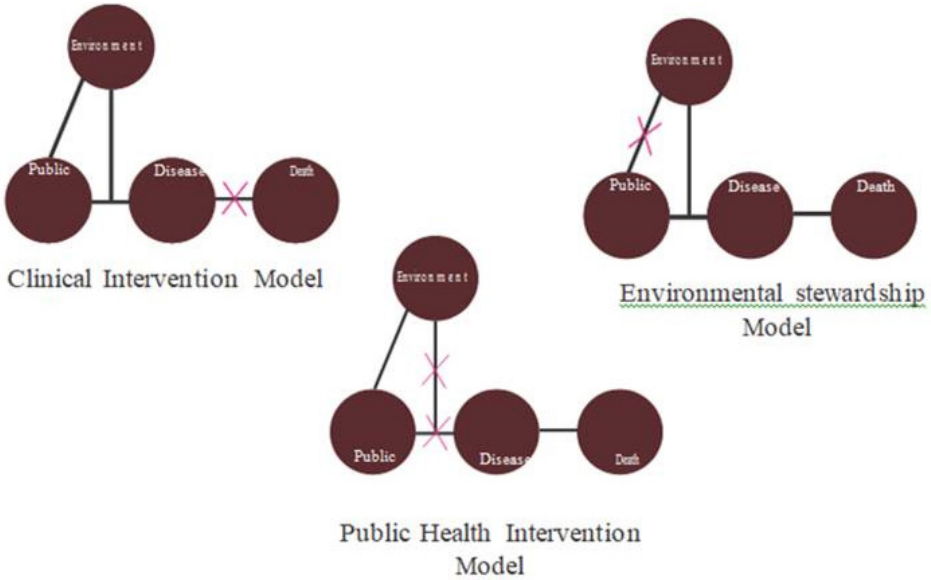


Figure 4.4: Models in improving human health and the environment

4.4.3. Philosophy and principles related to environmental health:

The philosophical underpinnings and key principles indicate the need to focus on addressing environmental health issues.

Air pollution is the world's largest single environmental risk to health (some 7 million people across the world die each year due to everyday exposure to poor air quality), but it cannot be viewed in isolation.

Degradation of the environment, the air we breathe, the food we eat, the water we drink, and the ecosystems which sustain us is estimated to be responsible for at least a quarter of the global total burden of disease. Environmental degradation is estimated to cause 174-234 times as many premature deaths as occur in conflicts annually. Disproportionate impacts of environmental harms are evident on specific groups: the poor, the young, the elderly, women and migrant worker.

Corona virus (Covid-19), Zika, Ebola, Middle East respiratory syndrome (MERS) , Severe acute respiratory syndrome (SARS), Marburg… new zoonotic diseases (spread from animals to humans) are currently emerging every four months, with the main drivers being exponential population growth, intensive livestock breeding, disturbed environments and biodiversity loss. Strengthening healthy ecosystems is a key to preventing or slowing the emergence of these costly diseases. A key need is for greater investment in integrated surveillance of wildlife, livestock and human health.

The UNEP Healthy Environment, Healthy People report indicates that lack of access to clean water and sanitation causes 58 percent of cases of diarrheal diseases in low and middle-in- come countries.

There is growing evidence to suggest that exposure to natural environments can be associated with mental health benefits. The 2014 epidemiological study has shown that people who move to greener urban areas benefit from sustained improvements in their mental health. Proximity to green space has been associated with lower levels of stress and reduced symptomology for depression and anxiety, while interacting with nature can improve cognition for children with attention deficits and individuals with depression.

Clean air and water, sanitation and green spaces, safe workplaces can enhance people's quality of life: reduced mortality and morbidity, healthier lifestyles, improved productivity of workers and their families, improve lives of women, children and elderly and are crucial to mental health.

An integrated approach based on evidence of the linkages between poor environmental quality and health, studies identified several priority problem areas for urgent policy attention, including:

1. Unsafe water, inadequate sanitation or insufficient hygiene cause mortality, morbidity and lost economic productivity (Figure 4.5);
2. Nutritionally, poor diet composition and quality, as well as increased physical inactivity, has increased the growth of non-communicable diseases throughout the world; and
3. Degraded ecosystems and stresses to the Earth's natural systems, which reduce ecosystem services that support human health, enhance exposure to natural disasters, and at times give rise to disease outbreaks.

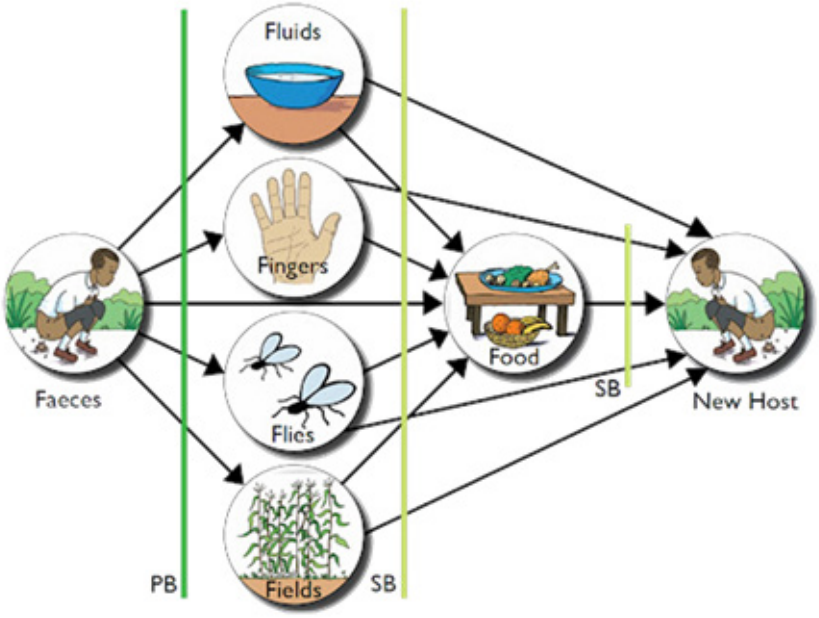


Figure 4.5: Diseases Transmission Method

The findings of reports provide a strong basis for adopting an integrated approach for improving human health and well-being through increased engagement by the health sector in ecosystem management and decision-making. They also identify integrated actions and strategies, such as:

- Reduce resource use and change lifestyles: Use fewer resources per unit of economic output produced and reduce the environmental impact of any resources used in production and consumption activities through more efficient practices.
- Enhance ecosystem resilience and protection of the planet's natural systems: Build capacity of the environment, economies and societies to anticipate, respond to and recover from disturbances and shocks through: agro-ecosystem restoration and sustainable farming systems; strengthening ecosystem restoration.

- Addressing the nexus between environment and human health through delivering on environmental sustainability can provide a common platform for meeting many of the Sustainable Development Goals (SDGs) through multiplier effects that can accelerate and sustain progress across multiple SDGs, and investing in environmental sustainability can serve as an insurance policy for health and human well-being.

Resource

Bogue, D. (1972) Principles of Demography New York.

Borrie, W.D. (1970) The Growth and Control of World Population. London: Wetdenfeld and Nicolson.

Development Planning. Population Council: New York.

Habitat (UNCHS) (1992) People, Settlements Environment and Development, Nairobi

Activity 4.4

1. What is the essence of environmental health?
2. What are the five target areas that are specified by UN Agenda 21?
3. What are 3 benefits of environmental health?

Checklist

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

№	Items	Yes	No
1	explain the relationship between population and environmental health?		
2	identify the environmental health intervention models?		
3	elicit the principles related to environmental health?		

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 section.

Self-test Exercises 4.4

Part I

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

1. Proximity to green space is associated with increased symptomology for depression.
2. Degraded ecosystems can give rise to disease outbreaks.
3. Nutritionally, poor diet composition and quality has decreased the growth of non-communicable diseases throughout the world.
4. Addressing the link between environment and human health is important for meeting many of the Sustainable Development Goals.
5. Conflicts cause seventy times as many premature deaths as occur in environmental degradation annually.

Part II

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

1. Which of the following condition may not lead to environmental health?
   A. agro-ecosystem restoration
   B. sustainable farming systems
   C. intensive livestock breeding
   D. None of these
2. In which of the following intervention models focus on treating disease which has already occurred in the population?
   A. Clinical Model
   B. Environmental Stewardship
   C. Public Health Model
   D. None of these
3. Which of the following policy seeks to lower population growth rates?
   A. anti-natalist
   B. pro-natalist
   C. both pro-natalist and anti-natalist
   D. none of these are answers
4. Which of the following diseases is common to the Middle East countries?
   A. Covid-19 C. MERS E. Marburg
   B. Ebola D. Zika
5. What is the basic requirement for a healthy environment?
   A. clean air
   B. safe and sufficient water
   C. safe and adequate food
   D. safe and peaceful settlements
   E. All of these are answers

Unit Summary

Population size and change play a fundamental role in human societies that they have been the subject of theorizing for millennia. Most of these theoretical viewpoints have incorporated demographic components as elements of far grander schemes. Only in a few cases have demographic concepts played a central role, as in the case of the theory of the demographic transition that evolved during the 1930s as a counter to biological explanations of fertility declines that were then current.

Malthus suggested that a number of 'checks' would serve to keep the population at a level of subsistence. These, are the 'preventive checks' and the 'positive checks'.

The Neo-Malthusians' view follows the thinking of Malthus in that population growth is considered the main cause of poverty. However, unlike Malthus, they see birth control as a means of checking this growth.

Unlike Malthus, Ester Boserup believes that population growth is a major factor determining agricultural developments. According to her, 'population growth stimulates innovation and development in agriculture' thus causing an increase in food production. According to Marx, poverty occurs, not because of overpopulation, but rather through lack of access to means of gaining subsistence.

A population policy is a policy that is formulated and implemented by a government in order to plan and control population growth, based on the economic, social, cultural, political, and demographic conditions of the country. The population policies of countries can be broadly categorized into two groups as: anti-natalist and pro-natalist policies.
Pro-natalist population policy seeks to increase fertility rates, in particular, and population growth rates, in general. Anti-natalist population policy seeks to lower fertility rates, in particular, and population growth rates, in general.

While Governments in developing countries have adopted measures to reduce population growth rates, a growing number of Governments in developed countries have expressed concerns about low rates of population growth.

Unit review Exercise

Dear learner; I hope you enjoyed reading the module and doing the self-test questions. Now you are at the stage of completion of module four. But, before moving to the next module you are required to do 'Assignment Four'. Hence, please try to do it carefully and properly. Note that the assignment has to be completed and submitted to the course tutor within 30 days.

Part I

Multiple Choice Questions: Choose the correct answer from the given alternatives.

1. Which one of the following is the most popular population control method in the world?
   A. Contraception C. One child policy
   B. Child Tax D. None of the above
2. Which one of the following diseases is more related to the African continent?
   A. Zika C. MERS E. Marburg
   B. Ebola D. SARS
3. The environmental health model which deals with addressing environmental problems from human activities and natural processes is
   A. Clinical Model C. Public Health Model
   B. Environmental Stewardship D. None of these
4. The condition that occurs wherein certain groups of people put at higher risk for environmental hazards due to marginalization is:
   A. Environmental racism C. Radiological health
   B. Biosafety D. None of the above
5. Which one of the following is not an environmental health concern?
   A. Food safety C. Hazardous materials
   B. Housing D. None of the above
6. Which of the following models deals with the control of disease-causing agents which might already have infested the environment?
   A. Clinical Model C. Public Health Model
   B. Environmental Stewardship D. None of these
7. Which of the following population policy seeks to increase the fertility rates of population?
   A. anti-natalist C. both pro-natalist and anti-natalist
   B. pro-natalist D. none of these are answers
8. Which of these theorists believe that, poverty occurs through lack of access to means of gaining subsistence?
   A. Thomas Malthus C. Ester Boserup
   B. Karl Marx D. Julian Simon
9. The theory and practice of assessing those factors in the environment that can adversely affect the health of present and future generation is_____.
   A. environmental health C. Environmental justice E. Environmental racism
   B. Environmental Stewardship D. Environmental determinism

Dear learner; thank you for attempting the activity questions. I hope you have written the answers to the questions. Please compare your answers with the feedback given below.

Self-Test Exercises

Section 1

Part I:	1. False	2. False	3. True	4. False	5. True		
Part II:	1. B	2. A	3. B	4. D	5.D		
Part III:	1.D	2. D	3. C	4.C	5.A	6. A	7.D	8.A

Section 2

Part I:	1. True	2. True	3. True	4. False	5. True
Part II:	1. B	2. A	3. A	4. A	5.E

Section 3

Part I:	1. True	2. False	3. True		
Part II:	1. D	2. A	3. A	4. C	5.A

Section 4

Part I:	1. False	2. True	3. False	4.True	5. False
Part II:	1. C	2. A	3. A	4. C	5.E

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

Feedback to Activities: Dear learner; thank you for attempting the activity questions. I hope you have written the answers to the questions. Please compare your answers with the feedback given below.

Feedback to Activity 4.1

1. Malthus had a simple enough proposition. People like other creatures will breed according the resources available, i.e., Food, shelter and clothing. The short answer is that Malthus was right up to his time and a bit beyond but that's it. Neo Malthusians, or NMs have learnt from the past. They've seen the green/agricultural revolution but understand that food is only one part of the equation. We have other parts as well like shelter and clothing. We also have environmental issues. In short, Malthusians looked at food, NMs will look at more than just food. Malthusian and Neo-Malthusian scholars say that population growth causes poverty, economic stagnation, and environmental degradation.
2. Neo- Malthusian
3. Boserup maintains that population growth is the cause rather than the result of agricultural change and that the principal change is the intensification of land use. The theory of agricultural development posed by Boserup is more subtle and complex than that of any of her predecessors. She sees population pressure as a major cause of change in land use, agricultural technology, land tenure systems, and settlement form. Malthus suggested that while technological advances could increase a society's supply of resources, such as food, and thereby improve the standard of living, the resource abundance would enable population growth, which would eventually bring the per capita supply of resources back to its original level.
4. Malthus suggested that a number of 'checks' would serve to keep the population at a level of subsistence. These, are the 'preventive checks' and the 'positive checks'.

Feedback to Activity 4.2

1. Pro-natalist population policy is a policy that seeks to increase fertility rates, in particular, and population growth rates, in general. Pro-natalists seek to incentivize increased fertility. They have a long historical pedigree and have been adopted by numerous countries, notwithstanding the civil liberties issues they can raise. While no single policy appears most effective, such policies do appear to influence fertility rates.
2. Anti-natalist population policy is a population policy that seeks to lower fertility rates, in particular, and population growth rates, in general. Countries may enact anti-natalist policies designed to reduce fertility.
3. The most common Population control methods are:
    - Child Tax
    - Contraception
    - Infant Mortality Decrease
    - One-child policies
    - Family planning

Feedback to Activity 4.3

1. Development is a process by which members of a society increase their personal and institutional capacities to mobilize and manage resources to produce sustainable improvements in their quality of life. Development represents the whole package of change by which an entire social system moves away from a condition of life perceived as unsatisfactory towards a situation or condition of life that is materially and spiritually better.
2. Social development refers to the institutions of societies through which development is enhanced: the 'soft' dimensions of development, often invisible and difficult to measure.
3. The commonly used indicators of social development include:
    - Social capital- Institutions = formal and informal social norms,
    - Discrimination,
    - Exclusion,
    - Female and male literacy rate,
    - Enrollment ratio of girls to boys,
    - Percentage of population living below poverty line, and
    - Percentage of population with access to sanitation.

Feedback to Activity 4.4

1. Environmental health is the branch of public health that: focuses on the relationships between people and their environment; promotes human health and well-being; and fosters healthy and safe communities.
2. One of the drivers of the integration of environmental health issues into the overarching notion of sustainable development has been the UN Agenda 21, agreed by governments at the 1992 UN Earth Summit. Chapter 6 of Agenda 21 specifically addresses health issues, with five key target areas all of which related directly to environmental health priorities. These target areas are:
    1. Meeting primary health care needs, particularly in rural areas;
    2. Controlling communicable diseases;
    3. Protecting vulnerable groups;
    4. Meeting the urban health challenge; and
    5. Reducing health risks from environmental pollution.

3.Environmental health programs are often cost-effective, reduce health care costs, and improve productivity, reducing the significant economic burden of disease in addition to improving the length and quality of people's lives.

Dear learner; how did you find the module? I hope you did well in the assignment questions? If you did, then you can proceed to the next module.

References

Barrett, R.Hazel (1992). Population Geography. Oliver & Boyd, Edinburgh.

Beaujeu- Garnier, J (1966) Geography of Population Longmans: London

Bogue, D. (1972) Principles of Demography New York.

Borrie, W.D. (1970) The Growth and Control of World Population. London:

Breese,G.(1965)Urbanization in Newly Developing Countries, New Jersey

Carr, Michael (1997).New patterns: processes and change in Human Geography, Thomas Nelson and sons, UK

Clark, N. Audrey (1998). Dictionary of Geography, Longman, Toronto.

Clarke, I. John (1972). Population Geography, 2nd ed. Pergamon Press, Oxford.

Clarke, J & L.A Kosinski (1982) Redistribution of Population in AfricaHeinemann: London

Daniel, P. & Hopkinson, M. (1989) The Geography of Settlement, Oliver and Boyd: ongkong

Daniel, Peter and Michael Hopkinson (1979). The Geography of Settlement. Oliver & Boyd, Hong Kong.

Development Planning. Population Council: New York.

Habitat (UNCHS) (1992) People, Settlements Environment and Development, Nairobi

Homby, W.F. & Jones, M. (1991). Settlement Geography, Cambridge University Press, Cambridge.

Hornby, W. & M. Jones (1993) An Introduction to population geography, Cambridge, CUP

Johnston, R.J. (1998). The Dictionary of Human Geography. Blackwell Publishers

Parnwell, Mike (1993). Population Movements and the Third World. Routlledge: London.

Parnwell, Mike (1993). Population Movements and the Third World. Routlledge: London.

Sauvy, Alfred (N.Y.). General Theory of Population. London: Weidenfeld and Ntcolson.

Trewarth, G.T, et al. (1957). Elements of Geography: Physical and Cultural. McGraw Hill Book Company, INC, New York.

Trewartha, G.T. (1953). A Case for Population Geography. Annals of Association of American Geographers, pp: 71-79.

Valentary, D.I. (1977). An Outline Theory of Population. Progress Publisher: Moscow.

Waugh, David (1990). Geography: An Integrated Approach, 2nd Ed. Glasgow, UK.

Waugh, David (1995) Geography: an integrated approach, Nelson, UK

Weeks, J.R (2002) Population : an introduction to concepts and issues, wadsworth group Belmont Wetdenfeld and Nicolson.

White, P. & R. Woods (1980) The Geographical impact of migration. Longman: London

Withenick, M.E.(1990) Population Geography, Addison Wesly Longman Ltd, UK

Woods, R. (1982) Population Analysis in Geography, Long man: London

Glossary

Plate tectonics: Plate tectonics is a scientific theory that explains how major landforms are created as a result of Earth's subterranean movements.

Plate boundary: A plate boundary is a three-dimensional surface or zone across which there is a significant change in the velocity (speed or direction) of motion of one lithospheric plate relative to the adjacent lithospheric plate.

Lithosphere: The lithosphere is the rocky outer part of Earth. It is made up of the brittle crust and the top part of the upper mantle. The lithosphere is the coolest and most rigid part of Earth

Faulting: a crack in the earth's crust resulting from the displacement of one side with respect to the other. "he studied the faulting of the earth's crust" synonyms: break, fault, fracture, geological fault, shift.

Anticline: An anticline is a structural trap formed by the folding of rock strata into an arch-like shape. The rock layers in an anticlinal trap were originally laid down horizontally and then earth movement caused it to fold into an arch-like shape called an anticline.

Syncline: A syncline is the downward arc or curve of a fold. A fold, in geology, is a bend in a rock layer caused by forces within the crust of the earth. The forces that cause folds range from slight differences in pressure in the earth's crust, to large collisions of the crust's tectonic plates.

Vents: an opening that allows air, gas, or liquid to pass out of or into a confined space.

Fissures: a long, narrow opening or line of breakage made by cracking or splitting, especially in rock or earth.

Tsunamis: a long, high sea wave caused by an earthquake or other disturbance.

Sustainable development: Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainable development goals: The Sustainable Development Goals (SDGs) aim to transform our world. They are a call to action to end poverty and inequality, protect the planet, and ensure that all people enjoy health, justice and prosperity.

Agenda21: Agenda 21 is a comprehensive plan of action to be taken globally, nationally and locally by organizations of the United Nations System, Governments, and Major Groups in every area in which human impacts on the environment.

GTP: The Growth and Transformation Plan was established by the government as a strategic framework for the agricultural sector from 2011 to 2015. The GTP aimed to: Enhance productivity and production of smallholder farmers and pastoralists. Strengthen marketing systems.

Adaptation: a modification of an organism or its parts that makes it more fit for existence. An adaptation is passed from generation to generation.

Mitigation: Mitigation is defined as "sustained action that reduces or eliminates long-term risk to people and property from natural hazards and their effects." It describes the ongoing effort at the federal, state, local and individual levels to lessen the impact of disasters upon our families, homes, communities and economy.

Reactive adaptation: Adaptation that is undertaken in response to an effect of climate change that has already been experienced.

Anticipatory adaptation: Adaptation that takes place before the impacts of climate change are observed. Example: Local government prevents new development on a greenfield site located in an area likely to be inundated during high tides in 50 years.

Planned adaptation: Adaptation that is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state.

Autonomous adaptation: The term autonomous adaptation implies that individuals or communities can undertake adaptation to environmental risks and scarcity independently of outside intervention.

Toronto Conference: Participants discussed "emerging concerns about global atmospheric issues including acid rain, stratospheric ozone depletion and global warming." The 1988 conference, "proposed a specific initial target for a global reduction in the emission of carbon dioxide – 20% below 1988 levels by 2005."The international media, ...

Kyoto Protocol: KYOTO PROTOCOL TO THE UNITED NATIONS FRAMEWORK. CONVENTION ON CLIMATE CHANGE. The Parties to this Protocol. Being Parties to the United Nations Framework ...

Buenos Aires Plan of Action: On 12 September 1978 in Buenos Aires, capital of Argentina, delegations from 138 States adopted by consensus a Plan of Action for Promoting and Implementing Technical Cooperation among Developing Countries (TCDC). They gave it the name of the city that had been host to their United Nations Conference on TCDC.

Eccentricity: is basically the ratio of the distances of a point on the ellipse from the focus, and the directrix. If the distance of the focus from the center of the ellipse is 'c' and the distance of the end of the ellipse from the center is 'a', then eccentricity e = c/a.

Climate variations: Climate variability is the way aspects of climate (such as temperature and precipitation) differ from an average. Climate variability occurs due to natural and sometimes periodic changes in the circulation of the air and ocean, volcanic eruptions, and other factors.

Milankovitch Theory: Milankovitch cycles are named after Serbian mathematician and astronomer Milutin Milankovitch, who first came up with the theory that past fluctuations in Earth's climate, the evidence of which scientists can see in geological sediments, were caused by changes in the amount of sunlight reaching the planet.

Incoming solar radiation: The incoming solar radiation is known as insolation. The amount of solar energy reaching the Earth is 70 percent. The surface of the Earth absorbs 51 percent of the insolation. Water vapor and dust account for 16 percent of the energy absorbed.

Climate Change: Climate change is the significant variation of average weather conditions becoming, for example, warmer, wetter, or drier—over several decades or longer. It is the longer-term trend that differentiates climate change from natural weather variability.

Global warming: Global warming is the long-term heating of Earth's surface observed since the pre-industrial period (between 1850 and 1900) due to human activities, primarily fossil fuel burning, which increases heat-trapping greenhouse gas levels in Earth's atmosphere.

Greenhouse gases: Greenhouse gases (also known as GHGs) are gases in the earth's atmosphere that trap heat. During the day, the sun shines through the atmosphere, warming the earth's surface. At night the earth's surface cools, releasing heat back into the air.

IPCC:

The IPCC prepares comprehensive Assessment Reports about the state of scientific, technical and socio-economic knowledge on climate change, its impacts and future risks, and options for reducing the rate at which climate change is taking place. It also produces Special Reports on topics agreed to by its member governments, as well as Methodology Reports that provide guidelines for the preparation of greenhouse gas inventories. The IPCC is finalizing the Sixth Assessment Report which consists of three Working Group contributions and a Synthesis Report. The Working Group I contribution was finalized in August 2021, the Working Group II contribution in February 2022, the Working Group III contribution in April 2022 and the Synthesis Report in March 2023.

Carbon dioxide: Carbon dioxide (CO_2) is an important heat-trapping gas, or greenhouse gas, that comes from the extraction and burning of fossil fuels (such as coal, oil, and natural gas), from wildfires, and from natural processes like volcanic eruptions.

Sample Assignment One

Dear learner; I hope you enjoyed reading the module and doing the self-test questions. Now you are at the stage of completion of Module One. But, before moving to the next module you are required to do 'Assignment One'. The assignment will carry 10% of your results. Hence, please try to do it carefully and properly. Note that the assignment has to be completed and submitted to the course tutor within 30 days. Give short answer for the following questions.

1. Define continental drift theory.
2. List the main continental and oceanic plates of the earth.
3. Write the type of landforms formed by endogenous and exogenous forces of the earth.
4. Discuss the natural and human induced factors of climate change.
5. Explain three climate change adaptation and three mitigation strategies observed in your locality.
6. Describe about the pillars of the Ethiopian Climate Change Resilient and Green Economic Strategy.
7. Define the meaning of sustainable development.
8. State the main principles and characteristics of good governance.
9. Explain the two important population policies with their exemplary strategies.
10. State two main impacts of population growth on environment.

GEOGRAPHY

DISTANCE LEARNING MATERIAL

GRADE 12

MODULE ONE

FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA
MINISTRY OF EDUCATION