GEOGRAPHY
GRADE 11

DISTANCE LEARNING MATERIAL

MODULE TWO

FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA
MINISTRY OF EDUCATION

GEOGRAPHY
Grade Eleven

Distance Learning Material
MODULE TWO

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UNIT EIGHT
GEO-SPATIAL INFORMATION AND DATA PROCESSING

MODULE INTRODUCTION

Dear learner, welcome to the second module of geography in grade 11. The second module covers the impacts of geography on development, major environmental changes around the world, contemporary geographic difficulties and worries, and geospatial science and data processing. It composes four units.

One of the most crucial elements in development is geography. Through the distribution and varieties of geology, relief, climate, soils, and biodiversity, a location's physical characteristics have an impact on economic development. All of these geographic characteristics have an impact on the expansion of industrialization, trade, and agricultural production. It appears that geography affects societal development policy decisions. Development, however, seeks to reduce geographic obstacles through technological breakthroughs. This indicates that geographic characteristics and development strategies are intertwined and interrelated. The relationship between geography and development; as well as the relationships between climate change and poverty is covered in this module.

The major environmental changes are also covered in the module. Many anthropogenic activities have imposed ecological, biological, social, and technological limitations that could lead to long-term environmental change. Dear learners, you are expected to understand how diverse anthropogenic activities, including habitat fragmentation, intense agricultural land use, overuse of natural resources, and encroachment by invasive alien species, can lead to long-term environmental changes. The unit of major environmental changes will cover habitat fragmentation, agricultural intensification, overexploitation of resources, invasive species, poverty-land degradation nexus, poverty-deforestation nexus, environmental degradation, and sustainable development.

The module also covers the most important global issues. In the 21st century, it is an enormous challenge to meet the needs of vast and growing populations while ensuring the sustainability of environmental resources. The main geographic issues confronting humanity today are the connections between population dynamics, inequality, resource degradation, droughts, and famines. The dynamics of global population increase, land degradation and desertification, underemployment and unemployment, drought and famine, deforestation, and the digital divide globally are all factors to consider.

Geospatial science and technology should be used to analyze the spatial distribution, phenomena, characteristics, and spatiotemporal dynamics of various socio-ecological qualities, and changes brought on by the interaction of people and their physical environment. Geospatial science and data processing unit are other components of this module. Basic relief and topographic concepts, ways of depicting relief features, significant relief features, and contour representation, as well as fundamental GIS concepts, elements, and some applications, are covered in this unit of the module. Dear learner, your are expected to cover four units of this module within 59 hours.

MODULE OBJECTIVES

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

1. To develop an understanding and acquire knowledge of:
- the effects of geographic location on economic development;
- the impacts of climate on economic development;
- the disadvantages of landlocked countries and the challenges it poses to economic development;
- the level and hurdles of intraregional trade in Africa;
- the intricate relationship between poverty and the environment;
- the effects of poverty on land degradation;
- population-related public concerns of our contemporary world;
- environmental degradation and its role in desertification;
- the basic concepts of geographic information systems; and
- the components of GIS.

2. To develop skills and abilities of:
- analyze effects of geographic location on economic development;
- collect and analyze data on the role poverty plays in deforestation;
- demonstrate areas frequently affected by drought and famine;
- depict different relief features on a topographic map;
- start using the main tools of Arc Map; and
- make and interpret different types of maps.

3. To develop the habits and attitudes of:
- argue how unfair water use could lead to regional conflict;
- explain the effects of poverty on land degradation;
- appreciate sustainable development is the solution for a sustainable environment; and
- adhere to the threats deforestation poses to our world

MODULE CONTENTS

UNIT FIVE
GEOGRAPHICAL LOCATION AND
ECONOMIC DEVELOPMENT (14 Hours)

UNIT INTRODUCTION

Dear learners welcome to the first unit of module two. This unit covers geographic location and economic development. Geographic parameters are the most important factors in development. Geographic location influences economic development through the distribution and types of geology, relief, climate, soils, and biodiversity. All these geographic factors pose an effect on the growth of agricultural production, industrialization, and commerce. Recently, the effect of these geographic variables has been virtually minimized through the use of modern technology. But still, the poorest countries of the world are found in the tropics where there is a hot climate; infertile soils; water scarcity, and tropical diseases. Geographical location thus appears upsetting development policy choices in society. Yet in response, development looks for lessening geographical barriers through technological advances. This designates that geographic features and development policies are closely linked and tied together. This unit thus addresses the linkage between geography and development. It also explains the bond between climate change and poverty; the challenges of landlocked populations; and the intraregional trade patterns in Africa. Brief notes and exercises are provided in the unit to support your learning. You are henceforth advised to thoughtfully read the notes and do the exercises to comprehend the issues you are studying.

UNIT LEARNING OUTCOMES

Dear learner; at the end of this unit, you will be able to:

- describe the effects of geographic location on economic development;
- explain the impacts of extreme climates on poverty;
- identify the challenges facing landlocked countries in development; and
- examine the levels and hurdles of intraregional trade in Africa.

SECTION ONE.
EFFECTS OF GEOGRAPHIC LOCATION ON DEVELOPMENT(5 Hours)

✵ Section Overview

This section mainly focuses on the study of the influence of geographic location on the development of particular regions and countries. It mainly insists on the explanation of the effect of geographic location on agricultural, industrial, commercial, and service developments.

Section Learning Outcomes

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

- 🌍 define the concepts of economic growth and development;
- 🌍 differentiate between the contrasting views of geographic determinism and possibilism on development;
- 🌍 appreciate the effect of geographic location on agricultural development;
- 🌍 explain the influence of geographic location on industrial development; and
- 🌍 describe the effect of geographic location on settlement and service development.

Keywords:

- ■ Development;
- ■ Economic growth;
- ■ Geographic determinism;
- ■ Geographic location;
- ■ Possibilism.

5. 1.1 Economic Growth and Development

> 1. Dear learner; what is economic growth? How it differs from development?
> 2. Which one addresses the welfare of people; economic growth or development? Please write short notes on these questions on a piece of paper and compare with the texts given below.

Dear learner; now it is hoped that you started thinking critically about the relationship existing between geography, economic growth, and development. You might have thought also about the differences and relations between economic growth and development. This section presents more details about economic growth and development. We hope you got focused on the essence of economic growth and development now. Then, strive to read and understand the note presented next. Economic growth and development are defined by different people in different ways. Economic growth is an increase in goods and services or growth of the gross domestic product (GDP) in a nation over a specific period.

It mainly focuses on the quantitative growth of the national per capita income; not giving due regard to the standard of living and welfare of citizens. Economic development on the other hand refers to the sustained development of the material well-being of society. Unlike economic growth, development focuses on both qualitative and quantitative development of the country's economy. Economic development enables people to be more educated, healthier, and endowed with good access to quality housing, better sanitation, and employment opportunities. It is often measured using the Human Development Index (HDI).

> Dear learner; from your reading, did you understand how economic growth and development are measured? 2. What is HDI? How it is calculated?

HDI is a quantitative measure of human well-being and development. It is computed using three dimensions: longevity (long and healthy life); access to knowledge and standard of living. Longevity is measured by life expectancy at birth. Knowledge is measured from literacy rates and average years of schooling within the adult age group. The decent standard of living is also measured by real per capita income. To obtain the final HDI result, each of the measurement results of the computed variables is first converted into 0 - 1 scales. The scaled values are then added to form the HDI. The calculated HDI values thus lie between 0 and 1. Countries scoring higher HDI values are hence considered to be better in human well-being and development. In the 2019 United Nations Development Program (UNDP, 2019) ranking of 189 world countries, Norway, Ireland and Switzerland (all in Europe) stood at the top with 0.957, 0.955, and 0.955 HDI scores, respectively. Niger, Central African Republic (CAR), and Chad (all in Africa) assumed the bottom end by scoring only 0.394, 0.397, and 0.398 HDI values. Ethiopia with a score of 0.485 HDI value ranked 173 of the 189 countries.

> 1. Dear learner; which one best measures development; GDP or HDI? Explain why?
> 2. According to the UNDP (2019) report, which countries of the world ranked at the top and which countries held the bottom position? Please write the names of the countries that ranked first and last?

5. 1.2 Geographical Determinism and Possibilism

> 1. What is geographical determinism?
> 2. How geography determines economic progress?
> 3. What is possibilism?
> Dear learner; please focus on the core-contents given below and try to connect your reading with the questions posed above. This will help you concisely comprehend the lesson.

Dear learner; we hope you recognized how economic growth contrasts with development in the preceding discussion. The succeeding discussion explains to you how geography and economic development are linked with each other. Hence, you need to note that geography and socioeconomic development have strong linkages.

There are two contrasting schools of thought on how geographic location and socioeconomic development are linked together. These differing philosophies are Geographical Determinism and Possibilism. Henceforth, we are going to discuss these contrasting issues discretely.

Geographical determinism assumes that the stage of the socioeconomic development of countries is exclusively determined by the geographic environment (location, climate, and geomorphology). According to deterministic theorists, countries of the temperate regions are more developed compared to those in the tropical areas because of their geographical location in distinct cold and hot environments, respectively. This type of thinking began during the 15th AD and persisted until the 1950s. The first adherents of this philosophy were Greek and Roman scholars like Aristotle, Hippocrates, and Strabo. The leading advocates of geographic determinism in the 19th and 20th were Karl Ritter (1779 - 1859), Ellen Churchill Semple (1863 – 1932), and Elsworth Huntington (1876 – 1947) (see Figure 5.1). Later on, many geographers were interpreting socioeconomic development through the deterministic approach. Nevertheless, the geographic deterministic school of thought falls under repeated criticism from part of the environmental possibilism followers.

Karl Ritter   Ellen Churchill Semple   Ellsworth Huntington

Figure 5.1 Prominent Theorists of geographic determinism

Dear learner; we hope that you got a thorough understanding about how geographic development influences socioeconomic development. But, is this always true? What do you think about it? From the above discussion, what geographic factors you think influence socioeconomic development? Can you name the famous adherents of geographic determinism? How the geographic determinism philosophy differs from the philosophy of possiblism? Explain on a piece of paper?

Alright, learner; the foregoing paragraph presented you with the geographic factors that influence socioeconomic development. It further explained the philosophy of geographic determinism and underlined the prominent adherents of the geographic deterministic philosophy. So now, please try to compare the geographic determinism theory with the theory of possibilism provided hereunder.

Paul Vidal de la   Lucien Paul Victor Febvre

Figure 5.2 Prominent theorists of possibilism

The theory of possibilism argues that geographic environment is not the only determinant factor of socioeconomic development. This school of thought again debates that the lifestyle of people and their socioeconomic context is not only decided by geographic location. According to these scholars, development is determined by the interaction of geographic location and human factors. Although geographic location and environmental factors play a significant role in socioeconomic development, they can be modified into useable opportunities by the creative mind of human beings. They conclude that 'nature is never more than an adviser' and 'there are no necessities but everywhere possibilities'. The leading proponents of this school of thought were Lucien Paul Victor Febvre (1878 - 1956) and Paul Vidal de la Blache (1845 - 1918) (Figure 5.2). Their notion is now widely accepted by geographers because the belief appreciates the ability of humans to change their environment using the latest technologies. Nonetheless, it does not mean that geographic location never plays a significant role in the socio-economic development of societies and countries.

(?) Dear learner; please make a comparison between geographic determinism and possibilism? Which do you think is correct? Does geographic environment have no significant value in changing the lifestyle of people and their socioeconomic development? Explain?

Dear learner; please think critically about the foregoing questions and try to connect your thoughts with succeeding notes. Geographic location (where a country finds) has a substantial impact on the socio-economic development of countries. It is 'an integral part of economic geography, regional science, and spatial economics'. The location of economic development projects can be fixed through consideration of broader contexts of countries, regions, and global environments. Geographic location thus strongly influences the scope of 'firms in that location' by controlling the distribution of the population (purchasing power); economic patterns; transport costs and trading networks. The cost of moving goods and services across spatial scales can influence the access of firms to markets. The costs and networks of transportation facilities affect the relative relevance of firms and the scale of decisions concerning innovation and capital investments.

(?) Dear learner; in what way and how geographic environment influences the lifestyle of people and socioeconomic development? Could please identify the most important human activities that are more affected by geographic location?

Dear learner; in appreciation of the influence of geographic location on development, this topic presents you with the effect of location on three distinct activities. Three theories each focusing on the three discrete activities questioning 'what economic activities are located where and why' are discussed. The theories explore the site selection of firms, families, and examination of the geographic variation of economic activities. They offer an analysis of the spatial uncertainties and hierarchical structure of economic segments. They identify variables that determine the location of specific undertakings over given spatial patterns. They also describe the allocation of the different parts of the territory among the different product types.

Dear learner; please distinguish between the thoughts of geographical determinism and possibilism and identify the respective thinkers? Explain how and in what respect geographic environment influences the lifestyle of people and socioeconomic development?

Activity 5.1.1

1. What is economic growth? What about economic development?
2. How does geographic location influence economic development?

Dear learner; the above two questions help you get general idea about the relationship existing between geography and economic development. Hence, please think critically over these issues and try to relate your imagination with the notes provided.

5.1.3 Effect of Location on Agricultural Development

Agricultural production and profitability principally rely on the suitability of land use patterns and environmental resources that are largely related to geographic location. Dear learner; under this topic, you are going to learn the effect of geographic location on agriculture through the analysis of a hypothetical land-use model (Figure 5.3) developed some 200 years ago by the German theorist named Johann Heinrich von Thunen.
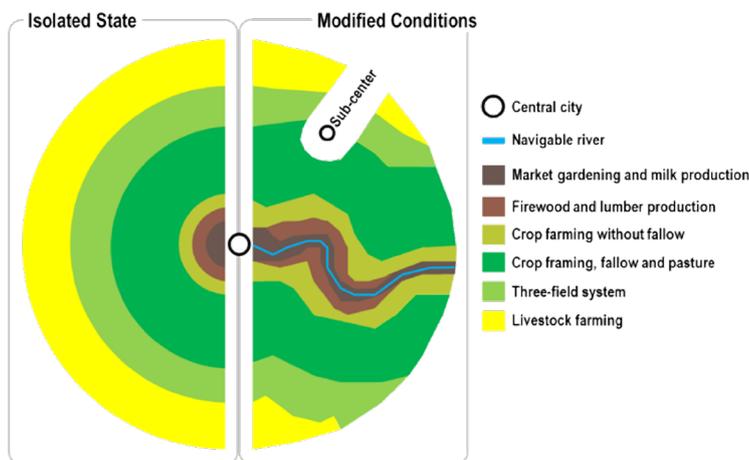
Figure 5.3 von Thunen's hypothetical circular land use model

Johann Heinrich von Thunen developed his agricultural land use theory in 1826 in his book The Isolated State. This earliest known agricultural location theory (von Thünen, 1826), imagined that being near to the market provides ample benefits in agricultural land-use systems. For that, he envisioned a central market city established at the heart of a plain of thorough physical similarities.

Dear learner; who is von Thunen? What do you know about him?
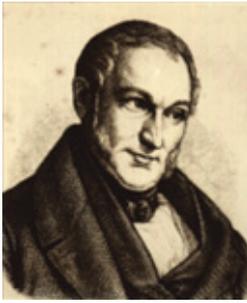
Johann Heinrich von Thunen
(1783 - 1850)

J.H. von Thunen was a 'German farmer and amateur economist' of the 18th AD. His proposed market city is located in an 'Isolated State' which is supposed to be 'self-sufficient' or with no external influences. Four concentric zones: intensive farming (dairying); forest gardening; extensive cropping and animal grazing were proposed activities in the model. Farmers were considered equally rational everywhere.

According to von Thunen, when the distance to the market increases, production costs remain the same; transport costs increase but locational rent is assumed to decrease (meaning transport cost and locational rent are inversely related). During his time there was no motor transport; maybe oxcarts were everywhere. As it was pre-industrialization there were no fossil fuels for energy production, refrigerators, and railroads. His interesting illustration of land and transport is somewhat excellent for his time. As one moves closer to the city, the cost of land increases. This is also true at present times. The theory is so important to geography although the isolated self-sufficient state and isotropic surface models are expected rare to find on Earth.

Dear learner; by referring Figure 5.3 above, can you describe the agricultural sub-sectors that are situated farther from the central market?
Why do you think that happens?
Which part of the circle (the left side or right side) do you think represent von Thunen's original model?
Please observe the model critically and compare your thought with the notes provided next.

The intent of von Thunen in developing this model (Figure 1.3) was to show the system of rising agrarian yield in concentric sectors. His model imagines that farmers nearer to the market city grow crops that have a premier price and provide the highest net incomes. Heavy and perishable crops (vegetables, fruits & dairy products) are suggested to be produced nearer to the city in the model. Bulky products (firewood & timber) are supposed to cover the next zone for they demand higher transport costs if produced further from the city market. Field crops such as grains are proposed to come from the third zone because they require relatively lower transport costs compared to vegetables and forest products. Ranching of animals is suggested to occupy the fourth zone for they can be self-transporting to market. The final zone beyond the fourth ring is suggested to remain free (unoccupied wilderness) for it is far from the city market.

The assumptions of von Thunen were:
- An isotropic self-sufficient state;
- A central market city established at the heart of a plain of physical similarity;
- Rising agrarian yield in four concentric sectors: intensive farming (dairying); forest gardening; extensive cropping and animal grazing;
- The cost of land (location rent) increase nearer to the market;
- Transport costs increase with increasing distance from the market;
- Farmers are equally rational everywhere.

Dear learner; could you please sketch the four agricultural activities of von Thunen's original concentric zones? Hint: you can find von Thunen's original hypothetical agricultural model from the internet.

Dear learner; we hope that you get a basic idea of how geographic location influences agricultural production. Next, you will read also about the influence of geographic location on industrial development.

5.1.4 The Influence of Location on Industrial Development

Dear learner; industrial production is commonly based on firm location, raw material, and labor inputs, transportation costs, and facilities, as well as consumers and market centers. These all demand suitable geographical locations and related characteristics. Dear learner; like what has happened for agriculture in the preceding paragraphs, this part presents you with a sample industrial location model (Figure 5.4) developed 100 years ago by the German economist, Alfred Weber. Focus and try to analyze the components of the figure.

M=market
P=factory
S1=input 1
S2=input 2
d(x)=distance
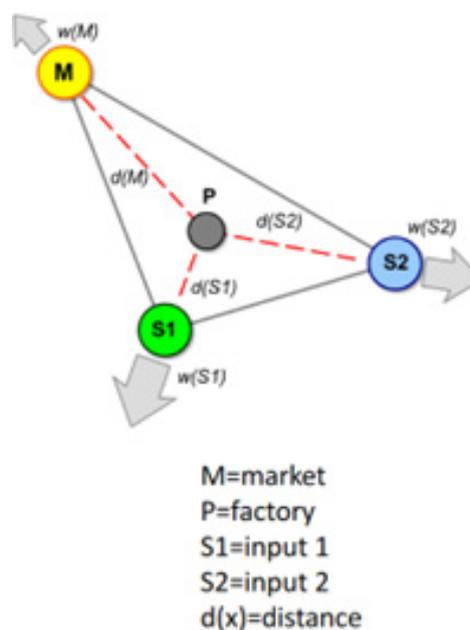
Figure 5.4 Weber's least cost triangular location model

1. Who developed first the least cost triangular industrial location model?
2. What were the major assumptions of Alfred Weber and how they differ from von Thunen's agricultural model?

Dear learner; please read the succeeding notes and make inferences between Alfred Weber's industrial location theory and that of the von Thunen's agricultural theory you read above.

Alfred Weber was a professor of economics at the University of Heidelberg, Germany (from 1907 to 1933). He developed the least-cost industrial location model in his book titled Theory of the Location of Industries. The theory was first presented in the German language (in 1909) and later translated into English in 1929. The model is considered the basis of modern industrial location theory.

Like, von Thunen, Weber adopted several assumptions during writing his least-cost location theory. Some of his assumptions include the following:

◈ firms choose a suitable location to minimize total costs and maximize profits;

◈ an isolated region having no external influences;

◈ isotropic space (with no variations in transport costs);

◈ markets are located in a specific number of centers;

◈ perfect competition (large numbers of firms & customers, and small firm sizes to prevent disturbances by monopolies and oligopolies);

◈ complete knowledge of market conditions (both for the buyers and suppliers);

◈ several ubiquitous natural resources (e.g. water, air, sunlight, sand, etc.); and

◈ many localized materials: materials found at specific locations e.g. labor, fuel, minerals, crops, wood, etc.

Weber assumed three key factors (transport & labor costs, plus agglomeration economies) influence industrial location. He then concluded that the firm location has to consider the three factors. The cost of transportation was the most important component of Weber's least-cost location theory. Thus Weber uses the 'Location Triangle' (Figure 5.4) to solve the mentioned problems.

What were the three key factors assumed by Alfred Weber during developing his 'Location Triangle' theory? Please reflect on this question and connect your understanding with the succeeding discussions.

Alfred Weber suggested that industrial firms have to locate in places where the costs of transporting raw materials and finished products are kept low. For that, he identified two particular cases:

◈ weight loss: this is the case when the weight of the final product is less than the weight of the raw material going into making the product.

◈ weight gain: this is the case when the final product is heavier than the raw materials that require transport.

Based on these raw material categories, Weber proposed two least-cost firm location types.

a.   Industrial firms using pure (non-weight losing inputs) during the process of production can locate nearer to markets. The inputs of such industries are bulk-gaining materials and they do not attract industrial firms to their occurrence locations. Examples of these are cotton textiles, soft-drink bottling, brewery, and beverages, wool, etc. Adding weight during processing for these industries makes the product bulky and more costly for shipping and transportation.

b.   Industries using impure gross materials lose part of their weight of raw materials during the production processes. The inputs of these industries are bulk-reducing. Such materials exert a strong influence on the location of industrial firms. Examples are bauxite and iron-ore refineries plus steel and sugar-cane mills. Industries using such raw materials have better locate nearer to their input sources. These enable the firms to carry the heavier raw materials for short distances whilst their lighter finished goods for long distances to the marketplace.

Relying on the aforementioned input-output firm relationships, Alfred Weber developed the material index model by dividing the weight of inputs by the weight of finished products:

MI = Material Index;   WIs= Weight of Inputs;   WOs= Weight of Outputs.

Then, he concludes:

●   If MI › 1, the industrial firm should locate nearer to the source of the raw material,

●   If MI ‹ 1, the firm should locate nearer to the market.

Weber proposes firms using bulky inputs like aluminum refineries should locate nearer to the supply sources; nearer to energy sources or at port sites. According to Weber, industries that use ubiquitous raw materials (e.g. water, solar power) are likely located closer to markets.

Alfred Weber was an economist, geographer, and sociologist. His theory was persuasive in the progress of present-day economic geography. He did a reputable job during his time in an industrial location. Nevertheless, his work was focused on heavy industries and forgot the light industrial firms. Similar to the land-use model of von Thunen, Weber assumed an isotropic landscape model by ignoring the role played by relief features and his 'isotropic space' assumption forgets the diverse transportation modes and costs. The proposed self-sufficient 'isolated state' with no external influences is difficult to find in reality; thus, threatens the validity of his model.

Alfred Max Weber
(1868 - 1958)

Dear learner; could you please describe the assumptions and key factors of Alfred Weber's industrial location theory? Can you explain the weight loosing and weight gaining cases of raw materials and industrial products mentioned by Alfred Weber related to options of industrial location?

5.1.5 Effect of Location on Settlement and Service Center Development

Dear learner; in the previous two topics, you learned how the location of land uses and industries were modeled by two German scholars. The topic at hand presents the spatial structure, size, function, and location of settlements and service centers. This was first attempted by another German geographer named Walter Christaller in 1933.

> **?** Who is Christaller? How he developed the 'Central Place' theory? Explain?

Walter Christaller was a German geographer who wrote a groundbreaking theory titled 'Central Places in Southern Germany' in 1933. His theory consists of the simple concepts of 'centrality', 'threshold', and 'range'. Centrality refers to a pull to a particular center. A threshold is the minimum purchasing power (population & income) required to attract a firm or new service provider. A range is the maximum distance that people travel to acquire goods and services.

Walter Christaller (1893-1969)

Dear learner; Walter Christaller developed his theory by studying settlement patterns in southern Germany. During formulating his theory, Christaller assumed an 'isotropic plain landscape' (or an area having a uniform physical environment). He anticipated also that this isotropic surface is uniformly settled and equally served by transportation in all directions. Farmers earn the same amount of income (equal purchasing power) and have similar demands for goods and services. Both farmers and business people in urban areas are also considered rational - seeking to minimize costs and maximize incomes. Perfect competition, equivalent income, and 'shopping behavior' on the parts of consumers are parts of the assumptions.

Based on these assumptions, Christaller developed a geometric hexagonal pattern of settlements and service centers in hierarchical order. For Christaller, the hexagonal structure was preferred for it minimizes the problems of overlapping prevalent in using concentric circular arrangements. His hierarchical model anticipated a well-established urban system containing a large city, a smaller number of towns, and many villages and hamlets in the hypothetical region. Christaller's central place hierarchy assumed uniform distribution and equivalent distance among the different levels of settlements and service centers all-over the 'isotropic' region.

> **?** As you read from the foregoing paragraph, Walter Christaller had developed a geometric hexagonal pattern of settlements and service centers in hierarchical order. So, why Walter Christaller preferred the hexagonal structure? Explain?
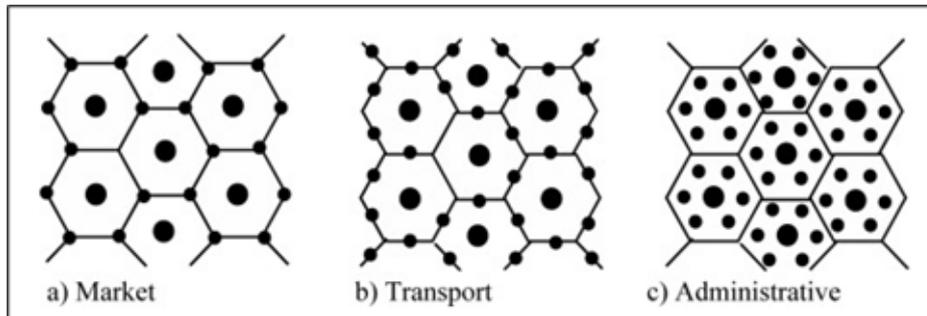
Figure 5.5 Chris Taller's hexagonal settlement model

Activity 5.1.2

Dear learner; please reflect on the following questions so as to internalize your reading about the relationship existing between geography and socioeconomic development presented in the foregoing sections.

1. How do you explain the influence of geographic location on development?
2. Please list the name of geographers that developed theories related to geography and development?
3. Is the cropping pattern in your area related to the von Thunen view?
4. How is the location of industries determined in your area? Does it have a similarity with the assumptions of Alfred Weber?
5. How long do you travel to market centers? Do people in your locality have equal purchasing power like what was proposed by Walter Christaller?

Feedback to Activity questions

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

Feedback to Activity 5.1.1

1. What is economic growth? What about economic development?

   Economic growth is commonly defined as an increase in goods and services or growth of the gross domestic product (GDP) in a nation over a specific period. It mainly focuses on the quantitative growth of the national per capita income not giving due regard to the standard of living and welfare of citizens. Economic development on the other hand refers to the sustained development of the material well-being of society. Unlike economic growth, economic development focuses on both qualitative and quantitative development of the country's economy. Economic development enables people to be more educated, healthier, and endowed with good access to quality housing, better sanitation, and employment opportunities. It is often measured using the Human Development Index (HDI).

2. How does geographic location influence economic development?

   Geographic location influences development through the type and distribution of topographic features; soils and water resources; biological diversity and through influencing movement and communication. For instance, relief determines the types and fertility of soils; rainfall patterns; biological diversity, temperature levels, and movement of people, animals, and materials. All these in turn determine the type of economic (development) activity prevailing in an area.

⚷ 🏛 Feedback to Activity 5. 1.2

1. How do you explain the influence of geographic location on development?

Geographic location influences development by affecting the performance of agricultural, industrial, commercial, and other activities. Detailed explanations and examples are provided in the foregoing notes. Please read the notes for more understanding.

2. Please list the name of geographers that developed theories related to geography and development.

Geographers who developed theories related to geography and development are:

 ◈   Karl Ritter;

 ◈   Ellen Churchill Semple; and

 ◈   Elsworth Huntington.

3. Is the cropping pattern in your area related to the von Thunen view?

Present-day transportation and technological advances were not widespread during the time of von Thunen. The dominant transport during his time was the horse-dragged cart and there were no refrigerators to keep perishable agricultural products for a long time. Today, motor vehicles, locomotives, and air crafts are minimizing distances between producers and consumers. Refrigerators are also used to store perishable items for long periods. Hence, a cropping pattern similar to von Thunen's model would be rare to find in the current world. Such cropping patterns may probably prevail in the list of developed countries of Africa. Try to hear from the students; they may provide different responses. Thunen's isotropic surface is rare to find everywhere.

4. How is the location of industries determined in your area? Does it have a similarity with the assumptions of Alfred Weber?

The assumptions of Alfred Weber could be considered during the planning of firm location in many areas. Raw material sources, market locations, labor, and transportation costs are important factors considered during establishing industries. Students may provide different answers depending on their environmental contexts. The isolated region without external influences and the isotropic space with no variations in transport costs proposed by Alfred Weber could be difficult to fit the contextual environment of the student.

5. How long do you travel to market centers? Do people in your locality have equal purchasing power like what was proposed by Walter Christaller?

The answer to this question would be also different based on the environmental contexts of the students. Some students may travel long distances to reach markets. Some others may also travel shorter distances. The distances to markets may also be minimized by the use of modern modes of transportation. It is also rare to find people with equal purchasing power in many of the localities where the students live.

Section Summary

Dear learner; geography and socioeconomic development have strong linkages. There are two contrasting schools of thought on how geographic location and socioeconomic development are linked together. These differing philosophies are Geographical Determinism and Possibilism. Geographical determinism assumes that the stage of the socioeconomic development of countries is exclusively determined by the geographic environment (location, climate, and geomorphology).

The theory of possibilism on the other argues that geographic environment is not the only determinant factor of socioeconomic development. This school of thought again debates that the lifestyle of people and their socioeconomic context is decided by the interaction of geographic location and human factors.

Dear learner; in appreciation of the influence of geographic location on development, three theories (agricultural land use theory; industrial location theory, and central place theory) were developed by three German scholars (Johann Heinrich von Thunen, Alfred Weber, and Walter Christaller, respectively).

Johann Heinrich von Thunen's agricultural land-use theory imagined that being near the market provides ample benefits in agricultural land-use systems. For that, he envisioned a central market city established at the heart of a plain of thorough physical similarities. Johann Heinrich von Thunen proposed four concentric zones: intensive farming (dairying); forest gardening; extensive cropping and animal grazing in his hypothetical model.

Alfred Weber's least-cost triangular location model assumed that three key factors (transport & labor costs and agglomeration economies) influence industrial location. According to Weber, industrial production is commonly based on firm location, raw material, and labor inputs, transportation costs and facilities, as well as consumers and market centers.

Walter Christaller had developed a geometric hexagonal pattern of settlements and service centers in hierarchical order. Christaller's hierarchical model anticipated a well-established urban system containing a large city, a smaller number of towns, and many villages and hamlets in the hypothetical region.

To generalize, geographic location (where a country finds) has a substantial impact on the socioeconomic development of countries. It is 'an integral part of economic geography, regional science, and spatial economics. The location of economic development projects can be fixed through consideration of broader contexts of countries, regions, and global environments. Geographic location thus strongly influences the scope of 'firms in that location' by controlling the distribution of the population (purchasing power); economic patterns; transport costs and trading networks. The cost of moving goods and services across spatial scales can influence the access of firms to markets. The costs and networks of transportation facilities affect the relative relevance of firms and the scale of decisions concerning innovation and capital investments.

✓ Checklist 5.1

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

№	Questions	Yes	No
1	Did you understand the concepts of economic growth and development?		
2	Did you understand how economic growth and development are measured?		
3	Can you define the HDI?		
4	Does the geographic environment have no significant value in changing the lifestyle of people and their socioeconomic development?		
5.	Can you identify the most important human activities that are more affected by geographic location?		
6	Can you distinguish between the thoughts of geographical determinism and possibilism?		
7	Can you name the famous adherents of geographic determinism?		
8	The geographic environment is not the only determinant factor of socioeconomic development?		
9	Can you identify the most important human activities that are more affected by geographic location?		
10	Did you understand the agricultural location theory of J.H. von Thunen; the triangular industrial location model of Alfred Weber and the central place theory of Walter Christaller?		

Self-test Exercise 5.1

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

Part I) True/False

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

1. Socioeconomic development enables people to be more educated, healthier, and endowed with good access to quality housing, better sanitation, and employment opportunities.
2. Geographic location has no significant role in economic and social development.
3. von Thunen's hypothetical model imagined that farmers nearer to the market city grow crops that have a cheap price and provide the lowest net incomes.
4. Alfred Weber assumed labor and agglomeration economies require only consideration of adjustment effects.
5. Christaller's hierarchical model anticipated a well-established urban system containing a large city, a smaller number of towns, and many villages and hamlets in the hypothetical region.

Part II) Multiple Choices

Instruction: For questions 6-10, choose the best answer from the given alternatives (5 points)

6. Which of the following parameters best measures the sustained material well-being of society and the welfare of citizens?

    A) Economic growth (GDP)   C) Access to ICT

    B) Socioeconomic Development   D) Geographic location

7. Which of the following statements is correct?

    A) The development of countries is exclusively determined by the geographic environment

    B) Countries in Africa are less developed because of their location in hot tropical climates

    C) The lifestyle and well-being of people are not determined by only the geographic setting

    D) The creative mind of human beings plays no significant role in socioeconomic progress

8. According to von Thunen's hypothetical agricultural model:

    A) Heavy and perishable crops grow far away from the central market

    B) Forest products are anticipated to occupy the area nearer the market

    C) The last remotest zone from the market is suggested to remain free

    D) The third zone from the market is expected to be vacant wilderness

9. Which of the following was the most important component in Alfred Weber's least-cost location theory?

    A) The cost of transportation   C) Agglomeration economies

    B) The cost of human labor   D) The cost of raw materials

10. Which of the following is Not True about 'Christaller's Central Place theory?

    A) It assumed a uniform distribution of settlements and service centers

    B) It assumed equivalent distance among settlements and service centers

    C) It anticipated a hierarchical pattern of settlements and service centers

    D) The model assumed varied topography and diverse geographic surface

Part III) Short Answer Writing

Instruction: Give short answers to questions 11-13 (10 points)

11. Economic growth is often measured using the _____ while development is measured through the use of the _____ (3 points).

12. In the 2019 United Nations Development Program (UNDP, 2019) ranking of 189 world countries, three countries of the world stood at the top and the other three countries held the bottom three lowest Human Development Index (HDI) positions. Then, those three country groups are respectively found in the continents of _____ and _____ (3 points)

13. In his 'Central Place' theory, Christaller developed a geometric hexagonal pattern of settlements and service centers in hierarchical order. Hence, why Christaller preferred the hexagonal structure to use the concentric circular model? (4 points).

🔑 Answer Key to Self-test Exercise 1.1

Dear learner; we hope you did well in the self-testing. You are now at the stage of completion of the first unit of module two. Now, please compare your answers with the feedback given and make corrections if there are errors in your answers.

Part I) True/False		Part II) Multiple Choices	
1	True	6	B
2	False	7	C
3	False	8	C
4	True	9	A
5	True	10	D

	Part III) Short Answer Writing
11	Economic growth is often measured using the Gross Domestic Product (GDP) while development is measured through the use of the Human Development Index (HDI).
12	12. In the 2019 United Nations Development Program (UNDP, 2019) ranking of 189 world countries, three countries of the world stood at the top and the other three countries held the bottom three lowest Human Development Index (HDI) positions. Then, those three country groups are respectively found in the continents of Europe and Africa.
13	Walter Christaller preferred the hexagonal structural model because it minimizes the problems of overlapping prevalent in using concentric circular arrangements.

Dear learner; how did you find the lesson? We think you enjoyed it and found it very interesting and exciting. We 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
CLIMATE EXTREMES AND POVERTY (3 Hours)

Section Overview

Dear learner; in the previous section (in Section One), you studied the effect of geographic location on economic development. In this section, you will learn about the effect of one of the geographic factors (extreme climates) on poverty. Climate change and variability drive extreme temperatures and rainfalls that eventually result in extreme environmental changes (events) to happen. Droughts, floods, and plagues are among the extreme environmental events taking place with the changes in weather and climate. These extreme events finally interact with the numerous aspects of human livelihoods. For instance, extreme droughts, floods, and plagues erode the potential of farming livelihoods by lessening crop yields; increasing pathogens; exacerbating insect attacks, and worsening the risk of parasitic weeds.

Section Learning Outcomes

Dear learner; after the completion of this unit, you will be able to:

- define the concepts of climate extremes,
- explain how extreme weather and climate events exacerbate poverty,
- describe how flooding events worsen poverty levels, and
- examine the poverty traps and critical thresholds.

Keywords:

- Climate extremes;
- Critical thresholds;
- Droughts;
- Flooding events;
- Impacts;
- Poverty traps;
- Vulnerability.

5.2.1 The Concepts of Climate Extremes

> Dear learner; in the previous section, you studied about the influence of geographic factors on development. Here again, you are going to learn about climatic extremes as geographic factors. What do you know about the geographic factors of climate?

Alright, learner! Climate extremes refer to excess temperature and rainfall events and environmental hazards happening following those excessive occurrences. They are commonly initiated by recurrent climate changes happening over longer periods. For instance, 'human-induced warming reached' around '1.0 0C above the pre-industrial levels in 2017'. It is also estimated to reach 1.5 0C by 2040 and 1.75 0C at the turn of the 21st Century if the current trend of warming continues (see Figure 5.6). Please; take minutes and consider Figure 5.6 very well and try to make meaning out of it for further understanding.
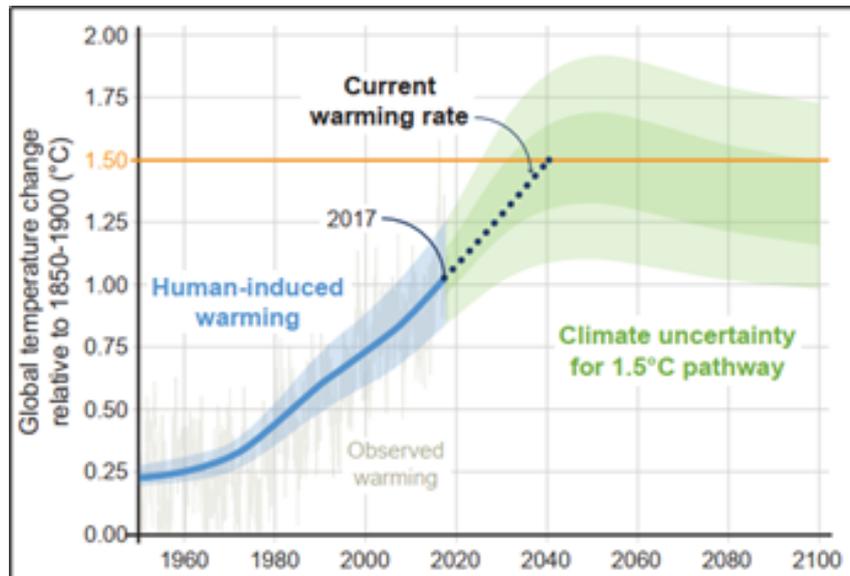
Figure 5.6 Global temperature changes (1940 – 2100) (IPCC, 2018)

Dear learner; from your reading above and by referring Figure 1.4:
1. How do you evaluate the human induced Global warming & temperature change of the past decades and how you describe the future trends?
2. What impacts do the warming and the changes in the Earth's climate will impose over human livelihoods and the Earth's life-forms?

The temperature increases mentioned above have been connected with more warming in the diurnal lowest temperatures than in the highest ones. Rainfalls have also been increasing during the mentioned period in the middle and high-latitude areas. Nevertheless, rainfalls have been showing decreasing trends over the indicated period in tropical and sub-tropical areas. Following those temperature and precipitation changes, extreme climatic events (heat and cold waves, floods, droughts) have been taking place over wider arid and semi-arid areas of the Earth. These extreme events have been finally interacting with the numerous aspects of human livelihoods. For instance, extreme droughts, floods, landslides, crop failures, livestock deaths, water shortages, and plagues (see e.g. Figure 5.7) have been eroding the potential of farming livelihoods through lessening crop yields; increasing pathogens; exacerbating insect attacks, and worsening the risks of invasive

a) A house inundated by floodwater due to heavy rainfall from typhoon Goni, 1st Nov. 2020, Albay province, Philippines (Browder et al., 2021)

b) Farmers receiving drinking water during a severe drought in the rural areas of Tien Giang, Vietnam (Browder et al., 2021)

Failed sorghum crop in Ethiopia (UN 26 January 2016) https://news.un.org/en/story/2016/01/520892-food-emergency-intensifies-drought-hit-ethiopia-un-appeals-more-resources

Livestock death in the Somali region of Ethiopia (25 Jan. 2022) https://www.dw.com/en/ethiopia-grapples-with-worst-drought-in-30-years/a-60831029

Figure 5.7 Examples of climate change-related hazards

Dear learner; could you please refer the following online links to help you improve your understanding about the issue you are studying.
❋ https://www.nationalgeographic.org/video/extreme-weather-interconnections-in-extreme-weather/
❋ https://www.youtube.com/watch?v=G4H1N_yXBiA
❋ https://www.youtube.com/watch?v=-D_Np-3dVBQ

5.2.2 Extreme Climate Events and Poverty

Dear learner; the incidence and intensity of the aforementioned climate extremes cause severe challenges in countries with higher levels of poverty. Extreme climatic events seriously affect poor people in those countries in many ways. Extremely poor people receive only 1.90 United States Dollars (USD) per day. About 10% of the global population is estimated to live within this threshold. An estimated 850 million people are quiet living now with ‹1.25 USD daily income of which the majority of those living below this poverty line are in sub-Saharan Africa (SSA). It is estimated also that nearly 1.3 billion people have no access to electricity. Other 900 million people have no access to clean fresh water and some other 2.6 billion lack access to improved sanitation. Similarly, nearly 800 million rural inhabitants lack access to all-weather roads. All these are poverty syndromes intensified by extreme climates. The root causes of such extreme climate-initiated poverty conditions are:

◈ vulnerability to droughts, flooding, typhoons, locust invasions,
◈ lack of good governance (absence of proper law enforcement),
◈ remoteness from service centers (lack of all-weather roads),
◈ property right-related problems including tenure insecurity,
◈ lack of adequate infrastructure and services (roads, water, electricity, education, health),
◈ poor access to markets and weak social networks,
◈ demographic-related characteristics (e.g. household sizes, age & sex compositions & dependency levels),
◈ unemployment and underemployment levels, and
◈ shelter and nutrition-related problems.

1. From the preceding reading, how do you evaluate the effect of extreme climates in the world? Which regions of the world are more affected by the extreme climatic events?

2. What causes the extreme climates?

3. How extreme climates intensify poverty levels in communities?

Dear learner; please think critically over the given questions and integrate your ideas with the foregoing and succeeding notes.

Hitherto, climate extremes intensify community, household, and individual levels of poverty by injuring infrastructure, distorting employment opportunities, and violating health, education, and housing services. Climate change extremes can, at large, impede socioeconomic development, reduce food security and expand poverty.

Exposure to climate hazards (extremes) and poverty levels are commonly derived from growing populations, urbanization (where immigrants reside in marginal hazard-prone areas), settling in coastal and floodplain areas, and the destruction and losses of natural ecosystems.

Poor people in Developing Countries (DCs) commonly live in peripheral urban areas that are exposed to the risks of flooding and urban waste. In rural areas, poor people often occupy drought-prone environments that are exposed to climate extremes. These poor people often lack access to necessary information and social support opportunities. They lack also the potential and capacity required to cope-up and respond to climate extremes (Table 5.1).

1. What short-term and long-term impacts caused by extreme climates?

2. How do people cope-up with poverty traps caused by the extreme climates?

Dear learner; based on your thought about the preceding question, consciously read the next lesson note. Climate extremes result in destitution and poverty traps on poor households by forcing people to consume or sell their assets during disasters and sicknesses. This deters the development of their human capital and undermines their capacity to adapt and cope with future shocks that eventually lead to the cycle of climate extreme poverty syndromes.

In general, climate extremes cause a shift from ephemeral to lingering poverty due to the absence of active reaction alternatives to exciting occasions. Households led by females, people living in slums, and children are among the most affected by climate extremes. Poor nomadic pastoralists could fall into lingering poverty when livestock feed supplies diminish due to climate extremes. Dear student; please note the long-term and short-term impacts of climate extremes on human livelihoods from Table 5.1.

Table 5.1 Climate Extreme and poverty linkage impacts on human livelihoods

Impact duration	Direct impacts	Indirect impacts
Short-term	Loss of income and earnings	Loss of working persons through death, injury, and illness
	Loss of assets (housing, savings, crops, land & properties)	Loss of labor and low productive output (e.g. crops, industry)
	Forced consumption of limited assets and savings	Loss of assets (physical and social infrastructure damage)
	Limited access to food, water, and healthcare	Diversion of government and private spending to responses
	Abandoning schooling and healthcare plans	Short-term supply chain disruptions
Long-term	Loss of fertile land	More spending on food imports
	Staple food price increment	Increased debt to recovery needs
	Food security reduction (malnourishment & stunting)	Budget allocation for reconstruction and recovery
	Lowering educational attainment and life expectancy	Reduction of exports and increased imports
	Reduce future resilience and coping capacity	Long-term supply chain disruption
	Cause long-term subsidiary impacts	Relocation of productive sectors
		Reduced income and consumption
		Low investment in physical infrastructure and human development (slow socioeconomic development)

Figure 5.8 shows that severe vulnerability to climate change will start in the 2050s in SSA whilst by the year 2100 many countries of the world will fall under extreme, severe, and serious climate change impacts.
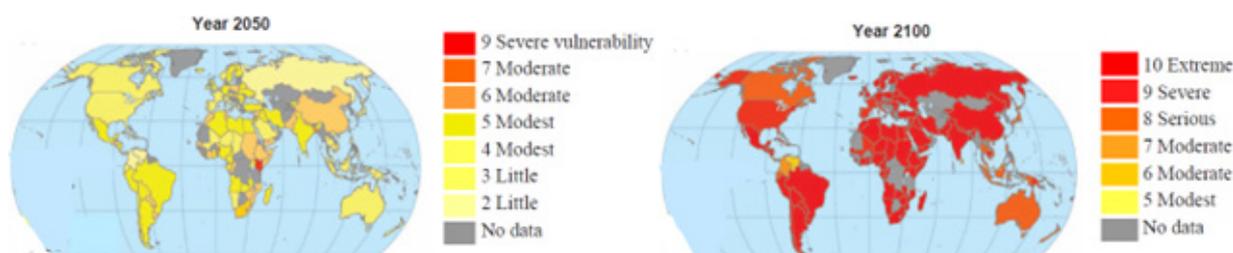

Figure 5.8 Vulnerability to climate change by 2050 and 2100 (UN, 2008)

Dear learner; could you please identify the typical extreme climatic events, their effect on communities and their linkage with poverty levels by referring Table 1.1? Identify also the countries that will be highly exposed to climate extremes by the year 2050 and 2100? Refer Figure 1.6 to answer this question.

5.2.3 Flooding Events and Poverty

Dear learner; floods are among the extreme climatic events that affect communities and worsen poverty levels. Spontaneous flash floods often damage walkways, plantations, infrastructures, and stream banks and cause widespread loss of livelihood assets. Field crops and domestic animals are damaged by the floods. These occasions further aggravate food insecurity and livelihood perils over households and then result in chronic poverty. During extreme flooding events, human settlements and urban infrastructures (water and power supply services) will be destroyed. The loss of similar physical assets and property due to extreme flooding events in poor areas generally causes displacements. Such events not only devastate properties but also disrupt the informal social networks of people in the affected areas (e.g. see a sample case from Ethiopia).

Learner; please enumerate the damages caused by occasional floods and the relation existing between flooding and poverty? By making inference from the above reading, it is possible to integrate your learning with the succeeding note. Please read the following case study from Itang District of Gambella in Ethiopia and answer the questions that follow.

CASE STUDY I

Ethiopia: Preventive measures not enough to avoid loss and damage from extreme floods

An increase in the frequency and severity of flooding in Ethiopia is affecting the livelihoods of small-scale agropastoralists who rely on the land for subsistence. A study conducted in the Itang District of the Gambella region found that despite applying a variety of preventive measures against flooding, households were still experiencing severe negative impacts (e.g. lost harvests and livestock, damage to houses and property). Furthermore, relying on social networks to cope in the aftermath of a flood was found to be unsustainable, as repeated floods erode this social capital.

What is the greatest climatic stressor?

Since 2000, households in the Itang area of the Gambella region in Ethiopia have reported dealing with increasingly severe floods. From 2006 to 2012 the region suffered a major flood every year, except for 2009 when they suffered from drought. The floods were especially severe in 2007 and 2012. In both years, the floodwaters that normally retreat by October were still high in mid-November.

Households annually experience flooding when the Baro River, a tributary to the Nile and the widest river in Ethiopia, overflows. However, at least once per season, they also suffer from flash floods that come from excessive rainfall in the upland mountain regions. Due to their unpredictability, these flash floods can be especially disastrous as they are capable of destroying crops and livestock without warning.

What is the impact?

As the region is primarily made up of agropastoralists that rely heavily on the land, flooding negatively affected nearly all of the 431 households surveyed. Ninety-four percent of respondents reported that their crops were severely damaged or destroyed following the 2007 flood. In addition to losing crops, 51 percent reported the loss of livestock, whose dairy products and meat are heavily relied upon for sale and consumption. Furthermore, the inability of livestock to graze due to flooded grazing land reduced dairy production in 2007 by half. Large-scale destruction of crops also leads to higher food prices, which make staple foods such as maize unaffordable and force already desperate households to reduce their food consumption.

How do affected people deal with floods?

The research found that households adopt both short- and long-term preventive measures. Short-term measures are undertaken right before a flood and include moving household property and livestock to relatives in unaffected areas, selling livestock before a flood, and harvesting premature crops. Longer-term measures include digging ditches around property and farms, raising the floors of homes, and erecting boundary walls. These preventive measures are effective for minor floods, but as floods increase in severity such measures become inadequate.

In the aftermath of a flood, respondents primarily cope by appealing to their social networks for support (i.e. relatives in unaffected areas), which usually comes in the form of shelter, food, and financial and material assistance. The government and NGOs also provide some assistance (e.g. food and shelter); however, this is rarely sufficient and only available during or immediately after a flood. Following a flood, households also resort to selling livestock and property to pay for food and other necessities.

Taken from Warner et al. (2021)

Dear learner; we hope you get information on how flooding affected the livelihood of people in the Itang area of Gambella from the foregoing reading. Now, try to answer the ongoing questions based on the information you get from the sample study.

?

1. Who were affected by the flooding events in the Itang District of Gambella?
2. What was the greatest climatic stressor in the area and how the flooding events were created? Can you identify the River that causes flooding in the area?
3. What was the impact and how many households were affected by the flooding?
4. How many percent of the households faced severe crop damage and how many percent of them lost their livestock by the 2007 flood?
5. How do the people affected by flooding in the Itang District cope-up with the climatic risks? What were the short-term and long-term measures taken by the households to minimize the climatic impacts?

Activity 5.2.1

1. What are extreme climates? Can you identify the typical examples?
2. How do you explain the linkage between climate extremes and poverty in developing countries?

Dear learner; please critically think over the given activity questions and relate your idea with the succeeding notes to make effective your learning.

5.2.4 Poverty Traps and Critical Thresholds

Dear learner; we hope you conceived how extreme climatic events like flooding and drought affected the livelihood conditions of communities and households from the preceding case study. Now, you are going to see also how extreme climate events push people into poverty traps. Poverty traps occur when extreme climates push poor people to be poorer and poorer. People repeatedly exposed to damaging droughts, floods, and famines are often hit by poverty traps due to climate extremes. Poverty traps often happen when the impacts of extreme climates frequently hit poor people and persist for tens of years. Grave thresholds or irremediable harms occur from the merger of numerous non-climate-related variables. For instance, when the social-network ties of poor people repeatedly break due to lingering climate extremes and poverty, their reciprocal support weakens. Coupled with the already existing poverty, the coping capacity of the poor further weakens and exposes them to aggravated lingering poverty traps (e.g. see a sample case from Burkina Faso, Africa).

> CASE STUDY II
>
> Loss and damage example: A dream of peaceful retirement shattered by drought
>
> My name is Ag Ayad Inanchanan. I was born in 1937, and am a veteran of the Burkina Faso army. During my military service, I invested all my earnings in livestock. I thought that would guarantee a peaceful retirement.

When I left the army, I had 135 cattle, 87 sheep, and 45 goats. The drought of 1973−74 changed everything. I lost 75 cattle that year because of the scarcity of fodder and drinking water. I was forced to sell some 30 heads also to save the remaining animals and maintain my household. That year, my two brothers lost all their livestock. With no property, they moved in with me and became part of my household. With my herd decimated, I decided to start vegetable cultivation. I was the first gardener in Tin-Akoff along the Beli River. I had seen how that was done when I was stationed in the South. Irrigation allows me to carry on even if the rains fail, but the small profits from gardening do not allow me to reinvest in livestock and expand my herd up to previous levels. It is only enough to maintain my family. Despite my efforts to become less dependent on rainfall, we continue to suffer from the negative effects of drought on our farm. My situation started to worsen again during the drought and locust invasion of 2004. I lost 20 of the 30 heads of cattle I had then. Then, in 2011, I lost 165 small ruminants that drowned in the Beli River when searching for fodder. A big rain that was sudden and brutal washed them away. And this year, in 2012, I will not even harvest 1 kg of millet from my field due to the invasion of birds in the area. Because I do not have enough animals to sell, I was forced to sell one of my handcarts to cover my food needs. The situation is becoming increasingly catastrophic. I never imagined my life would look like this now when I thought I was going on to a peaceful retirement.

Taken from Warner et al. (2021)

Climate extremes and poverty levels have distinct geography. For instance, Figure 5.9 shows that the highest levels of extreme poverty prevail in SSA, South, and Southeast Asia. Some specific areas with the utmost poverty levels saw large annual temperatures and rainfalls (see Figure 5.10). Referring to the indicated map, it appears that some areas show increasing temperatures but decreasing rainfalls (e.g. North Africa, South Africa, and the Mediterranean region). Conversely, increasing annual rainfalls were prevalent in South and East Asia. Many of the mentioned regions experience higher poverty levels. Unlikely the stable annual climates, tropical areas are observed experiencing the largest comparative extreme climatic changes and thus identified as climate change 'hot spots'.

Dear learner; use the opportunities created for you by critically attempting and answering all the questions set at every section and subsection throughout the unit; go back and forth in reading for in-depth understanding. Approach the following activity questions with this thinking or mindset.

?

1. Dear learner; what do you realize from the above reading? How and when do you think poverty traps happen? What non-climate related impacts do poor people face due to lingering poverty?

2. For more understanding, please read from Case Study II, how the dream of peaceful retirement of an army veteran named Ag Ayad Inanchanan was shattered by an extreme climate incident in Burkina Faso, West Africa? Then, answer the following questions based on your reading?

    a. What extreme climatic events traumatized Inanchanan's dreams of peaceful retirement?

    b. What properties Inanchanan lost by the extreme climatic incidents of the 1973/1974, 2004 and 2011?

    c. What did Inanchanan do to cope-up with climatic incidents?

    d. Where had Inanchanan started to grow vegetables?

    e. Dear learner; do you think the peaceful retirement dreams of Inanchanan were achieved? Why or why not?

Recent studies on extreme climate and poverty linkages indicated that:

◈ extreme weather accompanying climate change is increasing and will probably pose more calamities in the 2030s. Similar hazards, particularly those connected to drought and famine, could be significant sources of poverty during the mentioned time (see Figures 5.9 & 5.10),

◈ in the 2030s, some 325 million extremely poor people exposed to natural hazards and extreme climates may probably live in 49 countries (e.g. in SSA & South Asia),

◈ eleven countries that are at the most risk of disaster-induced poverty are Bangladesh, the Democratic Republic of Congo (DRC), Ethiopia, Kenya, Madagascar, Nepal, Nigeria, Pakistan, South Sudan, Sudan, and Uganda. Other 10 countries will have a great percentage of people in poverty, high multi-hazard exposure, and inadequate capacity to minimize the impacts (e.g. Benin, CAR, Chad, Gambia, Guinea Bissau, Haiti, Liberia, Mali, North Korea, and Zimbabwe). Niger, Somalia, and Yemen could also characterize the list. Although their entire exposure to hazards, other than drought is quite low, these countries have high levels of poverty and low capacities for disaster and risk management scenarios. Similarly, Afghanistan, Cameroon, Myanmar, and Papua New Guinea bear high experience of hazard and moderate poverty (with nearly 10% of their populations and/or one million people ‹1.25 USD per day poverty line, Figure 2.8) and limited disaster management capacity.

◈ disaster risk control should be the basic element of poverty-lessening efforts. This has to focus also on caring for livelihoods in addition to saving lives,

◈ future development goals should embrace targets on disasters and climate change.
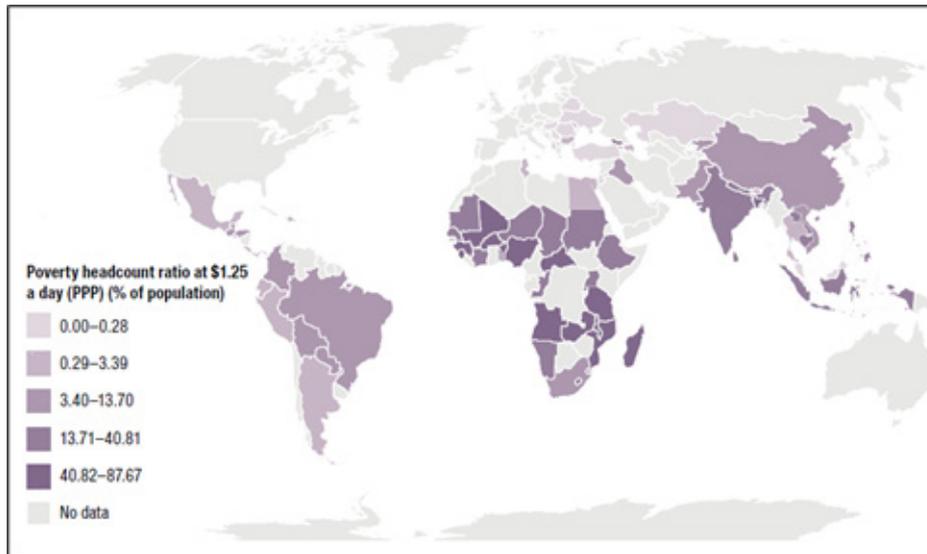
Figure 5.9 Share of population living with ‹1.25 USD per day during 2010-2012 (Wilkinson & Peters, 2015)

Dear learner; from your reading above and by referring Figures 5.9-5.13:

1. How do you describe the geography of extreme climates and poverty levels? Where do you think the highest poverty level prevails and which areas are classified as climate change hotspots?

2. In which regions the largest proportion of the world's population lived with ‹1.25 USD per day from 2010-2012?

3. How do you envisage the climatic extremes and poverty levels in the 2030s and in the year 2100? Increasing or decreasing? Explain?
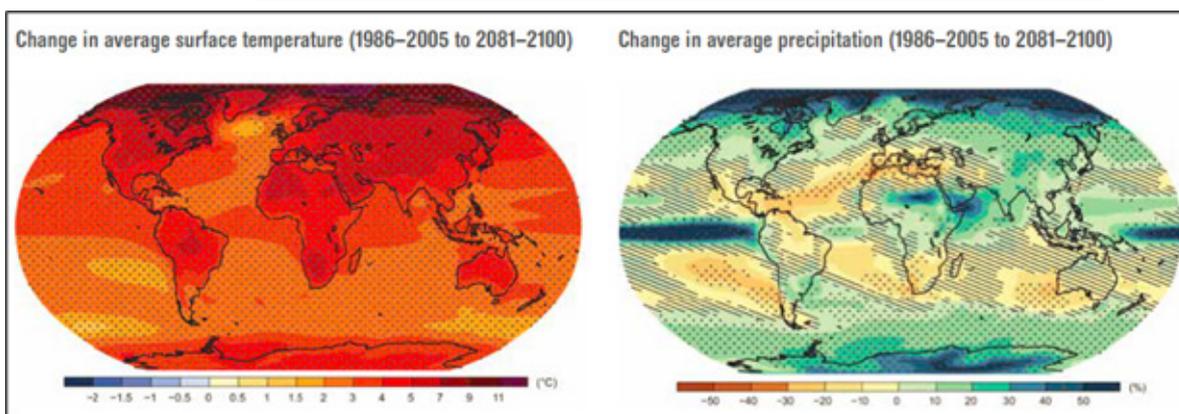
Figure 5.10 Annual surface temperature and rainfall changes (Wilkinson & Peters, 2015)

Dark-red shades indicate annual surface temperature changes and the dark-blue shades show precipitation changes to happen by the end of the 21st C.

Climate change and variability, in general, drive extreme temperatures and rainfalls that eventually result in extreme environmental changes to happen. Droughts, floods, and plagues are among the extreme environmental events taking place with the occurrences of extreme climates. These events finally interact with the numerous aspects of human livelihoods. For instance, extreme droughts, floods, and plagues erode the potential of farming livelihoods by lessening crop yields; increasing pathogens; intensifying insect attacks, and worsening the risks of invasive weeds. Climate extremes generally destroy the asset base of poor people and households.
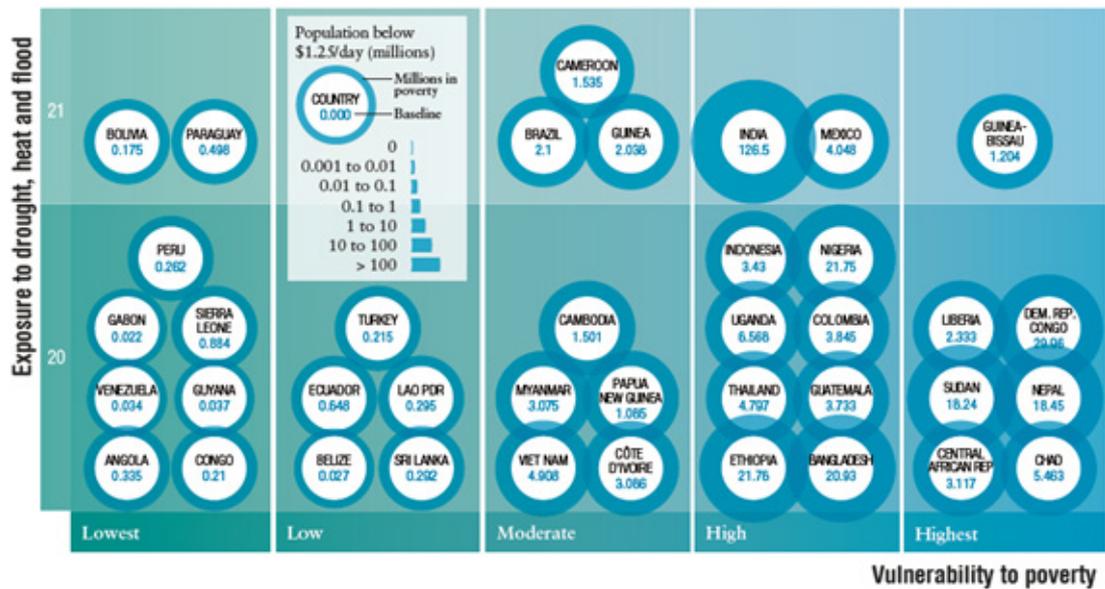
Figure 5.11 Set of countries with the highest exposure to droughts, extreme heat, and floods (projected poverty levels in 2030) [Shepherd et al., 2013]
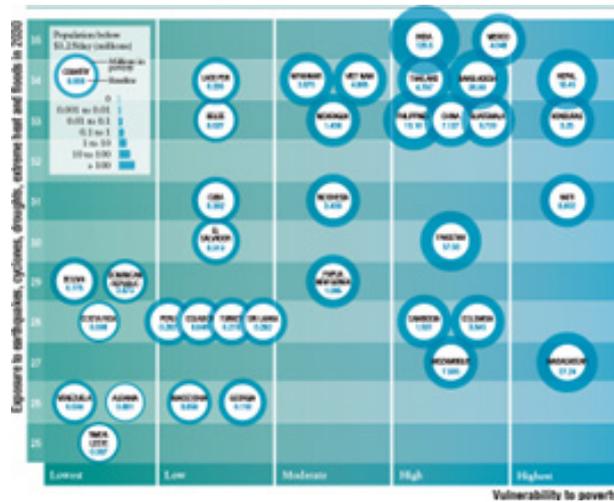
Figure 5.12 Set of countries ranking highest on multi-hazard exposures (earthquakes, cyclones, droughts, extreme heat, and floods) (projected poverty levels for 2030) [Shepherd et al., 2013]

Figure 5.13 Poverty risk at 1.25 USD baselines (percent of people by 2030) [Shepherd et al., 2013].

Extreme climate refers to the occurrence of an excessive value of the climatic (weather) elements below or above the normal thresholds over a specific geographic area and time (e.g. excessively low or high temperatures, rainfall, flooding, droughts, hail storms, heat waves, tornadoes, etc.). Extreme climates are rare cases but cause disastrous impacts on life and biodiversity.
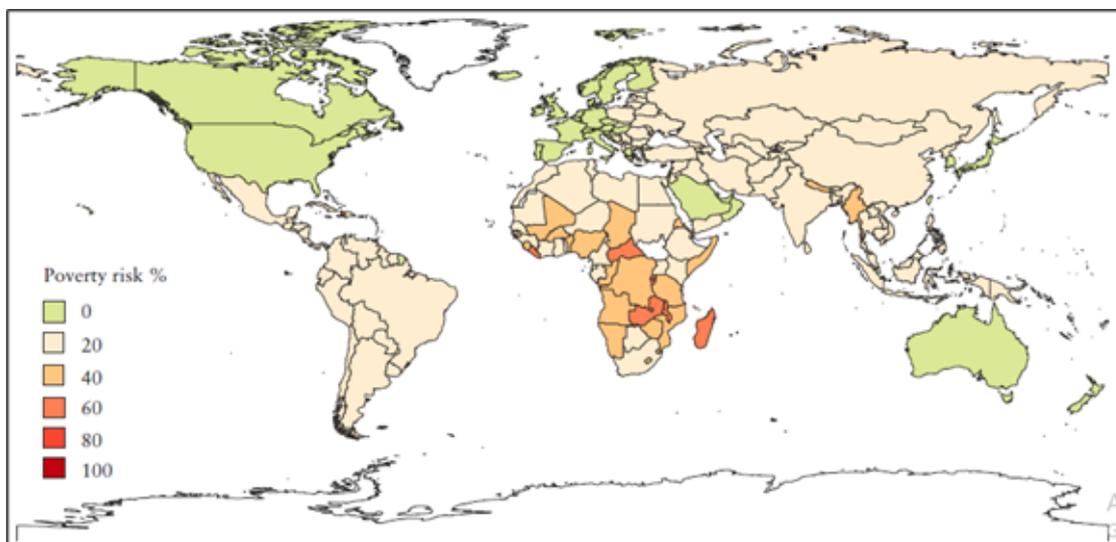
Extreme climates damage livelihood assets (water, livestock, and crops) as well as the capacity of people to access financial resources, and health and education services. When the events happen frequently and repeatedly; households face difficulties in cope-up with the shocks. In such cases, people fall into an endless poverty vicious cycle which can be referred to as a poverty trap − meaning people lack the necessary resources to escape from poverty. This is because the extreme climatic shocks cause both 'ex-post' and 'ex-ante' impacts on the 'incidence' of poverty.

Dear learner; we hope you learned a lot about how extreme climates have impacted the incomes and livelihoods of people in the world from the foregoing notes. So now, try the questions given below based on your reading to understand more about the lesson you studied.

Activity 5.1.4

1. How do you explain the effects of climate extremes on poverty dynamics and poverty traps?

2. What kind of disasters and impacts did the people in the Itang District of Ethiopia face from 2006 to 2012? What properties did they lose? How did they cope with the hazards?

3. What shattered the peaceful retirement dreams of Ag Ayad Inanchanan? What properties did he lose?

Feedback to Activity Questions
Feedback to Activity 5.1.3

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

1. What are extreme climates? Can you identify the typical examples?

Dear learner; extreme climates are excessive values of the climatic (weather) elements recorded below or above the normal thresholds over a specific geographic area and time. They are rare climatic cases but cause disastrous impacts on life and biodiversity. The typical examples are excessively low or high temperatures and rainfalls; floods, droughts, hailstorms, heat waves, tornadoes, etc.

2. How do you explain the linkage between climate extremes and poverty in developing countries?

Poverty levels in developing countries like Ethiopia are very high. These countries are hit also by frequent extreme weather and climatic changes that worsen the poverty levels of people. As these countries lack the basic capacity and technology, they are too weak to effectively mitigate extreme climate events.

The events thus further exacerbate the poverty levels of people in both rural and urban areas. Climate change extremes and poverty are thus strongly linked in developing countries of Africa.

Feedback to Activity 5.1.4

1. How do you explain the effects of climate extremes on poverty dynamics and poverty traps? Extreme climates (very high temperatures and rainfalls) cause droughts, floods, famines, and plagues. These events interact with the numerous aspects of human livelihoods. For instance, extreme droughts, floods, and plagues erode the potential of farming livelihoods by lessening crop yields; increasing pathogens; intensifying insect attacks, and worsening the risks of invasive weeds. Climate extremes generally destroy the asset base of poor people and households. They damage the livelihood assets (water, livestock, and crops) as well as the capacity of people to access financial resources, health and education services. When the events happen frequently and repeatedly; households face difficulties in coping with the shocks. In such cases, people fall into an endless poverty vicious cycle which can be referred to as a poverty trap − meaning people lack the necessary resources to escape from poverty. This is because the extreme climatic shocks cause both 'ex-post' and 'ex-ante' impacts on the 'incidence' of poverty.

2. What kind of disasters and impacts did the people in the Itang District of Ethiopia face from 2006 to 2012? What properties did they lose? How did they cope with the hazards? The people in the Itang District of Ethiopia face mainly severe flash floods with an occasional drought from 2006 to 2012. The disaster impacted the households by damaging their houses, crop harvests, livestock, and other properties. Many households lost their crop harvests, dairy cattle, and social networks. This in turn led to higher food prices, a reduction in food consumption, and an erosion of social networks. Households used short-term and long-term measures to cope-up with the risks. The short-term measures were moving household property and livestock to relatives in unaffected areas, selling livestock before a flood, and harvesting premature crops. The long-term measures were also digging ditches around properties and farms, raising the floors of homes, and erecting boundary walls.

3. What shattered the peaceful retirement dreams of Ag Ayad Inanchanan? What properties did he lose? The peaceful retirement dream of Ag Ayad Inanchanan was shattered by repeated droughts, locusts, and flooding hazards. Because of the recurrent droughts and flooding, he lost his livestock (cattle and ruminants).

Section Summary

Climate change and variability drive extreme temperatures and rainfalls that eventually result in extreme environmental changes (events) to happen. Exposure to climate hazards (extremes) and poverty levels are commonly derived from growing populations, urbanization, settling in coastal and floodplain areas, and the destruction and loss of natural ecosystems. Droughts, floods, and plagues are among the extreme environmental events taking place with the changes in weather and climate. These extreme events finally interact with the numerous aspects of human livelihoods. For instance, extreme drought, flooding, and plagues erode the potential of farming livelihoods by lessening crop yields; increasing pathogens; exacerbating insect attacks, and worsening the risk of parasitic weeds. Climate extremes again intensify community, household, and individual levels of poverty by injuring infrastructure, distorting employment opportunities, and violating health, education, and housing services. Climate change extremes can impede too socioeconomic development, reduce food security and expand poverty.

Climate extremes and poverty levels have distinct geography. For instance, the highest levels of extreme poverty prevail in SSA, and in South and Southeast Asia. Some specific areas with the utmost poverty levels saw large annual temperatures and rainfalls. For example, some areas in North Africa, South Africa, and the Mediterranean region experience increasing temperatures but decreasing rainfalls. Conversely, increasing annual rainfalls were prevalent in South and East Asia. Many of the mentioned regions experience higher poverty levels. Tropical areas are observed experiencing the largest comparative extreme climatic changes and thus identified as climate change 'hot spots'.

Recent studies on extreme climate and poverty linkages indicated that extreme weather accompanying climate change is increasing and will probably pose more calamities in the 2030s. there will be nearly 325 million exceedingly poor people living in 49 countries greatly vulnerable to natural hazards and climate extremes in the 2030s (e.g. SSA & South Asia). For instance, countries like Bangladesh, the Democratic Republic of Congo (DRC), Ethiopia, Kenya, Madagascar, Nepal, Nigeria, Pakistan, South Sudan, Sudan, and Uganda will be at the most risk of disaster-induced poverty in the 2030s. Other 10 countries (e.g. Benin, CAR, Chad, Gambia, Guinea Bissau, Haiti, Liberia, Mali, North Korea, and Zimbabwe) will have a great percentage of their people in poverty, high multi-hazard exposure, and inadequate capacity to minimize the impacts.

Poverty traps occur when extreme climates push poor people to be poorer and poorer. People repeatedly exposed to damaging droughts, floods, and famines are often hit by poverty traps due to climate extremes. Poverty traps often happen when the impacts of extreme climates frequently hit poor people and persist for tens of years. Grave thresholds or irremediable harms occur from the merger of numerous non-climate-related variables. For instance, when the social-network ties of poor people repeatedly break due to lingering climate extremes and poverty, their reciprocal support weakens. Coupled with the already existing poverty, the coping capacity of the poor further weakens and exposes them to aggravated lingering poverty traps. In general, climate extremes cause a shift from ephemeral to lingering poverty due to the absence of active reaction alternatives to exciting occasions. Households led by females, people living in slums, and children are among the most affected by climate extremes. Poor nomadic pastoralists could fall into lingering poverty when livestock feed supplies diminish due to climate extremes.

✅ Checklist 5.2

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

№	Questions	Yes	No
1	Can you define what climate extremes are?		
2	Extreme droughts, floods, landslides, crop failures, livestock deaths, water shortages, and plagues are eroding the potential of farming livelihoods through lessening crop yields; increasing pathogens; exacerbating insect attacks, and worsening the risks of invasive weeds.		
3	Climate extremes cause severe challenges in countries with higher levels of poverty.		
4	Did you understand what causes extreme climates?		
5.	Do you know the short-term and long-term impacts of extreme climates?		
6	Did you understand how people cope-up with poverty traps caused by extreme climates?		
7	Can you identify the direct and indirect impacts of extreme climates?		
8	Can you tell how many percent of the households faced severe crop damage and how many percent of them lost their livestock by the 2007 flood in the Itang District of Gambella?		
9	Tropical areas are the climate change 'hot spots in the world		
10	Did you know the regions in which the largest proportion of the world's population lived with ‹1.25 USD per day from 2010-2012?		

Self-test Exercise 1.2

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

Part I) True/False

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

1. Temperature and precipitation changes and extreme climatic events have been taking place over wider arid and semi-arid areas of the Earth.
2. Extreme climates never cause plagues, pathogens, insect attacks, and parasitic weeds.
3. Flooding events devastate people's properties but never disrupt the informal social networks of people in the affected areas.
4. Poor nomadic pastoralists could fall into lingering poverty when livestock feed supplies diminish due to climate extremes.
5. During poverty traps, people lack the necessary resources to escape from the shocks.

Part II) Multiple Choices

Instruction: For questions 6-10, choose the best answer from the given alternatives (5 points)

6. Which of the following community groups are most affected by extreme climates and persistent poverty traps?

    A) Households led by females, people living in slums, and children

    B) Industrialists, scientists, merchants, herders, and religious people

    C) Government officials and landlords living in affluent rural areas

    D) Journalists, pastoralists, and wealthy people living in urban areas

7. Which of the following is a long-term impact of climate change-induced poverty?

    A) Loss of income and earnings   C) Loss of fertile and useful land

    B) Limited access to healthcare   D) Loss of labor through injury

8. Which of the following is an indirect impact of climate change-induced poverty?

    A) Reduction of exports and increased imports

    B) Lower education and healthcare attainment

    C) Abandoning schooling and healthcare plans

    D) Reduced future resilience & coping capacity

9. In which of the following areas the highest level of extreme poverty prevails?

    A) Western Europe and Australia   C) North America and South America

    B) SSA, South and Southeast Asia   D) Eastern Europe and Central America

10. Which part of the world region is characterized as a climatic hotspot area?

    A) The Polar Frigid Zone   C) The Arctic Circle

    B) The Temperate Zone   D) The Tropical Zone

Part III) Short Answer Writing

Instruction: Give short answers to questions 11-13 (10 points)

11. Ho do poverty traps occur? (2 points)

12. How do climatic extremes intensify community, household, and individual poverty levels? (4 points).

13. What derives community or household exposure to climatic hazards and poverty risks? (4 points)

Answer Key to Self-test Exercise 5.2

Dear learner; I hope you did well in the self-testing. So now, you are at the stage of completion of the second section of module five. Thank you also for doing the self-test questions. Now, please compare your answers with the feedback given and make corrections if there are errors in your answers.

Part I) True/False		Part II) Multiple Choices	
1	True	6	A
2	False	7	C
3	False	8	A
4	True	9	B
5	True	10	D

Part III) Short Answer Writing	
11	Poverty traps occur when extreme climates push poor people to be poorer and poorer
12	Dear learner; climate extremes intensify community, household, and individual levels of poverty through injuring infrastructure, distorting employment opportunities, and violating food security, health, education, and housing services.
13	Exposure to climate hazards (extremes) and poverty levels are commonly derived from growing populations, urbanization (where immigrants reside in marginal hazard-prone areas), settling in coastal and floodplain areas, and the destruction and losses of natural ecosystems.

Dear learner; how did you find the lesson? We think you enjoyed it and found it very interesting and exciting. We 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
DISADVANTAGES OF LANDLOCKED COUNTRIES
(3 Hours)

Section Overview

Dear learner; do you remember how location affects economic development under the topic 'effect of geographic location on development'? Similarly, interactions between extreme climates and poverty levels; flooding events, and poverty conditions as well as extreme climates and poverty traps were deliberated under section two. In the current section, you are going to learn about the drawbacks faced by landlocked countries in their foreign trade endeavors and overall economic development activities. Landlocked countries have no direct access to the sea for their export-import trade. They are therefore forced to pay money to get access to seaports. In addition, their commercial activities face frequent delays and interruptions. You are thus required to search and find out more about the challenges and disadvantages of landlocked countries like Ethiopia.

Section Learning Outcomes

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

- describe the characteristic features of landlocked countries,
- evaluate the drawbacks faced by landlocked countries in their economic development.

Keywords:

- Disadvantages;
- Landlocked countries;
- Sea access;
- Political disadvantages;
- Transportation disadvantages.

5.3.1 Characteristics of Landlocked Countries

1. What are landlocked countries (LLCs)? What are their distinguishing characteristics?
2. How LLCs retained geographically disadvantaged locations?
3. How the end of First World War and colonization and the collapse of the United Soviet Socialist Republics (USSR) influenced the formation of LLCs? 4. Why most of the LLCs in Africa retained colonial drawn borders?

Dear learner; please think over the preceding questions and try to link your ideas with the ongoing notes. LLCs are those that do not possess any seacoast. Some of these nations may have coastlines, but these are only on closed waters. Rivers might run through a portion of the region, and there can be bodies of water within the country's borders. But every border is land-based, rather than water like an ocean shore.

Landlocked states are geographically dispersed across all continents. They occupy the mid-regions of continents and constitute about one-fifth of the world's nations. They fall under the category of geographically disadvantaged nations. They were formed following three historical events: at the end of the First World War; following the end of colonization; and the collapse and splitting of the former Soviet Union (USSR). In the case of African landlocked countries (Figure 1.12), colonization resulted in the drawing of borders and then making some areas completely enclosed by other states. Most of the African states have retained these colonial borderlines.

Of all the countries in the world, 49 are landlocked (see some from Figure 1.12). This number is equivalent to one-fifth (20%) of all countries in the world. They are also among the most disadvantaged and underachieving countries in the world. They are generally divorced from the benefits received from locating along the sea coast.

> **?** Why are landlocked countries commonly considered geographically disadvantaged?

Figure 5.14 Distribution of landlocked countries in the world

> **?** Dear learner; please study the landlocked countries from Figure 5.14 and think which continents have many landlocked countries? Try to relate your finding with your background knowledge?

5.3.2 Disadvantages of landlocked countries

Dear learner; focus and critically examine the effect of lacking sea outlet on the development prospect of countries like those in Africa. Based on this view, attempt the questions given below and read the succeeding notes.

Activity 5. 1.5

1. Why do landlocked countries face a disadvantage in their economic growth? Dear learner; please critically think on the question and try to link your thoughts with the notes provided in the succeeding paragraphs.

Dear learner; when the low economic and social performance of landlocked countries is compared with countries having direct access to sea coasts, the condition indicates the prevalence of strong bondage between geography and development. Lack of direct access to the sea; isolation from major economic centers; inadequate conveyance setups; and clumsy transit practices together impede the ability of landlocked states to grow effectually.

(?)

1. What are the main disadvantages encountered by landlocked countries?
2. Are there advantages benefiting landlocked countries? If yes, what are the benefits?

Dear learner; please think over the given questions and try to relate your thinking with the ongoing notes.

i) Lack of direct access to the sea

Landlocked countries lie far from seaports and lack direct access to the sea. They incur higher transport costs during their participation in foreign trade. The cost of international transport services is a crucial determinant of a country's trade competitiveness. Higher trade costs reduce a country's welfare and inhibit economic growth by making imports expensive and exports non-competitive. Landlocked countries, therefore, suffer noticeable drawbacks when competing in global markets against coastal areas. It has been estimated that doubling transport costs reduces a country's trade volume by around 80%.

(?)

1. In what respect the World Trade Organization (WTO) benefiting Landlocked Developing Countries (LLDCs)?
2. How excessive transport costs deter the trade of LLDCs?

Virtually, many Landlocked Developing Countries (LLDCs) are benefiting from the World Trade Organization (WTO) initiatives in their worldwide trade. They are provided with relatively better market access for goods and enjoy partial tariff lifts from More Developed Countries (MDCs). Tariffs imposed on goods originating from LLDCs by Canada, the European Union (EU), Japan, and the United States of America (USA) currently range from 3-7%. Sadly, the LLDCs pay on average more than three times the tariff reductions for conveyance costs. For example, 168 of 216 USA trading allies fall victim to higher transport costs than the tariff barriers. Exports from SSA to the USA enjoy nearly 2% tariff reductions. But, this counterbalances the transport cost that exceeds 10%.

Excessive transport costs also impede the trade in services, mainly the export of tourism services. Doubling travel costs reduces the demand for tourism as high as eightfold. As ›90% of the tourists visit DCs by air, competent air transport facilities are required for the attainment of tourism exports. In practical situations, air transport in Eastern and Southern Africa is found 10 times more costly than in the USA. Such mobile costs strongly limit the opportunity for benefits from tourism in those regions. This implies that countries lacking free-port access suffer more in their foreign trade activities.

(?) Dear learner; how do you evaluate the impact of being landlocked on development based on your observation and past experience? Reflect on this before proceeding to the next content.

ii) Transportation and transit-related disadvantages

Landlocked countries are entirely dependent on their transit neighbors' infrastructure for access to an international market. Where a landlocked country only has access to routes of poor quality, the cost of overland trade is significantly higher than it would otherwise be. Hence, the cost of trade in a landlocked country is heavily determined by the infrastructure levels, and, indirectly, by the level of development of its transit neighbors.

(?)
1. Which African LLDCs are facing severe transit barriers? Explain why the countries face transit challenges?
2. Is your country, Ethiopia, facing such a challenge? Justify your answer with tangible reasons?

Challenges of poor transit neighbor substructures are mainly severe in western and central Africa. For instance, although boasting of having better domestic road connections, Burundi is severely affected by the poor contiguous transit network of its neighbors. The short direct passage to the sea from Burundi is the so-called Central Corridor over Tanzania (Dar es Salaam). Nevertheless, the transit setup over this route is too poor.

Similarly, many of the Western African LLDCs have poor transit neighbor network problems. The derelict transport network corridor in the area shrinks the benefits expected from foreign direct investment (FDI). The best example here is the CAR. This country has no reliable all-weather road network to the sea. Its transit through Cameroon is impenetrable during the rainy season. Its transit corridor over the Oubangui River of the Democratic Republic of Congo (DRC) is also closed in the dry season due to diminished water flow and security reasons.

The least affected areas in this regard are the LLDCs of East Asia and South America. LLDCs in the mentioned regions relatively possess well-developed transport infrastructure. For instance, Thailand has a well-developed transport network in South Asia. Bolivia in South America has also a reasonable achievement in 'bypassing its neighbors' transit network' by making its central geographic location to be the South American fiber optics center. This recommends that LLDCs have the potential to develop activities that do not heavily rely on road-network infrastructure. Information communication technology (ICT) and telecommunication advancements appear to expand such occasions for the LLDCs.

To transit a country, there are hosts of transit and customs charges. Some of these must be paid upfront and some must be paid during traveling. In many cases, these charges must be paid in hard currency, where options are missing to convert local currency to hard currency. Sometimes agency fees at ports for transit freight may exceed that of domestic freight. Because local freight fees are more difficult to clear at ports than over the transit exits. The transit and custom charges include transit goods licenses, border fees, temporary road licenses, foreign vehicle permits, toll charges, foreign commercial licenses, cost of customs verification of containers, posting of security bonds, involvement with police and escort convoys, and cancellation of bonds.

? 1. Why the LLDCs of East Asia and Latin America least affected by the neighbor transit structures?

2. How regional organizations like the Southern African Development Community (SADC) and Common Market for Eastern and Southern Africa (COMESA) support their member states in their foreign trade?

Currently, there are some successful efforts and strategies in certain areas to ease procedures and lessen administrative charges. For instance, common warrants have been announced in the Southern African Development Community (SADC) and Common Market for Eastern and Southern Africa (COMESA) allowing road freight travel within member countries with no local permits or licenses. Another good example is the Bhutanese transit trade in South Asia. The transit of the Bhutanese trade is handled by its customs and never touched by Indian officials. The administrative burden for this country's trade appears as it is not landlocked. This is the result of the country's strong relations with India and its very small transit trade. This is an exceptional advantage that Bhutan is enjoying. In the former USSR, passage through the adjacent states of Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan was somewhat free of administrative challenges. A 72-hour pass was issued during the dawn of the 1990s to let transit across states with not having a visa but was no longer implemented due to waning international relations. Nevertheless, these types of governmental simplifications are not global. For instance in Central Asia, administrative influences on transit are growing.

iii) Political disadvantages

Political issues are also major challenges for the development of landlocked countries next to transportation. The deficiency of negotiating capacity with transit neighbors is one challenge faced by landlocked countries. The lack of access rights during conflict times from transit neighbors seriously affects the mentioned states. Civil conflicts within the countries themselves sometimes cause difficulties even if countries have good relations with those of the transit neighbors. During such conditions, trade routes may be cut due to border closures. The LLDCs often possess petite negotiating power over their transit neighbors.

? Dear student, the following questions are expected to urge you to think from different angles about key issues. So, please critically examine and address in advance.

1. What political disadvantages do LLDCs face in their foreign trade?
2. How political relations affect the trade of LLDCs? 3. Does conflict and political instability influence the trade among transit nations? Can you give examples from Africa?

Political relations strongly impact trade and commodity flows in LLDCs. For example, Bolivia has severe transit limitations in Chile for the two countries have weak political relations that lasted for more than 100 years. Armenia is presently blocked by ethnic Armenians and Turkey with the seizure of Kelbadiar (Azerbaijan) by forces from Armenian ethnic groups. Conflicts between Ethiopia and Eritrea have denied Ethiopia's use of the port of Assab and Massawa after 1997. Ethiopia now uses the port of Djibouti for its transit trade.

However, the route never satisfies Ethiopia's wide demand for the transport network is poorly developed. Alternative routes through Kenya, Sudan, and Somalia are characterized by poorly developed transport networks.

Political instability and conflict among the transit nations in Africa have been frequently obstructing their international trade. For instance, civil conflicts have greatly impacted the foreign trade of LLDCs in Africa. Just to mention a few cases:

◈ Togo: protests and internal conflicts in the 1990s;

◈ Algeria: the decade lasted macabre civil war;

◈ Ghana: ethnic violence 1993- 1994;

◈ Sierra Leone: the 10 Years of civil war;

◈ Guinea: coups and rebel wars;

◈ Liberia: a decade of violent civil wars;

◈ Cote d'Ivoire: recent political crisis;

◈ Mozambique: civil wars.

The mentioned political instabilities and administrative barriers strongly hindered the foreign trade of LLDCs in Africa. These all cause transit delays and route blockades. For instance, mean transit delays during border crossings all-over Africa range from 24-48 hours. In some areas, it can take even weeks. The mean trip from Kampala to Mombasa for instance takes about 21 days. Sometimes, the trip may take 60 days. Note that similar delays take place in other transit and port areas of Africa.

Generally, landlocked countries face dependence based on the infrastructure levels of the transit nations. Fees and direct costs due to administrative burdens and time delays in export trades are also part of the challenges faced by LLDCs.

Activity 5.1.6

1. How do you describe and explain the geographical challenge of landlocked countries?

2. How do you see the place of Ethiopia in light of such challenges?

Feedback to Activity Questions

Feedback to Activity 5.1.5

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

Why do landlocked countries face a disadvantage in their economic growth?

Landlocked countries face drawbacks in their economic development because they:

◈ lack direct access to the sea,

◈ pay much money for their import and exporting trade (affect their foreign earnings),

◈ get the low geopolitical significance,

◈ transportation challenges,

◈ exposed to conflicts and wars, and

◈ delayed exchange of goods and services, etc.

Section Summary

Landlocked countries are those that do not possess any seacoast. They lie far from seaports and lack direct access to the sea and are geographically dispersed across all continents. They occupy the mid-regions of continents and constitute about one-fifth of the world's nations. They were formed following three historical events: at the end of the First World War; following the end of colonization; and the collapse and splitting of the former Soviet Union (USSR).

Dear learner; LLC countries have no direct access to the sea for their export-import trade. They are entirely dependent on their transit neighbors' infrastructure for access to an international market. Due to this, they are forced to pay money to get access to seaports and incur higher transport costs during their participation in foreign trades. The excessive transport costs impede the trade in services, mainly the export of tourism services in these countries. The commercial activities of such countries face frequent delays and interruptions. They are; therefore, categorized as geographically disadvantaged countries.

Political instabilities and administrative barriers also strongly hinder the foreign trade of LLDCs. Conflicts and political turmoil cause transit delays and route blockades. Lack of direct access to the sea; isolation from major economic centers; inadequate conveyance setups; and clumsy transit practices together impede the ability of landlocked states to grow effectually. Generally, landlocked countries face dependence based on the infrastructure levels of the transit nations. Fees and direct costs due to administrative burdens and time delays in export trades are also part of the challenges faced by LLDCs.

Checklist 5.3

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

№	Questions	Yes	No
1	Did you understand the distinguishing characteristics of LLCs?		
2	Did you understand why and how LLCs retained geographically disadvantaged locations?		
3	Do you know why most of the LLCs in Africa retained colonial-drawn borders?		
4	Do you know the main disadvantages encountered by landlocked countries?		
5.	Are there advantages benefiting landlocked countries?		
6	Lack of direct access to the sea; isolation from major economic centers; inadequate conveyance setups; and clumsy transit practices together impede the ability of landlocked states to grow effectually.		
7	Do you know which African LLDCs are facing severe transit barriers?		
8	Is your country, Ethiopia, facing a severe transit challenge?		
9	Does conflict & political instability influence trade among transit nations?		
10	LLCs occupy the mid-regions of continents and constitute about one-fifth of the world's nations.		

Self-test Exercise 5.3

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

Part I) True/False

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

1. Some of the LLCs may have coastlines, but those are only on closed waters.
2. LLCs occupy the mid-regions of continents and constitute about one-fifth of the world's nations.
3. Landlocked countries are entirely dependent on their transit infrastructure for access to an international market.
4. Most of the African countries have borderlines drawn by their colonizers.
5. Ethiopia currently uses the ports of Assab and Massawa for its foreign trade

Part II) Multiple Choices

Instruction: For questions 6-10, choose the best answer from the given alternatives (5 points)

6. Which of the following is Not True about landlocked Countries?

   A) They have no direct access to the sea for their export-import trade

   B) They are forced to pay money to get access to the seaports

   C) Their commercial activities face frequent delays and interruptions

   D) They freely pass along the structure of their nearby transit neighbors

7. LLCs pay transit and customs charges in their international trade. So, what are the transit and custom charges paid by the LLCs?

   A) Transit good licenses, border fees, temporary road licenses, foreign vehicle permits

   B) Toll charges, foreign commercial licenses, cost of customs verification of containers

   C) Posting security bonds, involvement with police, escort convoys, cancellation bonds

   D) Residence costs, employment charges, health service charges, and education license

8. Which of the following groups of countries have no direct access to the Sea?

   A) Ethiopia, South Sudan, Bhutan, Bolivia, Kazakhstan, Lesotho, and Zambia

   B) USA, India, South Korea, Brazil, South Africa (RSA), China, Russia, Chile

   C) Argentina, Sudan, Mexico, Ghana, UK, France, Turkey, Canada, Australia

   D) Chile, Kenya, Algeria, Germany, Italy, New Zealand, North Korea, Japan,

9. Which of the following regional organizations assist the foreign trade activity of LLCs in Africa?

   A) Landcare and IJC   C) SADC and COMESA

   B) NATO and SEATO   D) OECS and CEC

10. Which of the following is correct?

   A) Many of the Western African LLDCs have good transit neighbor networks

   B) Bolivia makes the fiber optics geographic center location in South America

   C) Thailand faces poor and less developed transport network in South Asia

   D) The transit trade of Bhutan is handled and controlled by Indian officials

Part III) Short Answer Writing

Instruction: Give short answers to questions 11-12 (10 points)

11. Most of the LLCs in the world were formed following three historical events. Then what are those historical events?

12. Enumerate the disadvantages of LLCs?

Answer Key to Self-test Exercise 1.3

Dear learner; we hope you did well in the self-testing. You are now at the stage of completion of the third section of unit two. Now, please compare your answers with the feedback given and make corrections if there are errors in your answers.

Part I) True/False		Part II) Multiple Choices	
1	True	6	D
2	True	7	D
3	False	8	A
4	True	9	C
5	False	10	B

	Part III) Short Answer Writing
11	Most of the LLCs of the world were formed following three historical events. Those historical events were: ● the end of the First World War; ● the end of colonization; and ● the collapse and splitting of the former Soviet Union (USSR).
12	The disadvantages of LLCs include: ● Lack of direct access to the sea; ● Transportation and transit-related disadvantages; and ● Political disadvantages.

Dear learner; how did you find the lesson? We think you enjoyed it and found it very interesting and exciting. We 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 FOUR
INTRA-REGIONAL TRADE IN AFRICA
(3 Hours)

⚙ Section Overview

Dear learner; in the foregoing section, you studied the disadvantages of landlocked countries. In this section, you are going to learn about the inter-regional trade of African countries. Hence, please try to integrate your understanding of section three into the current information.

In Africa, population growth coupled with higher income and urbanization has derived growing demand for local food markets. The speedy rising demand progression has also created new opportunities and challenges. The opportunities initiated intraregional trade expansion while the challenges pose food security constraints at country levels. Present-day Africa's world trade is dominated by imports of processed food products while the export of untreated nonfood products. This pattern is so common in many countries of the continent. It is so pertinent to investigate whether the current supply capabilities can meet emerging needs.

Section Learning Outcomes

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

- 🌍 describe the trade flow trends within Africa,
- 🌍 identify top exporters and importers of the intra-African trade,
- 🌍 appreciate the commodity composition of trade flows within Africa, and
- 🌍 evaluate the intra-African trade policies and the challenges of integration.

Keywords:

- ■ Intra-Regional trade;
- ■ Commodity;
- ■ Exports;
- ■ Imports;
- ■ Trade flows;
- ■ Trade policies;
- ■ Trade challenges.

Activity 5.1.7

1. What is intra-Regional trade? Explain using examples?
2. Name what types of products African countries exchange in their foreign trade?
3. Are there regional organizations established to assist the intra-regional trade between African countries? If yes provide an example?

Dear student; thoughtfully address the guiding questions posed above and get prepared for the section lesson details

5.4.1. Trade Flow Trends within Africa

Dear learner; intra-regional trade is trade between countries of the same region (economic zone) or the same geographic area. The trade between the countries primarily focuses on the economic exchange of goods and services. The growth of intra-regional trade helped countries and regions become increasingly integrated economically as well as socially. Africa is a continent with many countries hosting millions of people with the potential for purchasing power.

> **(?)**
> 1. What are African major agricultural exports?
> 2. What are shares of the intra-regional trade of the regional economic organizations? Dear learner; please read the succeeding notes and try to comprehend the information.

Dear learner; what ideas did you raise pertinent to the questions, compare to the lesson note and refine your understanding. Africa's agricultural exports (Figure 5.15) have increased since the year 2000 in the form of intra-African agricultural trade although participation in world trade has remained low. In the continent, eight Regional Economic Communities (RECs) have established preferential tariff agreements; free trade zones, or customs unions among some neighboring member nations. The RECs include the: Arab Maghreb Union (AMU), Common Market for Eastern and Southern Africa (COMESA), Economic Community of West African States (ECOWAS), and Southern African Development Community (SADC). The mentioned RECs comprise 5, 19, 15, and 16 member states, respectively.
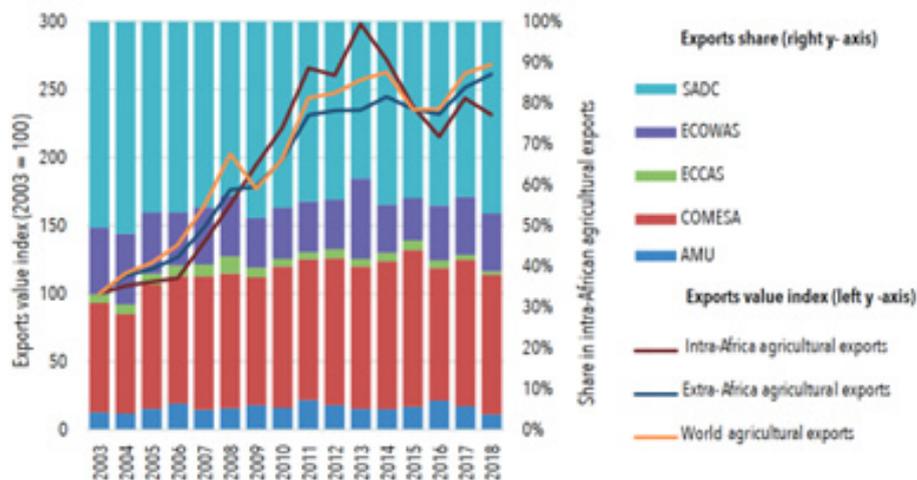
Figure 5.15 Intra-African agricultural exports by region of origin, 2003–2018 (Cissé et al., 2020)

The value (in USD) of intra-African food and agricultural trade rose steadily beginning roughly in 2007, peaking in 2013 with a significant decline until resuming a general upward trend in 2016 (see Figure 5.15). The intra-continental exports grew faster annually than extra-continental exports and global exports did from 2008 to 2015 whilst the reverse holds during the subsequent years. When compared to other RECs, the Economic Community of Central African States (ECCAS) ships the largest share of its intra-African exports outside of the region. On average, only 46% of ECCAS' intra-continental trade remained within the REC in 2016–2018, which is a significantly lower share than in 2005–2007 (58%). However; ECCAS' total exports are very small compared to the other RECs.

? Dear learner; could you please identify the top exporters and importers of Africa?

Larger exporters, SADC and COMESA, retained 84% and 66%, respectively, of their intra-African exports within their respective regions during 2016−2018. ECOWAS and AMU also retained 79% and 60% of their intra-African exports within their respective areas, respectively.

ECOWAS experienced the most notable intra-REC export trade spike in 2013; while other RECs underwent a more gradual increase and decline. Only SADC has demonstrated an obvious increase in exports since 2016. In a nutshell, intra-continental agricultural exports have grown steadily over the past two decades, largely by SADC and COMESA member countries.

4.2. Top Exporters and Importers

In the intra-African trade, roughly 70% of the formal market was accounted for by ten top exporters during (2016−2018 and 2005−2007). Agricultural imports were more widely dispersed, with top importing countries accounting for only half of the formal trade. Across the two time periods (2016−2018 and 2005−2007), South Africa remained the dominant market player. This country was exporting nearly a third of all intra-African formal exports and importing roughly a tenth of all agricultural goods. South Africa's exports increased over time, while its import share fell. The other top exporters include Egypt, Uganda, Kenya, and Tanzania whose shares increased over time.

? Dear learner; by reading the succeeding notes and Table 1.2 below:
1. Identify the ten top exporters of Africa during 2005-2007 and 2016-2018?
2. List-down the name of 10 African countries with the highest share of exports during 2005-2007 and 2016-2018?

Côte d'Ivoire, Zambia, Namibia, Tunisia, and Ethiopia were countries whose shares of the overall intra-African exports declined between the two time periods. In addition to South Africa, top importers were Kenya, Egypt, Zimbabwe, Mozambique, and the DRC which all increased their shares in the import market. Namibia, Botswana, Libya, and Nigeria were countries that decreased their shares. Table 5.2 presents the top 10 intra-African exporters and importers of agricultural products, in ascending order of their ranks (2016−2018 and 2005−2007). The top 10 intra-African exporters account for roughly 70% of the formal market.

Of ECOWAS countries, Côte d'Ivoire is the sole top intra-African exporter, and Nigeria is the sole top importer. South Africa, Kenya, Namibia, and Egypt are all top exporters and are also among the largest importers accounting for 25% of intra-continental agricultural imports. Egypt ranked the fourth largest importer from 2016 to 2018.

Table 5.2 Top intra-African exporters and importers of agricultural products (2005-2007 & 2016-2018)

Countries	2005-2007		2016-2018		2005-2007		2016-2018	
	Export share %	Rank	Export share %	Rank	Import share %	Rank	Import share %	Rank
South Africa	29.8	1	32.2	1	11.5	1	8.3	1
Botswana	-	-	-	-	6.9	2	5.3	5
Egypt	5.6	4	8.7	2	2	10	5.4	4
Uganda	3.6	8	6.4	3	-	-	-	-
Kenya	5.3	5	6.2	4	4.3	5	6.7	2
Cote d Ivoire	6.3	3	4.6	5	-	-	-	-
Zimbabwe					4.2	6	4.8	6
Zambia	4.1	7	3.8	6	-	-	-	-
Tanzania	2.2	10	3.1	7	-	-	-	-
Namibia	6.5	2	2.8	8	6.7	3	5.7	3
Tunisia	4.4	6	2.6	9	-	-	-	-
Ethiopia	2.8	9	0.5	10	-	-	-	-
Mozam-bique	-	-	-	-	2.6	9	4.3	7
DRC	-	-	-	-	3.3	7	3.6	9
Nigeria	-	-	-	-	2.6	8	2.3	10
Libya	-	-	-	-	4.6	4	3.6	8
Total	70.6		71		48.7		50.2	

Eastern and Southern African and Maghreb countries lead intra-African agricultural trade. Apart from Côte d'Ivoire as a large exporter and Nigeria as a large importer, other western and central African countries play only a small role compared to major players from the other regions that control 71% and 50% of the agricultural export and import flows, respectively.

In terms of trading partners, Ethiopia's top 10 import sources account for 99% of its intra-African imports. The top 10 export destinations account for 98% of Ethiopia's intra-African exports. The top import sources include Morocco, South Africa, and Egypt, while top export destinations include Somalia; Djibouti; and Kenya.

Dear student; do not overlook taking time and evaluating your learning progress and comprehension level at intervals throughout the modules.

1. Dear learner; could you please identify the major trade partners of Ethiopia based on what you read above and by referring Table 5.2?
2. How you explain the commodity composition of Africanexports and imports?

Africa's intra-continental agricultural trade is more diversified than the intraregional trade of South Asia which is relatively less diversified than the intra-European trade. Among the top 20 products exported within Africa, only 6 (maize, wheat, rice, cattle, apples, and vegetables) play key food security and nutritional role for African consumers. The remaining products include sweeteners and fats, beverages, processed foods, and traditional exports such as tea, coffee, palm oil, cotton, and tobacco products.

5.4.3 Intra-African Trade Policies and Challenges of Integration

Dear learner; fostering the intra-African trade needs the adoption of and application of coherent and efficient trade policies at national, regional, and even local levels. Though intra-regional trade policies constitute basic elements of integration of most of Africa's RECs, the application of the relevant trade procedures hardly addresses the priority essentials for the attainment of market integration. Substantial variations still occur in the trade systems within and between the RECs. Improving intra-African trade needs designing policies addressing the needs and benefits of African countries. The problem partially emanates from the discrepancy arising between high political ambition and severe local economic realities. Dear learner; detailed specific challenges confronting intra-African trade performances are discussed in the succeeding paragraphs.

Tariff and non-tariff barriers are the main challenges that hinder formal intra-Africa trade (see for example the informal currency exchange case in Ethiopia). In many cases, non-tariffs are more trade-restrictive than tariffs. The intraregional traders still face high tariffs although significant progress in efforts to promote regional integration has reduced tariff protections. Tapping into Africa's regional trade potential will require coordination between regions. Yet, the said regional coordination requires strong production and processing potential and careful consideration of nutrition-sensitive consumer demands. Both tariffs and non-tariff measures (NTMs) can incentivize transshipment and smuggling, or heighten the risk for businesses working to build streamlined, secure, and transparent supply chains.

Dear learner; please read the ongoing notes on Intra-African trade challenges and try to integrate the challenges with policy constraints discussed above. From your reading:
1. Identify the tariff and nontariff related barriers?
2. Ascertain administrative and regional coordination challenges?

Administrative barriers cause undue time delays that are unworkable for certain agricultural products, notably those that may deteriorate without cold storage and transport. Delays, costs, and administrative burdens discourage private investment in regional supply chains of sensitive agricultural products. They may partly explain also the high reliance on the informal trade of fruits, vegetables, and other time-sensitive goods. If these barriers are removed, time-sensitive agricultural foods (agri-foods) may offer good opportunities to enhance regional trade through the agri-food value chains.

> ❓ Dear learner; please read the following case study from Ethiopia and answer the following questions:
>
> 1. What is the main trade problem touched in the paper?
> 2. How do you explain the Delalas and the Black Market in relation to local realities in present day Ethiopia?
> 3. Is Birr devaluation really a problem? Explain using tangible evidences?
> 4. How you imagine the falling value of the Ethiopian Birr?
> 5. How you evaluate also the price of exports and imports?

Improving regional agri-food value chains will require due investment in road, transport, and information systems infrastructure. Improving linkages between production and agro-processing areas, and/or between groups of smaller producers and cross-border markets, can open new opportunities for regional value chains. But this applies particularly if infrastructure investment targets key corridor routes and provides relevant market information for priority regional value chains.

CASE STUDY III

Informal currency exchange in informal trade in East Africa

In Ethiopia, once prices are agreed upon in the relevant currencies, they are automatically converted into Birr at prevailing black market rates. Both buyers and sellers, including the delalas (brokers), carry small calculators for such purposes. At the time of this study, the value of Birr in the black market was less than the official exchange rate. For instance, the official exchange is Birr 1 = Ksh 13, while the black-market rate is Birr 1= Ksh 5−6. Similarly, the black-market exchange rates for the Djibouti franc fluctuated around 30 percent of the official rate. All key informants (operators and local administrators) complain that the value, or purchasing power, of Birr, is falling. The economic implication is that terms of trade are unfavorable to Ethiopia; export values are substantially lower than the value of imports. This situation is consistent with current trade balances—a large deficit in the trade balance and a shortage in foreign currencies—in formal foreign trade at the national level in Ethiopia.

Ksh refers to Kenyan shillings

Taken from ECA (2010)

Activity 5.1.8

1. What do you think are the major challenges of intra-African trade?
2. How do you explain the informal currency exchange practices such as reported in case study III?
3. Do you observe informal transactions in your village? Please discuss this with your classmates.

Feedback to Activity Questions

Feedback to Activity 5.1.7

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

1. 1. What is intra-Regional trade? Explain using examples. Dear learner; intra-regional trade is trade between countries of the same region (economic zone) or same geographic area primarily focusing on economic exchange of goods and services. For instance trade between African countries or between countries of Sub-Saharan Africa.

2. Name what types of products African countries exchange in their foreign trade? African countries commonly exchange non-processed exports (live animals, crops, cotton, oil seeds, skins and hides, food products, beverages, etc.).

3. Are there regional organizations established to assist the intra-regional trade between African countries? If yes provide an example.

Yes, eight Regional Economic Communities (RECs) related to preferential tariff agreements; free trade zones, or customs unions have been established. Some of the RECs are the: Arab Maghreb Union (AMU), Common Market for Eastern and Southern Africa (COMESA), Economic Community of West African States (ECOWAS), and Southern African Development Community (SADC).

Feedback to Activity 5.1.8

1. What do you think are the major challenges of intra-African trade?

The major challenges of intra-African trade include the following:

- ◈ transit-related challenges;
- ◈ political challenges;
- ◈ transportation challenges;
- ◈ custom, tariff, and currency exchange challenges;
- ◈ conflict and security-related challenges; and
- ◈ exchange of non-processed agricultural products to manufactured goods including heavy engineering machinery and chemicals; etc.

2. How do you explain the informal currency exchange practices such as those reported in case study III?

Informal currency exchange in Africa is a widespread practice in many countries which is affecting the formal trade in the region.

3. Do you observe informal transactions in your village?

Informal transactions in Ethiopia are very common like in other parts of Africa. Try to hear from the students for they might have detailed specific examples.

Section Summary

Dear learner; intra-regional trade is trade between countries of the same region (economic zone) or the same geographic area. The trade between the countries primarily focuses on the economic exchange of goods and services. The growth of intra-regional trade helped countries and regions become increasingly integrated economically as well as socially. Africa is a continent with many countries hosting millions of people with the potential for purchasing power.

Fostering intra-African trade needs the adoption and implementation of coherent and efficient trade policies at national, regional, and even local levels. Though intra-regional trade policies constitute basic elements of integration of most of Africa's RECs, the application of the relevant trade procedures hardly addresses the priority essentials for the attainment of market integration. Substantial variations still occur in the trade systems within and between the RECs. Improving intra-African trade needs designing policies that achieve the needs and benefits of African countries. The problem partially emanates from the discrepancy arising between high political ambition and severe local economic realities.

In the intra-African trade, roughly 70% of the formal market was accounted for by ten top exporters during (2016−2018 and 2005−2007). Agricultural imports were more widely dispersed, with top importing countries accounting for only half of the formal trade. Across the two time periods (2016−2018 and 2005−2007), South Africa remained the dominant market player. This country was exporting nearly a third of all intra-African formal exports and importing roughly a tenth of all agricultural goods. South Africa's exports increased over time, while its import share fell. The other top exporters include Egypt, Uganda, Kenya, and Tanzania whose shares increased over time.

Tariff and non-tariff barriers, lack of strong regional coordination, administrative barriers, the dominance of agricultural exports, poor transportation, and transit infrastructure, and political instability are the main challenges to African intra-regional trade. Present-day Africa's world trade is dominated by imports of processed food products while the export of untreated nonfood products. This pattern is so common among many countries of the continent.

Checklist 5.3

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

№	Questions	Yes	No
1	Do you know Africa's major agricultural exports?		
2	Can you identify the ten top exporters and importers of Africa?		
3	Can you list down the name of 10 African countries with the highest share of exports during 2005-2007 and 2016-2018?		
4	In terms of trading partners, Ethiopia's top 10 import sources account for 99% of its intra-African imports.		
5.	The top 10 export destinations account for 98% of Ethiopia's intra-African exports.		

№	Questions	Yes	No
6	The top import sources of Ethiopia include Morocco, South Africa, and Egypt, while top export destinations include Somalia; Djibouti; and Kenya.		
7	Among the top 20 products exported within Africa, only 6 (maize, wheat, rice, cattle, apples, and vegetables) play key food security and nutritional role for African consumers.		
8	Did you understand the Intra-African trade policies and challenges of integration?		
9	Fostering intra-African trade needs the adoption of and application of coherent and efficient trade policies at national, regional, and even local levels.		
10	Is Birr devaluation a problem in Ethiopian trade?		

Self-test Exercise 5.4

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

Part I) Multiple Choices

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

1. Which of the following REC groups ships its largest share of its intra-African exports outside of the region?

    A)   ECCAS   B) ECOWAS   C) COMESA   D) SADC

2. Which of the following African countries were the top three exporters in intra-African trade during 2016–2018?

    A) South Africa, Namibia, and Cote d Ivoire   C) South Africa, Kenya, and Namibia

    B) South Africa, Egypt, and Uganda   D) South Africa, Botswana, and Namibia

3. Which of the following countries were the three top importers in intra-African trade during 2016-2018?

    A) South Africa, Namibia, and Cote d Ivoire   C) South Africa, Kenya, and Namibia

    B) South Africa, Egypt, and Uganda   D) South Africa, Botswana, and Namibia

4. Which of the following countries are the top import sources of Ethiopia?

    A)   Sudan, Eritrea, and Djibouti   C) South Africa, Tanzania, and Kenya

    B)   Uganda, South Sudan, and Djibouti   D) Morocco, South Africa, Egypt,

5. Which of the following countries are the top export destinations of Ethiopia?

    A) Somalia; Djibouti and Kenya   C) Morocco, South Africa, and Egypt

    B) South Africa, Egypt, and Uganda   D) South Africa, Egypt, and Uganda

Part II) Short Answer Writing

Instruction: Give short answers to questions 6-7 (10 points)

6. In the ECOWAS region, _____ and _____ sole top intra-African exporting and importing countries, respectively (2 points).

7. Write the names of four top exporting and importing countries in all of the intra-African trade? (8 points)

Answer Key to Self-test Exercise 5.4

Dear learner; we hope you did well in the self-testing. You are now at the stage of completion of the 4th section of module five. Now, please compare your answers with the feedback given and make corrections if there are errors in your answers.

Part I) Multiple Choices

    1.A

    2.B

    3.C

    4.D

    5.A

Part II) Short Answer Writing

6. In the ECOWAS region, Côte d'Ivoire and Nigeria are the sole top intra-African exporting and importing countries, respectively.

7. The four top exporting and importing countries in all of the intra-African trade are:

    ◈   South Africa;

    ◈   Kenya;

    ◈   Namibia; and

> **?** Dear learner; could you please analyse and integrate the concepts and ideas presented per section throughout the module in your study? This will help you internalize and validate the information you got from the whole reading.

UNIT SUMMARY

Geography is one of the most important factors in socioeconomic development. Geographic location influences socioeconomic development through the distribution and types of geographic factors like geology, relief, climate and soils, biodiversity, and population distribution. All these geographic factors pose an effect on the growth of agricultural and industrial production and commercial activities. Geographical location and dynamic environmental features strongly influence development policy choices in society. Geography and development policies are so closely linked and tied together. Their linkage is still strong and persuasive

Geographic location determines development by influencing agricultural, industrial, and commercial activities. Three basic theories are known to geographers in this respect: Agricultural location theory; industrial location theory and central place theory. These theories are based on different assumptions about how agriculture, industry, and trade are influenced by geographic location, respectively.

Extreme climatic events result in droughts, unexpected rainfall, and sudden floods. These, in turn, cause the loss of biodiversity; death of plants and animals; reduction in agricultural yield, and health problems. The event indirectly threatens human livelihoods. As livelihood assets are reduced, households are exposed to chronic poverty. Poor people in turn negatively impact the natural environment through the harvest of livelihood assets. This again leads to more climate variability and creates a vicious cycle of climate-change-poverty mismatch.

Landlocked countries are those that do not have access to the sea. For instance, Ethiopia is a land-locked country that does not have a seaport. There are over 30 landlocked countries in the World. These countries pay a large amount of money to import and export commodities. This affects their economic development seriously. Ethiopia's foreign trade is also largely affected by the lack of its seaports. It is dependent on Djibouti, Sudan, and other countries for its international trade. This has had a huge impact on its development. Improper government policies; lack of access to improved transportation facilities; and administrative barriers also influence intra-regional trade in Africa in addition to the lack of sea access to international trade in many countries.

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UNIT SIX
MAJOR GLOBAL ENVIRONMENTAL CHANGES
(14 Hours)

UNIT INTRODUCTION

Dear learner, welcome to unit six, which deals with major global environmental changes. The effects of human activity on the planet's biosphere are extremely detrimental. Limitations in the ecosphere, biology, society, and technology, for instance, may cause long-term and recent environmental changes. Environmental deterioration, poverty, habitat fragmentation, resource overexploitation, forest degradation, and unsustainable development are the main environmental concerns facing our planet today. Dear learner, you should be aware of continuous environmental changes, the poverty-environment nexus, environmental degradation, and sustainable development, which are the focus of this module.

Unit Learning outcomes

Dear learner, at the end of this unit, you will be able to:

- 🌍 describe the nature and characteristics of persistent environmental changes;
- 🌍 explain the nature and characteristics of emerging environmental changes;
- 🌍 examine the intricate relationships between poverty and the environment; and
- 🌍 appreciate that a sustainable environment is part of sustainable development

SECTION ONE
PERSISTENT ENVIRONMENTAL CHANGES
(8 Hours

Section Overview

Dear learner, this section is concerned with long-term environmental changes. Human activity can cause a habitat to become fragmented through perforation, dissection, fragmentation, shrinkage, and attrition. Habitat deterioration is a factor in species extinction and biodiversity loss. Intensive land use affects biodiversity and promotes overexploitation in densely populated areas. Overexploitation and excessive land usage can lead to environmental and land degradation, as seen by the loss of soil organic carbon (SOC) and soil nutrients, ineffective agricultural intensification, and a temporary fix for the issue of food insecurity. Environmental and land degradation are contributing factors to climate change as well as extreme weather occurrences like flooding. Climate change and other factors have caused invasive alien species to spread across land and water surfaces.

Section Learning Outcomes

Dear learner, at the end of this section, you will be able to:

- distinguish between the nature and characteristics of persistent environmental changes,
- illustrates the species richness or biodiversity levels of terrestrial mammals around the world, as well as the degree of habitat fragmentation,
- explain habitat restoration techniques,
- identify the major negative impacts of agricultural intensification,
- appreciate the systems for sustainable agricultural intensification, and
- describe the influences of natural resources overexploitation and invasive species

Keywords:

- Agricultural intensification;
- Environmental changes;
- Habitat destruction;
- Invasive alien species;
- Overexploitation of resources;
- Persistent

6.1.1. Habitat Fragmentation

(?) Dear learners, what is a habitat? What is habitat fragmentation?

Learner, compare your answers to the following note. Habitat is the subset of physical environmental factors that permit a particular species to survive and reproduce. All features of the environment surrounding an individual animal at any given point in time are described as habitat.

Landscape modification by humans is by far the most major modern source of habitat loss, fragmentation, and biodiversity loss around the planet. Perforation, dissection, fragmentation, shrinkage, and attrition are five ways humans can modify landscapes and habitats spatially. Natural processes can also change landscapes and eliminate habitats for certain animals. Natural occurrences such as floods, volcanic eruptions, earthquakes, and temperature shifts, for example, cause habitat destruction. The introduction of invasive species into environments is also a major factor in the extinction of native species.

> **(?)** Dear learner, how do you interpret Figure 6.1's relationship between the world's terrestrial mammals' species richness or biodiversity levels and the degree of habitat fragmentation?
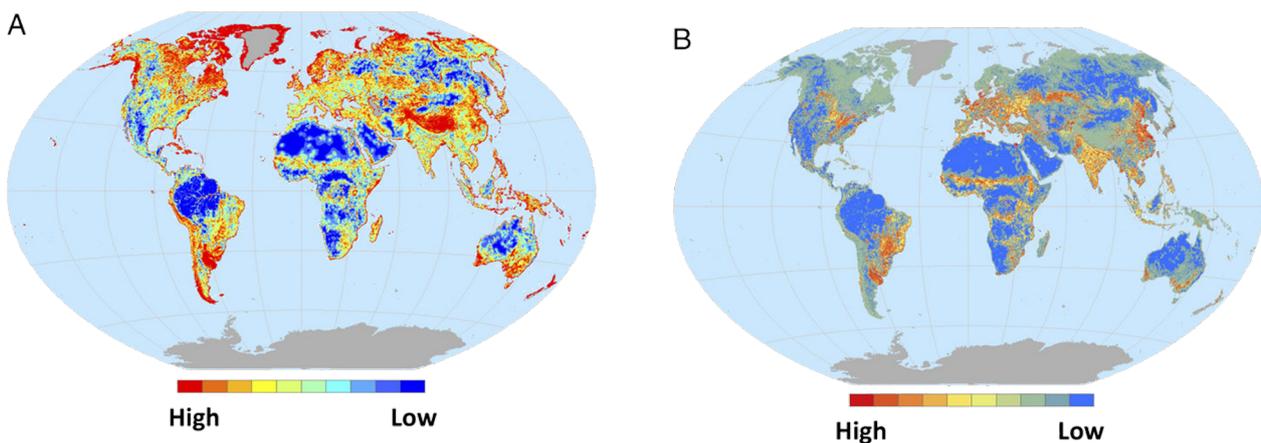

Figure 6.1: Degree of habitat destruction for the world's terrestrial mammals

Figure 6.1 depicts the world's terrestrial mammals' species richness or biodiversity levels (A) and degree of habitat fragmentation (B), with blue being the least fragmented places and red denoting the most fragmented habitats.

Access to proper habitat has a profound impact on all organisms' distribution and abundance, as well as their survival, reproduction, and long-term persistence. While the area between remains of natural vegetation cover may extend, some species prefer disturbed settings. Individuals may survive in a deteriorated habitat for a long time even if they are unable to reproduce.

Some types of habitat degradation take a long time to have an impact on a particular species. For example, the loss of huge trees with cavities is a major issue in forest and woodland ecosystems all across the world, threatening many individual species. Long-term population losses as a result of habitat degradation may thus go unnoticed or be extremely difficult to remedy once discovered. Extinction debt refers to the time it takes for a species to become extinct as a result of landscape change.

As a result, understanding what constitutes a habitat for a certain species is critical to addressing habitat loss. This knowledge is required to comprehend why species react to landscape change in the manner they do. Habitat restoration should be conducted by continual management, protection measures, and reconstruction of deteriorated or destroyed regions. What is your observation learner, regarding habitat degradation and corresponding remedial measure? Your reflection may serve as the basis for the following lesson study.

6.1.2. Agricultural Intensification

? Dear learner, what is agricultural intensification?

Check and recognize the extent to which your definition complies with the description provided next. Agricultural intensification is the process of increasing agricultural output per unit of input (labor, land, time, fertilizer, seed, and feed or cash). It is especially important when the food supply must be expanded, such as during periods of high population increase. Agricultural intensification was successful in increasing agricultural productivity by using improved seeds (high-yielding varieties), inputs (high doses of fertilizers, pesticides, and weedicides), heavy machinery, and copious water for irrigation with good soils, but it failed to address some environmental issues.

Opening up natural ecosystems for agriculture reduces carbon stores results in the net removal of nutrients from available soil stocks, and reduces ecosystem variety; hence agroecosystem productivity and natural resource integrity are fundamentally enemies. To enhance agricultural productivity, far more land would have been devoted to cultivation, destroying forests, marshes, and other ecosystems. The way heavy land use affects biodiversity in an environment has a strong relationship with its evolutionary history.

Because there is often flexibility to regulate negative interactions and trade-offs through changes in the temporal and spatial arrangements across fields when population pressure on land is low, the potential for 'friendship between agro-ecosystem production and natural resource' is considerable. Soil degradation occurs in the absence of fertilizer inputs as population pressure on land increases and flexibility in land use patterns is limited. As a result, fertilizer inputs are required to prime farming systems, causing soil deterioration to spiral downward. When environmental or social issues are involved, intensification that makes more efficient use of resources may be more crucial.

? Dear learner, what are the major negative impacts of agricultural intensification? From your experience what should be done against such negative effects of agricultural intensification?

Since the late 1960s, the green revolution has been a series of research and technology transfer projects that have introduced high-yield crop varieties and employed pesticides to enhance agricultural productivity to alleviate hunger and poverty in the world's most populous countries. The following detrimental consequences of agricultural intensification were observed.

⬥ **Loss of biodiversity:** Monocropping and major reductions in agricultural diversification have resulted from the widespread adoption of a few genetically homogeneous crop varieties (for example, high-yield rice cultivars and dwarf wheat) across huge areas. Only 15 crop species and eight livestock species now provide 90% of all human food. Many key genetic features that had been bred into traditional kinds over thousands of years were lost forever.

⬥ **Reduction of soil quality:** Increased reliance on synthetic fertilizers (compost, crop residues, green manures, and other organic additions) rather than natural fertilizers (compost, crop residues, green manures, and other organic amendments) has lowered soil quality. Furthermore, nitrate pollution of water bodies causes nitrogen fertilizer leaching.

◈ **Pesticide hazard:** Pesticides stay in soil, air, surface, and groundwater for long periods, poisoning them. They make their way up the food chain and end up in higher organisms (bio-magnification). Pesticide exposure causes cancer in animals over time (for example, chlorinated hydrocarbons).

◈ **Soil salinization:** Intensification of water used for irrigation has led to soil salinization, resulting in land toxicity due to the accumulation of sodium ions in soil solution that adversely affects plant growth.

◈ **Increase in pests and disease:** Indiscriminate use of pesticides was adopted to manage the increased pests and disease problems in crops due to mono-cropping.

◈ **Soil compaction:** The use of heavy farm machinery for sowing, fertilizers, pesticide, herbicide application, and harvesting.

Due to long-term nutrient mining and soil organic carbon (SOC) depletion, intensively used cropland in a densely populated area in Sub-Saharan Africa is characterized by poor health. Furthermore, feeding zero-grazing cattle with fodder and crop residues reduces nutrient replenishment at the plot level. Low yield in farmers' fields is due to significant depletion of soil nutrients, unsuitable land management techniques, excessive soil erosion, and unaffordable agricultural inputs for all farmers. Agricultural intensification is inefficient and a short-term solution to the problem of food insecurity due to environmental degradation. As a result, a more environmentally friendly and sustainable agriculture system must be devised to feed a growing global population while also meeting the needs of future generations. Refer to the Figure 6.2 components below and attempt to interpret the message the figure conveys.
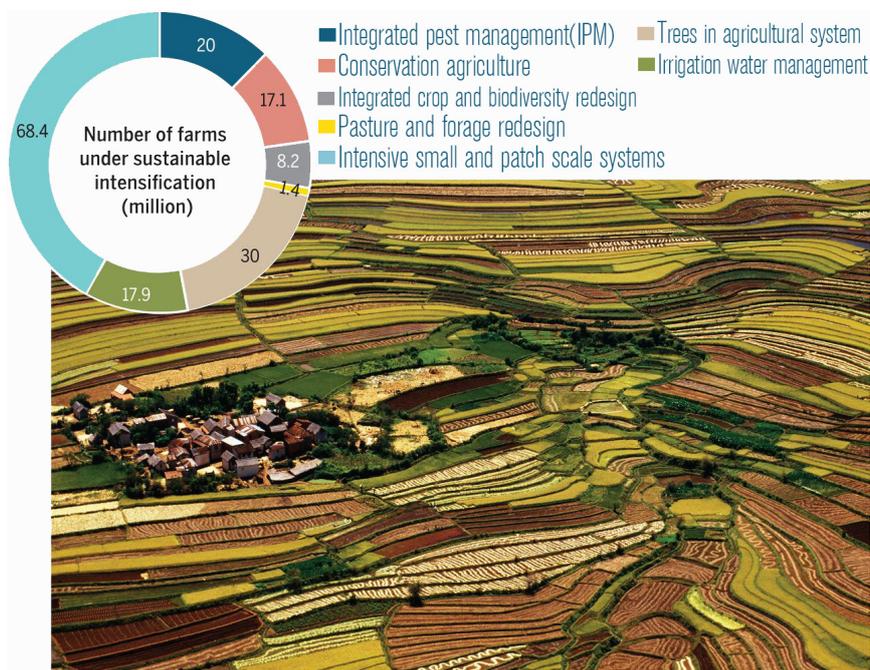

Figure 6.2: Sustainable agricultural intensification systems

Improved fertilizer and water use efficiency through plant and animal breeding programs, as well as the deployment of integrated soil and pest management strategies, could lead to sustainable agricultural intensification. When compared to monoculture agricultural systems, agroforestry can provide additional ecosystem services for sustainably boosting regional food security. There is a need to strike a balance between rising food demands and biodiversity preservation.

Dear learner kindly attempts to respond to the questions in activity 6.1.1 to demonstrate your understanding of this section.

Activity 6.1.1.

Dear learner, please try to provide appropriate answers to the following questions.

1. How do you understand the notion of habitat destruction as compared to habitat loss, habitat fragmentation, habitat degradation, and habitat conversion?
2. What are the causes and consequences of habitat fragmentation?
3. Are agricultural productivity and natural resources friends or foes?
4. What is overexploitation? And how does it occur?
5. How does a habitat influence a given organism?
6. What are some of the most important factors for habitat loss?
7. How could farmers move from degraded and low productivity conditions to sustainable intensification and thereby improve productivity or natural resource integrity?

Dear learner, have you answered all of the questions in Activity 6.1.1 correctly? If you selected "no," reread this section and give the questions another shot. Next unit if you responded in the affirmative.

6.1.3. Overexploitation of Resources

? Dear learner, how does overexploitation occur?

Student, compare your answers to the following note. Everything humans do and how they live is intimately related to and dependent on the resource base, which is inexorably and logically linked. There will be resource exhaustion whenever there is an excess of the population over available resources. Over-exploitation occurs when natural resources (wild medicinal herbs, grazing pastures, fish stocks, forests, hunting animals, and water aquifers) are harvested at an excessive rate without appropriate attention to regeneration.

What does this suggest student? This paragraph clarifies the details for you. Under such circumstances, stocks are rapidly depleted, and they face economic or ecological extinction. Continued overexploitation has the potential to deplete the resource base. Humans are not the only ones who overexploit natural flora and animals; introduced predators and herbivores can also do so. Because overexploitation is such a broad notion, it may be more acceptable to employ specific concepts. For instance, instead of overexploitation,

◈ Overfishing can be used in fishing management. It occurs when a fish stock has been fished down below the size that on average would support the long-term maximum sustainable yield of the fishery. When coastal ecosystems are protected, they support controlling marine overfishing.

◈ Overgrazing can be used in livestock management.

◈ Over-logging in forest management. Forests are exploited or over-logged when they are logged at a rate faster than reforestation takes place. Some species may go extinct because of the changes in the living conditions of animals as a result of forest overexploitation. Devastating effects of deforestation include soil erosion, an increase in greenhouse gases leading to global warming, loss of biodiversity, increased flooding, and drought. Therefore, sustainability programs aiming to educate people about the importance of natural resources have to be enacted as a way of focusing on the long-term risks associated with environmental degradation.

◈ Over-drafting in aquifer management. Overexploitation of water resource occurs if a water resource, such as the Ogallala aquifer is mined or extracted at a rate that exceeds the recharge rate at a rate that exceeds the practical sustained yield. An aquifer that has been exploited is said to be over-drafted or depleted. Hence, when sustainable ecosystem protection is required for rivers, streams, and lakes since recharge usually comes from them.

The exploitation of minerals has become easier, and humans are digging deeper to access different ore due to the advancements in technology in the contemporary era. There has been an increase in the exploitation of minerals, such as phosphorus, gasoline, copper, and zinc, and their production is estimated to decline in the next decades.

Oil mining continues to rise due to the increase in the number of engines that use petroleum thereby magnifying its depletion. The amount of oil remaining would last for only 25 years due to the high rate of oil exploitation. Oil is an essential commodity in manufacturing, planting, mining, and transportation among many activities and its depletion would be devastating. The adverse effects of oil depletion include the fall in business, the high cost of living in developing countries, and uncertainty in the transport sector. Therefore, to reduce the problem, the manufacturers need to be trained on lean manufacturing through recycling, reusing, and reducing wastage while consumers sensitized on how to adopt re-use, reducing wastage, and recycling techniques. It is better to utilize solar and wind power to reduce the dependency on fossil fuels, which is a major cause of environmental pollution, climate change, global warming, and the destruction of natural habitats.

6.1.4. Invasive Alien Species

? Dear learner, how do you characterize invasive alien species?

Invasive alien species include animals, plants, and microbes that infiltrate and invade ecosystems beyond their historic range. They are invaders, outstanding competitors, nonnatives, exotics, invasive, expand their geographic ranges, nuisance species, and split into multiple species. Some species, such as the rose, modify leaves into thorns, while another plant species might develop fruit only at the top of its canopy, out of reach of a non-climbing predator. Student, please internalize the essence of invasive species and their characteristics so that you can identify the responsibilities that humans are expected to bear.

6.1.4.1. Causes of Invasive Species Expansion

? Dear learner, why could invasive species spread?

The proliferation of invasive species is often exacerbated by climate change. Changes in the species that cause a genetic variation and increase an organism's ability to survive could occur in response to climate change. Flooding can cause a new invasive aquatic or wetland plant invasion but it can also be used to control them. Flooding is a type of disturbance, just like plowing, fire, or any other practice that disrupts the soil profile and denudes the surface of vegetation. Invasive plant species love disturbance because it provides an opportunity for establishment. Flooding has also been used to a limited extent to control aquatic and wetland invasive plants. In water bodies where the level can be regulated, weeds can be submerged.

6.1.4.2. Habitat Basis Classification of Invasive Species

(?) Dear learner, please distinguish between aquatic and terrestrial invasive species

Invasive species can be classified according to where they grow. Most species are terrestrial and found on land but others are limited to the aquatic environment. Some weeds only infest a particular crop or cropping system, complex plant communities, or growing conditions.

a. Terrestrial invasive species

Phenotypic plasticity is the term used to describe the variance that occurs between individual plants of the same species that are grown in different conditions. Plants exhibiting behavior is how some scientists prefer to think of phenotypic plasticity. Scientists say the mayapple (Podophyllum peltatum), a herbaceous perennial that grows in rich woodlands, "decides" whether a node will sprout a vegetative or sexual shoot two years before it appears aboveground (see Figure 6.3).

Figure 6.3. Mayapple (Podophyllum peltatum)

Purple loosestrife (Lythrum salicaria) in the desert, for example, can respond physically to its immediate surroundings; even a desert can have a day of cold rain (see Figure 6.4). This is not always a permanent genetic difference like mutation or adaptation, but rather a transitory change that occurs within the individual plant's life cycle.

Variations in the nature and placement of new organs are the most common changes. To acclimatize to lower light levels, one structural modification is to elongate leaf morphology.

Figure 6.4. Purple loosestrife (Lythrum salicaria)

b. Aquatic invasive species

One of the risks of invasive aquatic and wetland plants is that their populations grow enormously year after year with no limits, causing ecosystems to become unstable. Wetlands can get overgrown with invasive plant species to the point where native birds no longer choose to live there. Invasive plant species pose a threat to freshwater supplies. Aquatic and wetland plants compete for sunshine, nutrients, and water with invasive aquatic and wetland plants. They are generally more aggressive than their native equivalents in getting these nutrients and consuming them, leaving little for native plants. As a result, a biologically diversified plant ecosystem has given way to a monoculture of one invading species.

Aquatic invasive plants are modified structurally to live in water. They have been categorized further based on their location in the aqueous environment. These categories are floating, emergent, and submerged.
Floating weeds are plants that rest upon the water's surface, and their roots hang freely on the water or sometimes attach to the bottom of shallow ponds or streams.

Emergent species are plants that grow in natural marshlands and can be found around the shorelines of ponds and in the littoral zone of lakes. They generate larger stems or other support structures in response to the water level. Emergent species are always rooted in very damp soil and stand upright. However, as the water level in a lake or pond rises, emerging species must develop more support tissue. Eventually, buoyancy gives floating-leaved species like waterlines a competitive advantage because they are not forced to build more structures when water depth changes. Mangroves are emergent invasive species that live in saline water and must deal with the problem of salt in the environment in tropical and subtropical locations (see Figure 6.5). The mangrove's competitive adaption is to have its roots above water to obtain oxygen. In fine, frequently wet muck, there is very little oxygen accessible. Roots grow upward above the mud, allowing them to breathe while also supporting the plant. More lenticels equal more oxygen and vice versa.

Figure 6.5. Mangroves

Water hyacinth (Eichhornia crassipes) is another emergent aquatic perennial that develops rosettes of thick, spongy leaves (see Figure 6.6). It's native to South America, but it's now found on every continent except Antarctica, and its distribution is likely to expand as the temperature warms. The water hyacinth can be found in pure stands along the edges of ponds, lakes, canals, ditches, and slow-moving streams, and it flourishes in shallow freshwater marshes. The plants have fibrous and dark roots beneath the water level. A horizontal stem known as a stolon connects the rosettes at the waterline. The hyacinth deoxygenates rivers, killing fish populations, and reducing residents' income and food supply.

Figure 6.6. Water hyacinth (Eichhornia crassipes)

Submerged weeds: Although a few floating stems or leaves may exist on the water surface, these plants grow completely underwater.

6.1.4.3. Ecological Classification of Invasive Plants

? Dear learner, please classify invasive species according to their ecological system

The invasive plants are often classified using ecological categories related to population behavior. Four phases of invasion are defined as follows.

The introduction is the phase of invasion that results from dispersed weeds arriving at a site beyond their previous geographical range and establishing populations of adult plants. Transportation species become common in an area.

Naturalization is the second phase, during which the species establishes new self-sustaining populations, disperses widely and integrates into the local flora. Abiotic variables (such as high temperature, high PH, high salinity, NO-3, or NH4+) determine whether an introduced species can survive and reproduce in the new environment.

Colonization is the third step, in which plants in the founding population reproduce and multiply to form a self-sustaining colony. Alien organisms compete for resources by growing quickly and efficiently.

Dispersal is the fourth step of dispersal and establishment in new places, and it is determined by dispersal ability, dispersal vectors, and habitat connectedness. The pace of dissemination can be determined by kinetic production, tolerance to low P and N availability, relatively high salt tolerance, sea currents, and strong shipping activity. The graph shows that it is less expensive to avoid the introduction of invasive species than it is to wait and maintain them once they have become established. Refer to Figure 6.7 and identify the status of the spreading of invasive species and contrasted level of management.
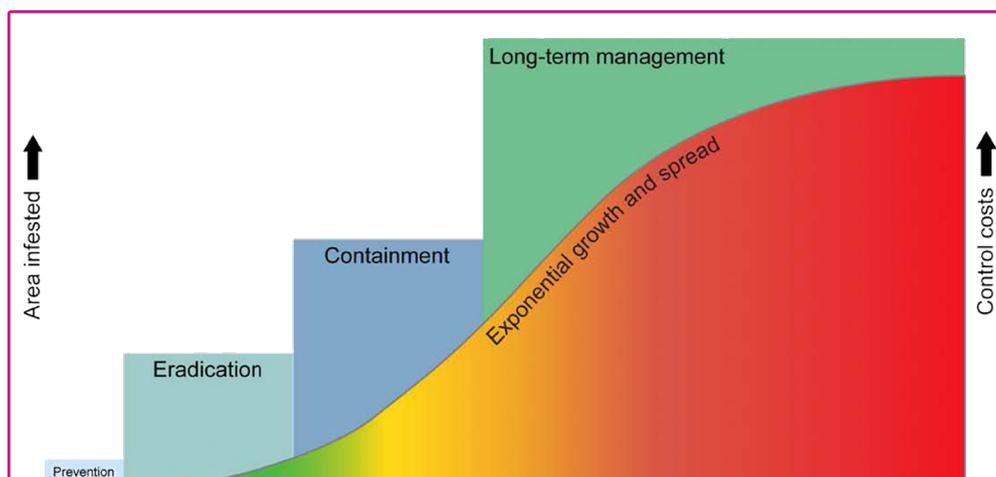

Figure 6.7. The relationship between invasive species spreading and the level of prevention or management cost of the invasive species at different times.

During the absence of the species, low-cost prevention is essential. A small number of localized invading species can be eradicated. When there is a rapid rise in distribution and abundance, containment is conceivable but eradication is unlikely. When invasive species are widespread and prolific, long-term control at a significant cost targeted at population suppression and facility and resource protection is an alternative. With time, the contaminated area and management expenses expand rapidly.

(?) Dear learner, what are the major impacts of invasive plants?

Invasive plants are one of the leading drivers of biodiversity loss, species extinction, and the endangerment of natural ecosystems. They are causing native insects, birds, and other species to lose habitat and food supplies. Invasive species encroachment disrupts normal ecological processes such as plant community succession, as well as native plant-animal connections such as pollination, seed dissemination, and host-plant relationships. They may also endanger human health. Student tries to recall and summarize the key concepts and issues of this section and use their understanding to complete the reflective activity 6.1.2 outlined below.

Activity 6.1.2.

Dear learner, please attempt to note the questions outlined below critically and attempt to complete each.

1. How do you differentiate between the expansion of terrestrial invasive species, such as phenotypic plasticity, and Purple loosestrife?
2. How do you describe the nature of invasive alien species?
3. How are invasive species often expanding in different ecosystems?
4. How do you distinguish between the different types of aquatic invasive species?
5. How do you describe the level of prevention or management cost in different invasion phases

Dear student, have you completed the questions in Activity 6.1.2? If you answered no, please read this section again and try again to answer the questions. If you said yes, move on to the next section.

Feedback on Activity 6.1.1

1. Habitat loss refers to the disappearance of natural environments that are home to particular plants and animals. There are four major types of habitat loss: habitat destruction, habitat degradation, habitat fragmentation, and habitat conversion. Habitat fragmentation is the process in which a large area of habitat is transformed into some smaller patches of smaller total area isolated from each other by matrix or habitats unlike the original. Fragmentation reduces animal ranges and restricts movement, placing animals in these areas at higher risk of extinction. Habitat destruction occurs when a natural habitat, such as a forest or wetland, is altered so dramatically that it no longer supports the species it originally sustained. Habitat degradation is a general term describing the set of processes by which habitat quality is reduced because of natural processes (drought, heat, cold) and human activities (forestry, agriculture, urbanization). Human beings indirectly cause habitat degradation through pollution, climate change, and the introduction of invasive species. Habitat conversion is the elimination or severe diminution of the integrity of a natural habitat caused by a major, long-term change in land or water use. Examples are land clearing, replacement of natural vegetation by crops or tree plantations, permanent flooding by a reservoir, drainage, dredging, filling, or channelization of wetlands, or surface mining.

2. Land conversion for development from growing populations, mining for materials, harvesting lumber for paper products, trawling and urban sprawl, and agriculture are causes of habitat destruction. Habitat destruction is currently ranked as the primary cause of species extinction worldwide. Habitat fragmentation results in the loss of resources like food and turn could lead to the destruction of species.

3. The positive relationship between agricultural productivity and natural resource can be represented as follows. In response to the rapid population growth, the need for sustainable agricultural intensification with improving soil fertility, nutrient use efficiency, and crop nutrition is important to boost crop productivity and food security. Sustainable intensification is a system where agricultural yields are increased without causing an adverse environmental impact and involving the conversion of additional non-agricultural land.

The best option of sustainable agricultural intensification can be practiced through increased inputs of organic manure (compost/animal dung), drip irrigation, crop rotation with seasons, Nitrogen-fixing legume crops added, agroforestry with trees interspersed with crops, and growing local varieties of a crop. The negative relationship between agricultural intensification and natural resources signifies when agricultural intensification has resulted in the loss of biodiversity and ecosystem services on farmland and landscape characteristics on species richness of plants, ground beetles, and on the biological control potential of natural enemies.

4. Over-exploitation generally involves an excessive harvesting rate, occurring without sufficient attention to regeneration. Overexploitation of biodiversity signifies harvesting species from natural resources, including wild medical plants, grazing pastures, fish stocks, forests, and water aquifers to the point of a faster rate of diminishing returns. A third of the world's endangered vertebrates are threatened by overexploitation. Overfishing and overhunting are both types of overexploitation. How does overexploitation occur? Human population size and natural resource consumption rates exert tremendous pressure on the world's plants and animals. Unsustainable hunting, fishing, logging, and harvesting of the wild population could lead to extinction.

5. A habitat is a place where an organism makes its home, which meets all the environmental conditions an organism needs to survive. Shelter, water, food, and space are the main components of a habitat. Access to suitable habitat significantly influences the distribution and abundance of all organisms and it significantly influences survival, reproduction, and long-term persistence.

6. Anthropogenic activities, such as pollution, invasive species, agricultural development, diminished water, and food resources, urban sprawl, logging, mining, destructive fishing practice, and intensity and frequency of fires in an ecosystem are the most important factors for habitat loss.

7. Agricultural intensification with excessive fertilizer application, erosion, soil contamination, acidification, altering the natural cycling of nutrients in the soil, salinization, and loss of soil genetic diversity all contribute to a reduction in soil quality. To address this issue, farmers must practice sustainable agricultural intensification, which can be accomplished by improving nutrient and water use efficiency through plant and animal breeding programs, as well as implementing integrated soil and pest management practices.

Feedback on activities 6.1.2

1. Phenotypic plasticity is the term that describes the variation between individual plants of the same species but growing in different environments. Some scientists prefer to think of phenotypic plasticity as plants expressing behavior. The mayapple (Podophyllum peltatum), a herbaceous perennial growing in rich woods, is described by scientists as "deciding" whether a particular node will develop a vegetative or sexual shoot two years before the shoot appears aboveground. Purple loosestrife (Lythrum salicaria) possesses the ability to make physical changes in response to its immediate environment; even a desert can have a day of freezing rain. This is not necessarily a permanent, genetic variation like mutation or adaptation but a temporary change during the life cycle of the individual plant

2. Invasive alien species are accidentally or intentionally introduced species outside of their natural geographic range and become problematic leading to local or global extinctions of native species and eventual ecological devastation. Invasive alien species are primarily spread by human activities through transportation, often unintentionally. The species establishes new self-perpetuating populations, undergoes widespread dispersal, and becomes incorporated into the resident flora. Plants in the founding population reproduce and increase in number to form a colony that is self-perpetuating.

3. Floating weeds are plants that rest upon the water's surface, and their roots hang freely on the water or sometimes attach to the bottom of shallow ponds or streams. Emergent species are typical plants of natural marshlands that are often found along the shorelines of ponds, and shallow water in lakes known as the littoral zone. They respond to the water level by growing longer stems or other support structures. Submerged weeds: Although a few floating stems or leaves may exist on the water surface, these plants grow completely underwater.

4. Prevention at a very low cost is essential when invasive species are not established. Eradication is the alternative method when small numbers of localized invasive species are found. Containment is possible but unlikely eradication when rapid increase in distribution and abundance. Long-term management with high costs aimed at population suppression and facility and resource protection is optional when invasive species are widespread and abundant.

Section summary

Dear learner, please summarize the main lesson points by considering the following points:

1. Landscape modification by humans is by far the most important modern cause of habitat loss, habitat fragmentation, and reduced levels of biodiversity worldwide.

2. Habitat fragmentation results in the extinction of different flora and fauna species

3. The delay in a species extinction following landscape change is sometimes termed extinction debt.

4. Agricultural intensification is an increase in agricultural production per unit of inputs (labor, land, time, fertilizer, seed, and feed or cash) to expand the food supply, for example during periods of rapid population growth.

5. Agricultural intensification leads to the following negative impacts, including loss of biodiversity, reduction of soil quality, pesticide hazard, soil salinization, increase in pests and disease, and soil compaction.

6. The intensively utilized cropland in a densely populated area is characterized by poor health due to long-term nutrient mining and soil organic carbon (SOC) decline.

7. Sustainable agricultural intensification could be achieved through improving nutrient and water use efficiency via plant and animal breeding programs, and the implementation of integrated soil and pest management practices.

8. Overfishing: occurs when a fish stock has been fished down below the size that on average would support the long-term maximum sustainable yield of the fishery.

9. Overexploitation of water resource occurs if a water resource, such as the Ogallala aquifer is mined or extracted at a rate that exceeds the recharge rate at a rate that exceeds the practical sustained yield.

10. Forests are exploited or over-logging occurs when they are logged at a rate faster than reforestation takes place.

11. The exploitation of minerals has become easier, and humans are digging deeper to access different ore due to the advancements in technology in the contemporary Era.

12. Oil mining continues to rise due to the increase in the number of engines that use petroleum thereby magnifying its depletion.

13. Invasive alien species include animals, plants, and microbes that infiltrate and invade ecosystems beyond their historic range. They are invaders, outstanding competitors, nonnatives, exotics, invasive, expand their geographic ranges, nuisance species, and split into multiple species.

14. The proliferation of invasive species is often exacerbated by climate change. Flooding can cause a new invasive aquatic or wetland plant invasion but it can also be used to control them.

15. Invasive plants are among the main causes of biodiversity loss, species extinction, and native ecosystem threat.

16. Students' refined understanding of the core lesson points shall be exhibited by students themselves at this stage.

✓ Checklist 6.1

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

№	Questions	Yes	No
1	Did you distinguish between the nature and characteristics of persistent environmental changes?		
2	Did you describe the species richness or biodiversity levels of terrestrial mammals worldwide, as well as the degree of habitat fragmentation?		
3	Did you identify the main negative effects of agricultural intensification?		
4	Can you identify the systems for sustainable agricultural intensification?		
5.	Can you explain habitat restoration techniques?		
6	Do you appreciate the systems for sustainable agricultural intensification?		

Self-test exercises 6.1

Part one: Multiple Choice items

Instruction: Dear learner, please choose the best answer from the given alternative for each of the following questions.

1. The process of increasing agricultural output per unit of input refers to:

    A. Agricultural intensification

    B. Habitat Fragmentation

    C. Loss of biodiversity

    D. Sustainable agricultural intensification

    E. All

2. Intensification of water used for irrigation has led to

    A. Soil salinization

    B. Soil compaction

    C. Reduction of soil quality

    D. increase in pests and disease

3. Which one of the following belongs to the overexploitation concept?

    A. Overfishing   C/ Over-logging

    B. Overgrazing   D/ all

4 which one of the following may cause specific changes that result in genetic variation and increase an organism's ability to survive?

    A. Climate change   C/ alien species invasion

    B. Flooding   D/ None

5. Which of the following is not one of the major negative impacts of agricultural intensification?

    A. loss of biodiversity,   C/ soil salinization

    B. reduction of soil quality,   D/ soil compaction   E/ None

Part Two: True/ False Item

Instruction: Dear learner, please respond to the correct sentence by saying "True" and the incorrect sentence by saying "False".

1. Natural processes are by far the most significant modern cause of habitat loss, fragmentation, and biodiversity loss worldwide.

2. Agricultural intensification is inefficient and only provides a temporary solution to the problem of food insecurity caused by environmental degradation.

3. The majority of invasive species are aquatic, but others are only found on land.

4. Invasive plants are one of the most serious consequences of species extinction.

5. Extinction may result from sustainable hunting, fishing, logging, and harvesting of wild populations.

☞🗝 Answer keys to self-test exercises 6.1

Multiple Choice Item: 1. A   B. A   3. D   4. A   5/ E

True/False Item: 1. False   2. True   3. False   4. False   5. False

SECTION TWO
POVERTY-ENVIRONMENT NEXUS
(4 periods)

⚙ Section Overview

Dear learner, poverty drives many impoverished people to overexploit and destroy the natural resources on which they rely for survival. The well-being, nutrition, and health of the local poor are immediately impacted by the degradation of environmental resources since poor people depend more directly on environmental resources for their livelihoods. Regional poverty is influenced by many factors, including a lack of government services, a fragile ecological environment, and frequent natural disasters. Two of the major effects of poverty on the environment are deforestation and land degradation. Lower agricultural output is a result of land degradation, which makes poverty worse. Particularly for the poorest households who depend on harvesting wild forest products, deforestation causes a loss of revenue. The highlighted issues are the focus of this section.

Section Learning Outcomes

Dear learner, at the end of this section, you will be able to:

- 🌍 outline the nexus between poverty and the environment;
- 🌍 recognize the cause-effects relationship between land degradation, deforestation, and poverty, and
- 🌍 familiarize yourself with the land management options to substantially reduce land degradation in your local environment.

Keywords:

- ■ Deforestation;
- ■ Environment;
- ■ Land degradation;
- ■ Poverty

6.2.1. Poverty and land environmental degradation

❓ Dear learner, how would you describe the "vicious cycle" of poverty and environmental degradation?

👉 "Poverty" is a multidimensional concept that includes a lack of access to the whole range of capital assets that can be used to pursue a livelihood. "Environment" is a broad term that represents natural resources including renewable (they can replenish themselves, provided that the stock, or population, is above a certain limit or threshold) and nonrenewable (the resource cannot replenish itself).

A set of mutually reinforcing relationships between poverty and environmental harm has been identified as the poverty-environment nexus. Figure 6.4 depicts the link between poverty and environmental degradation as a "vicious cycle," in which poverty leads many impoverished people to overexploit and degrade the resources on which they rely to exist day to day. This results in environmental degradation, which exacerbates the scope and depth of poverty. The link has also been shown as a downward spiral, with rising poverty leading to rising environmental damage, and so the poor and the environment's situations becoming increasingly terrible. Poverty-environment linkages are dynamic and context-specific, reflecting the geographic location, scale, and economic, social, and cultural characteristics of individuals, households, and social groups.
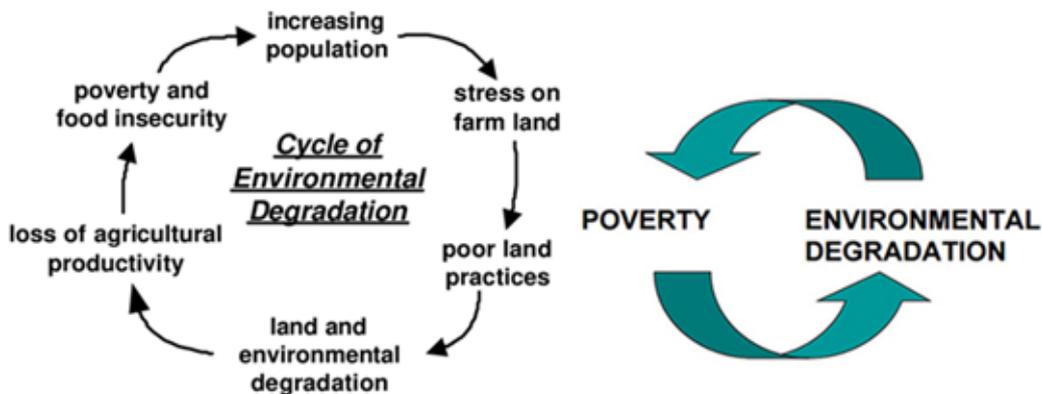

Figure 6.8 'Vicious cycle' between poverty and environmental degradation

Therefore, addressing the issue of poverty requires a good understating of the interactions of the poor with their environment. Poverty-environment mainstreaming, therefore, aims at achieving the best balance between environmental preservation and poverty reduction for the benefit of the poor and long-term environmental sustainability. Student, please concentrate both on the environmental problems and attributing factors first, then imagine what humans should do to alleviate those problems.

6.2.1. Poverty and Land Degradation

? Dear learner, please reflect on what land degradation is. its causes and effects are?

"Land degradation" is a persistent decline in land conditions resulting in a long-term reduction or loss of the biodiversity and ecosystem function and services, the productivity of land, its ecological complexity, and human values, caused by direct and indirect human-induced processes.

Soil degradation, biological degradation, vegetation alterations in natural or semi-natural ecosystems, and water resources degradation are major components of land degradation. Land degradation affects people and ecosystems throughout the planet and is both affected by climate change and contributes to it.
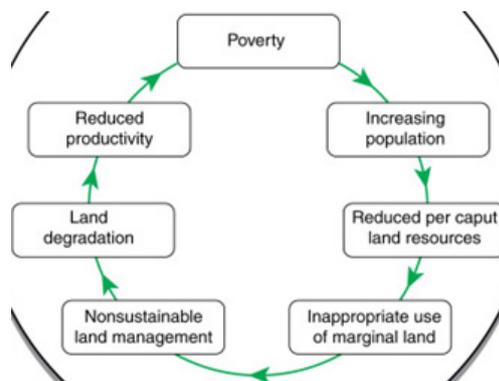

Figure 6.9: The vicious cycle of land degradation Source: United Nations Convention to Combat Desertification (2013)

The relationship between poverty and land degradation is complex. Land degradation is caused by both impoverished and non-poor households. Soils in poor countries' humid tropics are poor, leached, and quickly exhausted, resulting in low yields. The soil resource is being depleted due to water erosion, exhaustion, and soil deterioration caused by overcropping, pollution, salt deposition, and overuse of chemical fertilizers. Soil erosion caused by torrential rain is more likely to occur where natural vegetation cover has been destroyed for farming or where animals have been overgrazed.

Options for land degradation management include soil management, vegetation management, water management, and integrated options. Erosion, soil carbon loss, salinization, acidity, and compaction are all choices for soil management. Preventing overgrazing, improving cropland management, reducing forest cover loss, maintaining tree stocking density, and maintaining tree species diversity are all options for vegetation management. Water management options include preventing over-extraction and reducing aquifer and surface water depletion, as well as managing landslides and flooding. Management of biodiversity loss, dust storms, invasive species spread, pollution, urbanization, wetlands, and wildlife corridors are all integrated choices.

6.2.2. Poverty and Deforestation

"Deforestation" is the conversion of forest to non-forest land and can result in land degradation.

> **(?)** Dear learner, how do you recognize and interpret the cause-effects relationship between poverty and deforestation?

Poverty causes deforestation; poor people deforest but so do the rich. Added income may not deter poor people from deforestation. Deforestation causes poverty depending on who does it and why, deforestation can destroy or create assets for poor people. Deforestation harms access to forest goods and services, which is especially important for poor households.

> **(?)** Dear learner, please explain the three interrelated components of the forest strategy and operational policy.

To achieve a balanced linkage between forest preservation and poverty reduction for the benefit of the poor and long-term environmental sustainability, forest strategy, and operational policy have three interdependent parts. These include:

- ◈ The first is harnessing the potential of forests to reduce poverty by strengthening the rights of people especially marginalized groups to forests and fostering their participation in forest management. Poverty could be reduced by promoting sustainable forestry, community forestry, and agroforestry.
- ◈ The second is integrating forests into sustainable economic development strategies by improving forest governance and introducing legal and institutional reforms; and encouraging investments that catalyze the production of forest products, including environmental services.
- ◈ The third is protecting local and global environmental values through establishing protected areas, improving forest management in other areas, and developing markets and finance for international public goods such as biodiversity and carbon sequestration.
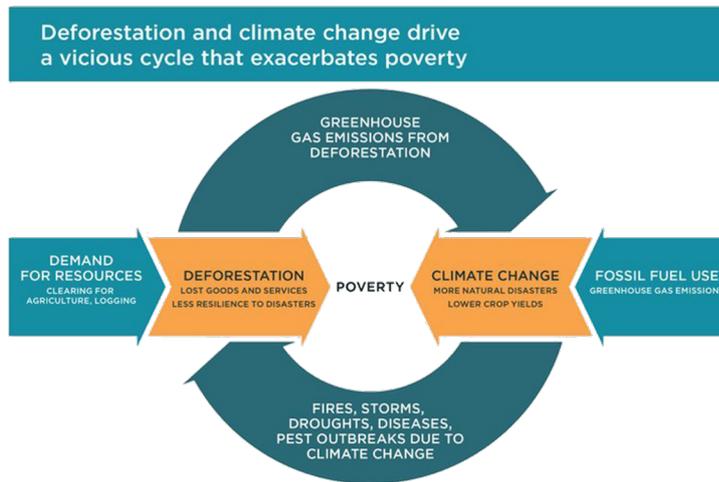
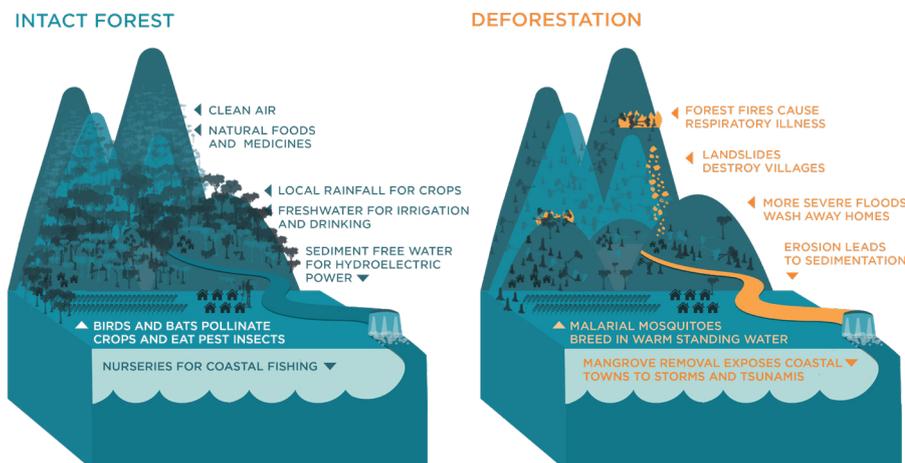Figure 6.10. Deforestation, climate change, and poverty nexus

Figure 6.11. Services from intact forests and risks of deforestation

(?) Dear learner, how can the best balance between environmental preservation and poverty reduction be achieved for the benefit of the poor and the realization of long-term environmental sustainability?

Dear student, please try to answer the questions in activity 6.2 to show that you comprehend this section.

Activity 6.2. Dear learner, please try to attempt the following questions.

1. How do you explain the linkage between poverty and the environment (Figure 6.8?)

2. How do you explain the linkage between poverty and land degradation (see Figure 6.9)

3. How do you understand the nexus between deforestation, climate change, and poverty from Figure 6.10

4. Please try to distinguish services from intact forests and risks of deforestation by referring to Figure 6.11

Dear learner, have you answered the question in Activity 6.3 truthfully? If you selected "no," read this section again before attempting the questions. Check your response to the feedback provided below before moving on to the next unit if you selected "yes."

Feedback to activity 6.2

1.   The relationship has also been portrayed as a downward spiral, with increasing poverty leading to increasing environmental degradation and; hence; the situation of both the poor and the environment getting worse and worse.

2.   Poverty is caused by the inappropriate use of marginal land and non-sustainable land management practices, which in turn leads to land degradation. Severe land degradation leads to declining land productivity which increases poverty.

Section summary

Dear learner, summarize the lesson by considering the following points. The term "poverty-environment nexus" refers to a set of relationships between poverty and environmental harm that reinforce one another. The amount and depth of poverty are further exacerbated by the overexploitation and degradation of the environmental resources that poverty causes many poor people to overuse to exist daily. Due to poor households' incapacity to make investments in the management of land resources, poverty may contribute to land degradation. Agricultural production is diminishing as a result of land degradation, which in turn harms household income and exacerbates poverty. Poverty contributes significantly to deforestation by removing fruit and timber. Access to forest products and services is harmed by deforestation, especially for low-income households. Approaches for tackling land degradation include soil management, vegetation management, water management, and integrated options.

Checklist 6.2

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

№	Questions	Yes	No
1	Did you explain how poverty and the environment are inter-twined? And		
2	Did you realize how poverty, deforestation, and land degra-dation are all related in a cause-and-effect manner?		
3	did you become familiar with the land management options to significantly lessen land degradation in your local environ-ment?		

Self-test exercises 6.2.

Part one: Multiple Choices

Instruction: Dear learner selects the most appropriate response to the following questions from the list of possible answers.

1. Poverty causes many impoverished people to overexploit and degrade resources, resulting in environmental degradation that worsens the scope and depth of poverty implies

   A. Vicious cycle' between poverty and environmental degradation

   B. Vicious cycle' between poverty and deforestation

   C. Poverty and Land Degradation   D/ all

2. Which option does not belong to water management?

   A. Preventing overgrazing,

   B. preventing over-extraction and reducing aquifer and surface water depletion

   C. managing landslides and flooding   D/ none

3. Which of the following choices is not a part of vegetation management?

   A. Preventing overgrazing,   C/ maintaining tree stocking density

   B. improving cropland management,   D/ reducing forest cover loss   E/ None

4. Poverty and environmental degradation have several mutually reinforcing linkages that are identified:

   A. the poverty-environment nexus

   B. Poverty _ Land Degradation Nexus

   C. Poverty _ Deforestation nexus   D/ None

Part two: True False Item

Instruction: Dear learner says true if the sentence is correct, and false if the sentence is wrong.

1. Deforestation is always caused by poverty.
2. Land degradation is affected by climate change and contributes to it.
3. Options for vegetation management must maintain soil carbon loss and tree species variety.
4. Farmland degradation lowers agricultural production, which may or may not result in decreased household income and more poverty.

Answer keys for self-test exercises 6.2

Multiple Item: 1. A   2. A   3. E   4.

True/False Item: 1. False   2. True   3. True   4. False

SECTION THREE
ENVIRONMENTAL DEGRADATION AND
SUSTAINABLE DEVELOPMENT (2 periods)

✪ Section Overview

Dear learner, in this section, you will get acquainted with and supported as you learn about environmental degradation, including its concepts, types, causes, and impacts. Environmental degradation is the degradation of the environment brought on by the loss of species, the destruction of habitats, pollution, and the depletion of resources including the quality of the soil, water, and air. Long-term development is critically impacted by environmental degradation. The subsection discusses sustainable development as a strategy for halting environmental deterioration. Sustainable development is facilitated by government regulation, the control of unlawful dumping, recycling, garbage reduction, avoiding plastic waste, and environmental education. Therefore, dear learners please think about what is expected of each person and society to stop environmental deterioration and encourage sustainable growth, and then share your ideas.

Section Learning Outcomes

Dear learner, at the end of this section, you will be able to:

- 🌍 Identify types, causes, and effects of environmental degradation, and
- 🌍 explain the ongoing global efforts to avert environmental degradation and then ensure sustainable development.

Keywords:

- ■ Environmental Degradation;
- ■ sustainable development

6.3.1. Environmental degradation

> ? Dear learner, what is the definition of environmental degradation?

"Environmental degradation" is the deterioration of the environment through the destruction of ecosystems, habitat destruction, the extinction of wildlife, pollution, and depletion of resources such as the quality of air, water, and soil.

> ? Dear learner, please identify the major types of environmental degradation.

Student, you are advised to think in depth about the concept, types, and features of environmental degradation and derive your meaning from the lessons.

Type of environmental degradation

a. Soil degradation is the degradation of soil quality due to poor farming practices, and excessive use of fertilizers, and pesticides.

b. Water degradation is the pollution of water quality as a result of trash dumped in oceans, illegal dumping, and disposal of large amounts of industrial waste into nearby surface water.

c. Atmospheric degradation includes air effluence, particle pollution, and the depletion of the ozone layer due to increased demand for material goods and consumption levels of the world population.

d. Other kinds of pollution, including noise and light pollution, are part of environmental degradation.

Causes of environmental degradation

? Dear learner, please identify the major causes of environmental degradation.

Student, as you might have guessed, some of the causes of environmental degradation include the following among others:

◈ **Land disturbance:** land damage is the basic cause of environmental degradation.

◈ **Pollution:** pollution of the air, water, land, and noise are the harmful causes of environmental degradation.

◈ **Overpopulation:** rapid population growth necessitates more food, materials goods, clothing, and shelter, as well as higher total consumption levels, resulting in an increase in greenhouse gas emissions, which leads to air pollution and global warming. Overcrowding causes the land to be overused, diminishing soil cover and fertility, vegetation cover and productivity, and laying the groundwork for catastrophic output failure when the next drought strikes.

◈ **Landfills** a large amount of waste disposed into landfills causes environmental degradation. Leaks in landfills result in significant soil pollution, and the bad smell of landfills poses a great risk to the health of the environment and the people who live there.

◈ **Deforestation:** Land clearance is the first and perhaps the most irreversible form of environmental degradation. In the tropics, once the forest biomass is cleared, immediate economic and social consequences are severe. Exposed soils erode rapidly, are subject to declining fertility, and often contribute to flooding and siltation of rivers and dams.

◈ **Illegal dumping** of waste into rivers, lakes, or oceans can cause pollution of water that in turn leads to the contamination of fish and other animals. Waste disposed into forests and soils can contaminate the soil which also leads to groundwater contamination.

◈ **Natural causes,** including earthquakes, tidal moves, storms, and wildfires can crush nearby animals and plants group to the point where they can no longer survive in those areas.

Which one of the indicated causes of environmental degradation is more critical in your perspective and similarly which of them are encountering in your locality? Make your reflections before moving to the discussion of environmental degradation effects.

Effects of environmental degradation

? Dear learner, please identify the major effects of environmental degradation.

The degree of the environmental impact varies with the cause, the habitat, and the plants and animals that inhabit it.

◈ Impact on human health: Areas exposed to toxic air pollutants can cause respiratory problems, such as pneumonia and asthma.

◈ Loss of biodiversity: environmental degradation due to deforestation, global warming, overpopulation, and pollution results in loss of biodiversity.

◈ Depletion of the ozone layer is a result of the presence of chlorofluorocarbons and hydrochlorofluorocarbons in the atmosphere. The ozone layer is important for protecting the earth from harmful ultraviolet rays.

◈ Atmospheric changes: Environmental degradation can alter some of the natural processes such as the water cycle and the normal processes of animal and plant activities.

◈ Scarcity of natural resources- environmental degradation through over-exploitation of natural resources, pollution, and deforestation can contribute to the scarcity of resources, particularly arable land, water, genetic resources, medicinal plants, and food crops.

◈ Environmental degradation has a direct link with long-term food shortages and famine.

6.3.2. Environmental Sustainability as a Solution to Environmental Degradation

? Dear learner, what does the term "environmental sustainability" refers to?

"Environmental sustainability" refers to maintaining essential ecological processes and life-support systems (such as soil regeneration and protection, the recycling of nutrients, and the cleansing of waters), preserving genetic diversity (the range of genetic material found in the world's organisms), and ensuring the sustainable utilization of species and ecosystems, on which human survival and development depend.

Environmental degradation is a central issue in sustainable development. Environmental protection through stopping deforestation, government regulation, controlling illegal dumping, recycling and reducing wastes, avoiding plastic waste, and environmental education contribute to sustainable development. Environmental protection is an imperative solution to sustain the quality of aquatic and terrestrial ecosystems.

Adapting to sustainability is the most basic response to environmental degradation. The livelihood of people in highly variable environments tends to exhibit considerable self-reliance and flexibility, as well as a high degree of careful adaptation to local environmental resources and environmental change.

Diverse crop varieties, diverse cropping systems, and integrated management of crops and livestock are important adapting mechanisms for sustainable production. Besides, conserving the earth's vitality and diversity, improving the quality of life, reducing non-renewable resource depletion, and developing environmentally-friendly behavior are internationally accepted principles of sustainable development.

Activity 6.3:

Dear learner, how do you explain the linkage between environmental degradation and environmental sustainability?

Dear learner, have you correctly responded to the question in Activity 6.3? Reread this section and try the questions again if you answered "no." If you answered "yes," check your response to the feedback provided below before moving on to the following unit. Based on your reading and understanding of the section lesson refer to the forthcoming conclusive components.

Feedback to Activity 6.3

Environmental deterioration could harm human health and well-being, as well as cause climate change, ozone layer thinning, and biodiversity loss, all of which are detrimental to sustainable development. Therefore, the most fundamental response to environmental degradation is an adaptation for sustainability. For instance, varied cropping systems and coordinated crop-livestock management are crucial adaptation strategies for sustained production. Internationally recognized concepts of sustainable development include preserving the vitality and diversity of the earth, enhancing life quality, limiting the use of non-renewable resources, and encouraging environmentally responsible behavior.

Section summary

Dear learner, please emphasize the following points when summarizing the section. Environmental degradation includes noise and light pollution, as well as damage to soil, water, and the atmosphere. Environmental degradation is a result of a variety of factors, including land disturbance, pollution, overcrowding, landfills, deforestation, illegal waste dumping, earthquakes, tidal movements, and wildfires. Environmental degradation harms human health, biodiversity loss, ozone layer thinning, atmospheric changes, and natural resource scarcity. Environmental preservation halting deforestation, government regulation, preventing illegal dumping, recycling and decreasing trash, avoiding plastic waste, and environmental education are some of the strategies to maintain the quality of marine and terrestrial ecosystems. Dear learner it is to encourage you to consider the local community's role in environmental conservation

Checklist 6.3

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

№	Questions	Yes	No
1	Did you Identify the types, causes, and effects of environmental degradation?		
2	Did you explain the ongoing global efforts to avert environmental degradation and then ensure sustainable development?		

Self-test exercises 6.3.

Part one: Multiple Choices

Instruction: Dear learner selects the most appropriate response to the following questions from the list of possible answers.

1._____is the degradation of soil quality due to poor farming practices, and excessive use of fertilizers, and pesticides

    A. Soil degradation

    B. Water degradation

    C. Atmospheric degradation   D/ all   E/ A and B

2. Which of the following is not one of the possible causes of environmental degradation?

    A. Overpopulation   C/ Loss of biodiversity

    B. Deforestation   D/ Water degradation

3. the destruction of the ozone layer brought on by the world's population's growing consumption of material goods refers to:

    A. Atmospheric degradation   C/ soil degradation

    B. Light pollution   D/ Water degradation

4. Which of the following is detrimental to sustainable development?

    A. human health and well-being,   C/ ozone layer thinning,

    B. climate change,   D/ biodiversity loss   E/ all

Part two: True False Item

Instruction: Dear learner says true if the sentence is correct, and false if the sentence is wrong.

1. Environmental degradation is not necessarily a central issue in sustainable development
2. Waste disposed into forests can contaminate the soil which also leads to groundwater contamination.
3. Landfill leaks only cause major soil pollution the environment at serious risk.
4. The most fundamental response to environmental degradation is adapting to sustainability.

Answer keys for self-test exercises 6.3

Item one: 1. A   2. C   3. A   4. E

Item Two: 1. False   2. True   3. False   4. True

UNIT SUMMARY

The most urgent problem currently affecting our planetary systems is continuing environmental change. Loss of habitat, biodiversity loss, and the spread of alien species are examples of persistent environmental changes. Landscape alteration brought on by human activities and natural processes may result in habitat loss. The loss of habitat has the potential to lower biodiversity worldwide. Natural ecosystems may disappear as a result of an unsustainable rate of resource extraction and inadequate focus on regeneration. Natural ecosystems used for agricultural intensification have negative effects on the environment, including continual declines in carbon reserves, net nutrient losses from available soil stocks, and decreased ecosystem diversity. The spread of invasive species on water surfaces and dry lands is another environmental problem brought on by climate change and flooding. Rising levels of poverty in less developed nations push the poor to exploit and deplete the natural resources they need to survive daily. Both the situation of the poor and the environment may get worse. The ideal balance between long-term environmental sustainability, poverty alleviation for the benefit of the poor, and environmental preservation must be reached to address sustainable development. Sustainable development involves protecting the health and diversity of the environment, enhancing human welfare, reducing the use of nonrenewable resources, and promoting environmentally friendly behavior.

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UNIT SEVEN
GEOGRAPHIC ISSUES AND CONCERNS
(17 Hours)

UNIT INTRODUCTION

Population dynamics are closely linked with national and world development challenges and their solutions. In the contemporary world, the greatest challenge is to meet the needs of large and growing populations while ensuring the sustainability of environmental resources. The linkages between population dynamics, inequalities, and resource degradation are major contemporary geographic issues. This unit; therefore, presents and discusses some of the major geographic issues and public concerns of our current world. These include population-related public concerns of our contemporary world; land degradation and desertification; unemployment and underemployment; drought and famine; plus deforestation and the worldwide digital divide. Dear learner; please try to integrate these geographic issues and concerns with what you read in 'Unit Six' (i.e. with the major global environmental challenges).

UNIT LEARNING OUTCOMES

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

- describe the population growth-related challenges of the Developing Countries (DCs) and the remedial measures;
- examine population-related public concerns of our contemporary world;
- evaluate the ever-unrestrained problems of unemployment and underemployment;
- describe environmental degradation and its role in desertification;
- identify areas frequently affected by drought and famine;
- examine the threats deforestation poses to our world; and
- appreciate the emerging digital divide between different regions of the world.

SECTION ONE
POPULATION-RELATED CONCERNS OF
OUR CONTEMPORARY WORLD (5 Hours)

⚙ Section Overview

The population-related concerns of our present world are principally family sizes, household income levels, education access, rates of population and economic growth (standard of living), unemployment, and underemployment. This unit thus focuses on these important variables that pose a significant impact on household livelihoods. Dear student; you are hence expected to grasp the basic knowledge of these essential components.

Section Learning Outcomes

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

- 🌍 identify major population growth-related challenges of the Developing Countries (DCs);
- 🌍 assess remedial measures to the population dynamics in the DCs;
- 🌍 evaluate the relationship between family size and education access in the developing and developed world;
- 🌍 describe the mismatch between population growth and the rate of economic growth; and
- 🌍 show how population growth affects economic growth (living standards of people) in the developing world.

Keywords:

- ◼ Economic growth rates,
- ◼ Education,
- ◼ Employment,
- ◼ Family size,
- ◼ Household income,
- ◼ Population growth rates,
- ◼ Underemployment,
- ◼ Unemployment.

7.1.1 Population Growth-Related Challenges in the DCs and Remedial Measures

The highest population growth rates are often experienced in the DCs. This would probably worsen the poverty levels of people in those countries and result in severe socioeconomic and environmental challenges. The situation demands remedial measures to link population dynamics with development goals. Dear learner; this section presents the population growth-related challenges and the remedial measures in the DCs.

Activity 7.1.1

Dear learner; please attempt the following questions by referring back to your module four:

1. Why are population dynamics becoming major contemporary world issues?
2. How do you explain the dynamics of the world population?
3. Identify major challenges of DCs related to population changes?
4. What do you think would be the solutions for the challenges posed by growing populations?

Higher population growth rates in the more developed countries (MDCs) were reached many years ago. The natural growth rates have been continuously declining in those countries for numerous decades. The highest population growth rates in the DCs on the other hand were experienced from 1960 to 1990. Yet, population growth rates have been falling in all countries for the last 20 years. Nevertheless, the highest population growth is predicted to happen in the DCs. This will probably worsen the poverty levels in those countries. The situation could add stress to the basic economic and social services like health, education, and the environment in the DCs. From the DCs, sub-Saharan Africa (SSA) will face the most rapid rate of population growth in the coming decades. Most rapid population increases during the coming decades are also assumed to occur in urban areas (in cities & towns) of the DCs. The increased urban population often comes with more challenges and prospects.

? What are the challenges of high population growth and rapid urbanization in the DCs?

Dear learner; as you read in the foregoing paragraph, rapid population growth and urbanization often cause severe challenges for communities. Population pressure and rapid urbanization in the DCs would probably result in severe socioeconomic and environmental challenges. For instance, it can result in:

◈ rapid environmental change (land degradation, resource depletion & air pollution);
◈ biodiversity loss, habitat destruction, and species contraction;
◈ extended urbanization (expansion of slums and squatter settlements in urban areas);
◈ chronic poverty and malnutrition (food insecurity and water scarcity);
◈ health and related problems (poor health which likely results in higher rates of mortality);
◈ lack of better education;
◈ increased rural-urban migration;
◈ housing and shelter shortages;
◈ inequality and marginalization;
◈ climate change and related hazards; and
◈ transportation shortages.

Resource distribution, polarization, and marginalization are among the acute problems facing DCs currently. For instance, only 5% of the world's population enjoys 23% of the world's energy supply. Conversely, 40% of the world population has no access to suitable hygiene services. Another 1.2 billion people lack basic facilities at all.

Additional information is available online for you at:

https://www.youtube.com/watch?v=mRcxGJcBDVo

https://www.youtube.com/watch?v=SxbprYyjyyU

https://www.youtube.com/watch?v=Um-bo2MWDsQ

The following are the promising strategies to solve the challenges posed by growing populations in the DCs (i.e. to bring population dynamics into the development agenda):

◈ ensuring appropriate investment in human capital throughout the life course of citizens to realize the dividends of the demographic transitions (e.g. better education, employment, and health services);

◈ promoting healthy aging and economic well-being in old age: providing an enabling and supportive environment to the old age group to integrate them into the development process;

◈ sustainable urban planning for growing populations: ensuring appropriate infrastructure (education, health & similar services);

◈ giving special attention to vulnerable populations: enhancing the adaptive capacity of people affected by droughts, famines, and climate change hazards;

◈ ensuring international negotiations and collaborations on migration among source and destination countries;

◈ consolidation of rural-urban relations via sustainable integrative development planning,

◈ diagnosing the diversity of demographic situations and their varied implications;

◈ changing fertility patterns: through girls' and women's education; accessing reproductive health services; and

◈ equal opportunity for citizens: fair access to employment, and socioeconomic benefits.

Activity 7.1.2

Dear learner; please reflect on the following questions.

1. How do you describe the world population dynamics?
2. How do you compare the major challenges of population dynamics in MDCs and DCs?
3. How do you realize the possible ways to bring population dynamics into the development agenda in counties of SSA?

7.1.2 Family Size, Education, and Income of Families

Dear student; please consciously identify and attempt all the questions designed for you as means of motivation while studying each section lesson. Consider questions of activity 1.2 and all others provided for you. Population growth dynamics and economic growth rates have important implications on families, households, and household incomes. This section thus presents you with family sizes, household types, and household incomes.

Activity 7.1.3

Dear learner; complete the following questions considerately before reading the text descriptions.

1. What is the difference between family and household?
2. Explain how household size affects education and income?
3. How do you evaluate education access levels in developing countries?

Family refers to members of households who have kinship or blood relationships and/or those bound together through marriage. It includes all related individuals (parents, children, aunts, uncles, grandparents, etc.). Family covers;

◈ married couples without children,

◈ a married couple with one or more unmarried children, and

◈ one parent with one or more unmarried children - representing the concept of a "nuclear family".

Household: refers to groups of persons who are living together and make common supplies of food, shelter, and other essentials required for living. It may comprise people with no blood or marriage relationships but share similar shelter or housing units. A household may comprise other than one family. It can consist of one or more than one non-related person, or exclusively of non-related individuals. Yet, a family cannot embrace more than one household. The household is generally the principal unit in society. Choices concerning childbearing, education, healthcare, living engagements, division of labor, saving, and even migration are often decided at household scales.

Basic household types can include:

◈ a single-person household: comprise only one member;

◈ couple-only household: comprises married or in-partnership couple only;

◈ couple with children household: holds married or in-partnership couple and their children only;

◈ single parent with children household: comprise a single parent and children;

◈ extended-family household: comprise all members that are related to each other plus one or more members outside of the nuclear family unit;

◈ non-relative household: include at least one member who is not related to the head.

> The couple-only, couple-with-children, and single-parent-with-children configurations are each example of households in which all members belong to the same nuclear family unit.

Household composition refers to the description of households based on age, relation to the head, number of marital pairs, or nuclear families it holds. It has a significant influence on the welfare activities of family members and individuals. Configuration and size of the households are connected to childbearing, education, healthcare, expenditure urgencies, and consumption arrangements. Dear learner; please attempt the following question and try to integrate your information with the following notes.

?
1. How do you explain household composition?
2. What factors (conditions) influence household sizes?

Dear learner; we hope that you have reflected well on the household members and factors affecting its size from your experience. Hence, build on your thinking by comparing it to the description of the lesson note presented next.

Worldwide mean household numbers range from 2 to 9 persons. The minimum and maximum sizes range from ‹3 individuals per household in Europe and North America to ›5 individuals per household in Africa and the Middle East, respectively. Please note that the size of households can differ with the conditions of fertility and marriage; permanency and mobility; 'home-living among young people'; occupation patterns; local culture and norms, and migration.

Increased size of children (age 5-14 years) conveys extra load to households in the DCs. Households with large family sizes in those countries are forced to pay more money for schools and teachers; and the purchase of educational materials. This may influence the quality of education. Countries with higher levels of births are liable to have higher levels of illiteracy among girls (aged 15-24 years) than those countries with intermediate birth rates. Spending more years in schooling delays the probability of childbirth and enables smaller family sizes. Households with an extended number of children are more likely to invest less money in child education and healthcare which thus pushes them to continual poverty (see Figure 7.1). Educating women thus helps to minimize the rate of births. Limiting the size of families similarly contributes to the attainment of better education.
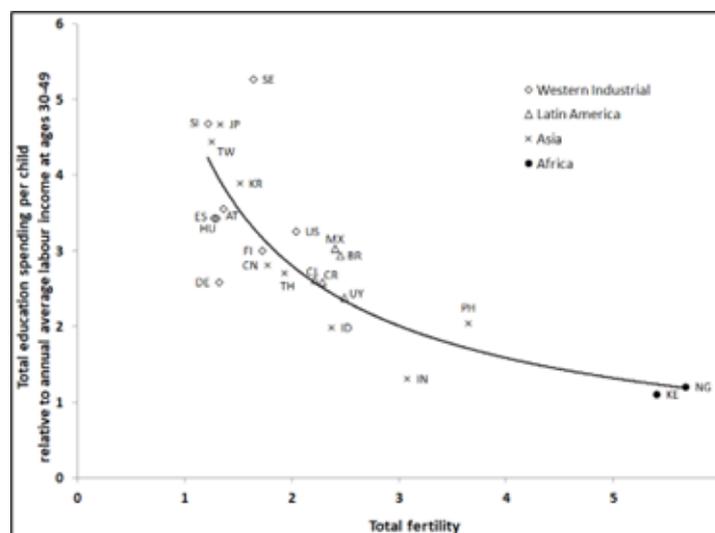

Figure 7.1 Education expense concerning labor income versus total fertility

(Derived from estimates produced by the National Transfer Accounts Project).

?
From the notes you read above, how do you explain the relationship existing between family size and education?

Multi-generational households belong to housing units hosting co-residence of families of three or more generations. Such households provide co-residence to children (‹ age 15 years) and elders (› age 60 years). Such families are frequent in Africa (14%) and Asia (13%); but rare in the USA and Europe which is around 2% (Figure 1.2).

Similarly, skipped generation households refer to the co-residence of elders (grandparents) with grandchildren; however, not parents of the grandchildren. Dear learner, as we repeatedly advise you, critically identify and interpret the text note and corresponding illustrative figures (such as fig. 7.2) and try to construct understanding.
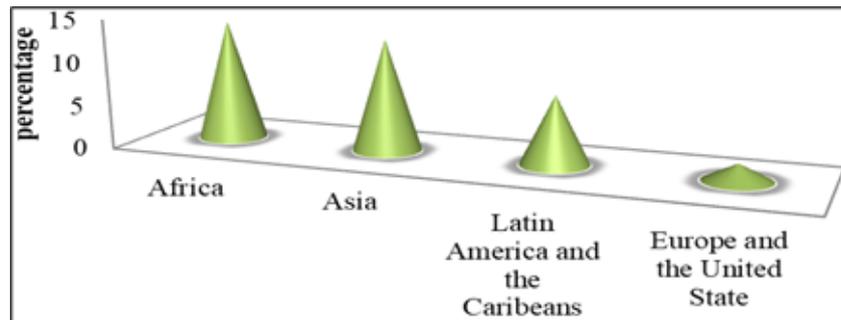

Figure 7.2 Multi-generational households with both children and elders

Household income: household income consists of all earnings, whether monetary or in-kind (such as goods and services), collected by households or their members annually or at frequent intervals. However, it excludes bonus gains and other irregular and typically one-time earnings.

Income distribution is uneven across the world scales. Income from wealthy countries emerges from 16% of the population and accounts for 55% of the world's total. DCs account for 72% of the world population but contribute only 1% to the global total. For instance, mean incomes from North America and the European Union are about 16 and 11 times larger than that of SSA, respectively. Nevertheless, the per-capita incomes of DCs are increasing faster than the MDCs. Nonetheless, the absolute average per-capita income gap between DCs and MDCs had increased from about $27,600 in 1990 to over $42,800 in 2018. Mean income gaps (inequalities) between citizens of DCs are too large.

> **(?)** What is household income and how do you evaluate the income distribution across the world?

Lower economic growth rates and more employment losses excessively affect people in the DCs. Enormous employment and income losses rapidly push an immense rise in poverty. Low-income households often hold a large number of children and investment is low on human capital. They are frequently exposed to a meager food supply and poor health. Households with fewer children and more income, invest more money per child for nutrition, health, and education. Recently, the Coronavirus (COVID-19) pandemic has been worsening disparities within countries.

7.1.3 Rate of Population and Economic Growth

The problems of growing populations and food supplies have been the main concern of people since historical times. Some people perceive that the relationship between population and economic growth is direct while others believe the relationship is indirect. This section thus presents the divergent views concerning the relationship between the rates of population and economic growth. Dear learner; you are going to read the following notes about Malthusian and anti-Malthusian views of population change. Please attempt the following questions before reading the notes.

Dear learner; there are two major contrasting views concerning the relationship existing between population growth and economic development. These are:

1) The pessimistic Malthusian and neo-Malthusian views and

2) Optimistic anti-Malthusian views.

1) Malthusian and neo-Malthusian views

Thomas Robert Malthus (1766-1834)

Thomas Malthus was an English economist and clergyman during the 18th AD. He argued that rapid population growth results in resource scarcity and economic stagnation. Malthus thought population growth and food production are inversely related. He assumed the population grows faster than food supplies and leads to poverty and hunger. Malthus argued that population multiplies in a Geometric fashion (1…2…4…8…16…32…) while food production increases constantly in an Arithmetic progression (1…2…3…4…5…6…).

Malthus thought these contrasting trends create a condition where population number outstrips food supplies that eventually cause resource scarcity, hunger, disease, and war plus resource conflicts - that he called catastrophes. He considered the catastrophes inevitable positive checks of population growth emerging to equalize the imbalance between population and economic growth. Malthus proposed preventive checks in place of the inevitable positive checks to control population growth. Preventive checks to Malthus are moral restraints that include delayed marriage, avoidance of making sexual meetings, and having fewer children. Thomas Malthus developed his theory in 1798 in his treatise titled: "An Essay on the Principles of Population".

? Dear learner; based on the foregoing reading, what are positive and negative checks of population change? Who are the anti-Malthusians?

Neo-Malthusians are the followers of Malthus's views. They argue that there is an imbalance between rates of population and economic growth. They believe that rapid population growth retards economic progress.

2) Anti-Malthusian views

Anti-Malthusians are in general optimists who consider population growth shall not slow down economic development. They argue that an increase in population is an opportunity rather than a predicament for economic development. They add that resource limitations initiated by increased populations could be minimized by the creativity (inventiveness) of the human mind.

They are of two types: a) Marxist view; and b) Boserupian view
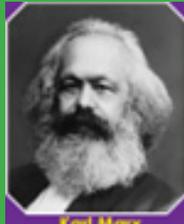
Marxist view (1818 – 1883)

Karl Marx was a German philosopher and political writer of the 19th AD. He was among the socialist (communist) theorists that opposed the theory of Thomas Robert Malthus. According to Karl Marx, production in the capitalist system is not targeted at meeting people's needs; but the accumulation of capital. The system considers the poor unnourished people as a 'surplus population'. Capitalism uses the 'surplus population' for securing job competition among the jobless to cut wages and maximize profits for the ultimate capital buildup.

Karl Marx suggests socialism as the best solution to growing populations and increasing food demands. He advocated the establishment of socialism; a new social system with differing economic structures and socio-political orders.

? Who was Boserup? How her theory differs from the views of Karl Marx?

Boserup's view (1910-1999)

Esther Boserup was a Danish economist of the 20th C. She argued that population growth can be compensated through food production using induced technology and innovation. She developed this anti-Malthusian theory in a thesis titled: "Theory on Population and Agriculture" in 1965; against Thomas Malthus. Boserup argues population is an important variable that positively influences agricultural development through the application of innovative technology.

Boserup and her supporters argue population growth could not be regulated by the shortage of food supplies and necessities as reported in Malthus (1798). According to these scholars, the increasing demand for food supplies from growing populations encourages agricultural innovation and the use of technologies in farming to keep pace with the growing needs. In this context, Boserup confirms that necessity is the mother of invention.

The connection between population and economic growth rates is intricate. Having more people provide the potential to engage abundant human labor in the production of material goods and services. Engaging large labor in the production sector likewise offers enormous economic benefits. In this context, population growth provides the potential for economic development.

On the other side, if the rate of economic development exceeds the rate of growth in the human population, per-capita income will increase. Slowing down the rate of population growth past lowering fertility rates may thus result in the "Demographic Dividend". This means that the number of working-age population increases compared to the dependent population.
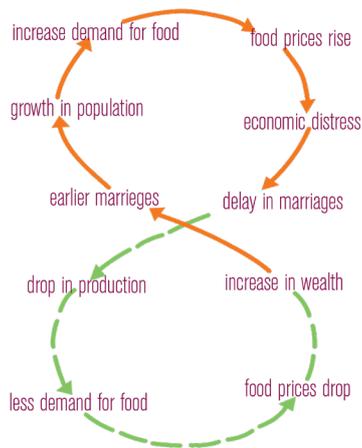
The Demographic Dividend then allows for investing more in health and education. It again pushes to increase labor productivity and helps DCs to sustain a steady macroeconomic situation. If the working population is properly engaged in production activities, production, and per-capita income will rise more swiftly than in the previous.

Nevertheless, the rapid falls in population growth rates were observed not to promote full potential economic development in many DCs (e.g. in Latin America and the Caribbean region). This implies that birth reduction alone never brings full development; though it potentially speeds up economic progress. Sustainable economic growth thus depends not only on fertility declines. It relies on the availability of veracious institutions, sound socio-economic policy, human capital, job opportunities, equity, and fair income and wealth distribution. Rapid population growth brings a higher youth dependency ratio and inequality. It is often linked with challenges such as chronic poverty, poor health, low education access, hunger, and malnutrition.

7.1.4 Employment, Unemployment, and Underemployment

Population and economic growth, family size and household income, employment, and underemployment are contemporary geographic issues and concerns of the world. The ongoing discussion thus focuses on these important issues. Dear learner; keeping this in mind, try to answer the question raised below that prepares you for the next successive lessons.

? Activity 7.1.5

1. Why is unemployment becoming such a critical problem in society; particularly in DCs?

Employment: employment refers to the occupation of individuals or groups of people in certain income-making activities for earning money or useable products to satisfy personal and household livelihood needs. The occupation could be permanent or temporary depending on the type of employment. The type could be also self-employment (working in one's own business); working in public services (through monthly wages); occupation in private companies or corporations; and/or working in any income-generating activities on a daily; monthly or annual basis.

The universally regulated age of employment is ≥ 15 years (completion of compulsory training). Nevertheless, the age limit can vary from country to country depending on the level of development. The minimum age limit for employment in Ethiopia is ≥ 18 years. In most cases, age ≥ 18 years is commonly accepted to be the minimum age of occupation by many countries so as not to endanger the morale, health, and well-being of citizens.

? From the foregoing reading, what do you understand about employment? What is unemployment and how it differs from under employment?

Unemployment: unemployment can literarily be conceived as joblessness or having no occupation to harvest money or products for supporting self-living or household livelihoods. It is the occasion when an active working person or persons lacks the opportunity to get an appropriate occupation for producing livelihood support resources.

Unemployment levels have recently been taken as signals of economic development, market recital, and social well-being. The rates of unemployment in general terms may vary from country to country and from region to region. DCs for instance, face the highest rates of unemployment compared to MDCs. This is because DCs are characterized by higher rates of population growth and urbanization. They lack the necessary economic structure to engage the growing job demand beyond agriculture. Higher levels of unemployment could be indications of economic disaster. Lower levels of unemployment may equally be indicators of an 'overheated economy'.

Addressing youth unemployment problems in DCs like those in Africa is becoming a formidable policy contest nowadays. Large numbers of university graduates in those countries lack employment opportunities due to deficiencies in 'employable skills' (skill discrepancies) with the demands of the employment market.

Note: The unemployment rate for any region or country can be computed as: (Number of unemployed individuals)/(Sums of employed and unemployed individuals) x100=unemployment rate of a year

Case Example: Given that the number of unemployed people is about 2,350,000 and those employed are 56,000,000 in Ethiopia in 2022, the unemployment rate is estimated as:
(2,350,000)/(56,000,000+2,350,000) x100=2,350,000/58,350,000x100=4%.
This implies that of hundred people, four individuals are unemployed in the country in 2022.

The DCs require urgent nurturing of sustainable development programs to host the unemployed youth population. The agricultural development activities in those countries have to be supported by non-farming enterprises. This may create economic diversification and a wide range of opportunities for youth employment.

Underemployment: underemployment refers to the condition where productivity and duration of occupation remain below the expectations, preferences, and capacities of employed persons. It includes the inadequacy of time to cover the work (time-related underemployment); and/or incompatibility of 'occupational skills' and payments (inadequate employment situations) to the employed persons. Both aforementioned impressions reflect 'the under-utilization of the worker's capacities.

To generalize, employment and unemployment hold the basic life affairs of individuals and households in society. For instance, unemployment poses distressing effects on individuals' and households' livelihoods. It upsets not only the unemployed individual but also household members as well as the broader community. Unemployment mainly distresses the living conditions of elders at the retirement age.

? What is dependency ratio? How it is calculated?

The Economic Dependency Ratio (EDR): relates the number of non-workers (unemployed and underemployed) to the number of workers or employed in a given country, representing the share of the dependent population. It is computed as:

$$\text{Economic Dependency Ratio (EDR)} = (U+I+\text{Age } 0\text{-}14 \text{ years})/E \times 100$$

Where U=unemployed persons (age ≥ 15 years), I = persons not in the labor force or underemployed (age ≥ 15 years), E= employed persons (age≥ 15 years), and age 0-14 years = children age 0-14 years. For instance, the economic dependency ratio of the urban population of Ethiopia in 2018 was:

Economic Dependency Ratio (EDR)=(1,770,294+5,682,453+3,757,574)/7,518,855 x100=149, implying that 149 dependents could be supported by 100 employed persons in terms of food, clothing, health, education, and others. Table 1.1 indicates the economic dependency ratio of the urban population by activity status and sex in Ethiopia in 2018.

Table 1.1: Economic Dependency Ratio (EDR) of the urban population of Ethiopia by activity status and sex in 2018.

Sex	Urban total population		Activity status			Economic dependency ratio/EDR
	All aged	Aged 0-14 Years	Employed	Unemployed	Economically not active	
Male	8,734,738	1,878,340	4,213,920	584,585	2,040,242	107
Female	10,038,297	1,879,235	3,304,935	1,185,709	3,642,210	203
Total	18,773,035	3,757,574	7,518,855	1,770,294	5,682,453	149

Activity 7.1.6

Dear learner, please reflect on the following questions?

1. How do you explain the linkage between family size and level of socio-economic development?
2. What is the difference between unemployment and underemployment?
3. Why has participation in the global labor market been steadily declining?
4. Why does addressing youth employment remain a daunting policy challenge in Africa?

Feedback to Activity Questions

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

Feedback to Activity 7.1.1

1. Why are population dynamics becoming major contemporary world issues?

The dynamics of growing populations have become a pressing issue for world nations because it poses several environmental and socioeconomic problems. For instance, it causes:

◈ large-scale environmental degradation;
◈ unprecedented urbanization;
◈ climate change and related hazards;
◈ more demand for food and water resources;
◈ global environmental change; and
◈ health problems, etc.

2. How do you explain the dynamics of the world population?

The growth of the world population is so great and rapid. For instance, the world population was about 1 billion in the year 1800. It increased to around 1.7 billion in 1900. Maybe due to increased medical facilities, the world population exceeded 2.5 billion in the 1950s and reached over 5 billion by the year 2000. In 2015, the world population earmarked over 7 billion. It is estimated to reach over 9 billion in the 2050s and ›11 billion by the year 2100.

3. Identify major challenges of DCs related to population changes?

DCs face the worst challenges of world population growth. For instance, they face:

◈   rapid environmental change (land degradation & resource depletion);

◈   biodiversity loss, habitat destruction, and species contraction;

◈   food insecurity and water scarcity;

◈   rapid urbanization; and

◈   health and related problems.

4. What do you think would be the solutions for the challenges posed by growing populations?

Proposed solutions for problems posed by growing populations:

◈   ensuring appropriate investments in human capital;

◈   achieving better education, sustainable job creation, and reproductive health services,

◈   promoting healthy aging and economic well-being in old age;

◈   prioritize planning for sustainable urban growth for growing populations;

◈   providing particular attention to vulnerable populations;

◈   reducing rural-to-urban migration; and

◈   changing fertility patterns.

Feedback to Activity 7.1.2

1. How do you describe the world population dynamics?

The dynamics of the world population are described in question number 2 in brainstorming question 7.1.

2. How do you compare the major challenges of population dynamics in MDCs and DCs?

DCs face the worst challenges of world population growth. For instance, they face:

◈   rapid environmental change (land degradation & resource depletion);

◈   biodiversity loss, habitat destruction, and species contraction;

◈   food insecurity and water scarcity;

◈   rapid urbanization; and

◈   health and related problems.

The mentioned challenges are also experienced in the MDCs. But, the MDCs have well-established experience, technology, and finance to tackle the problems. They have therefore good capacity to cope-up with the challenges and are less affected by the challenges compared to the DCs.

3. How do you realize the possible ways to bring population dynamics into the development agenda in counties of SSA?

The countries of sub-Saharan Africa have to improve their human, material, financial and technological capacities to confront the challenges posed by a rapidly growing population. They have to take the following measures to avoid challenges introduced due to growing populations:

◈   ensuring appropriate investments in human capital;

◈   achieving better education, sustainable job creation, and reproductive health services,

◈   promoting healthy aging and economic well-being in old age;

◈   prioritize planning for sustainable urban growth for growing populations;

◈   providing particular attention to vulnerable populations;

◈   reducing rural-to-urban migration; and

◈   changing fertility patterns.

Feedback to Activity 7.1.3

1. What is the difference between family and household?

Family refers to members of households who have kinship or blood relationships and/or those bound together through marriage. It includes all related individuals (parents, children, aunts, uncles, grandparents, etc.). A Household refers to a group of individuals who live together and make common provisions of food, shelter, and other essentials for living. These may comprise people with no blood or marriage relationships but share a similar shelter or housing unit.

2. Illustrate how household size affects education and income?

People with large family required to pay more money for school. This minimizes the amount of money invested in individual children's schooling. This implies that households with large families depend on the low quality of education because the money invested per child would be low. These families may sometimes not send their children to school due to a lack of money to pay for schooling. Conversely, households with few children invest more money per child which can allow them to go to better schools. This generally indicates that households with smaller family sizes get more access to better education compared to those who have large families and pay less. People with large families may probably secure less income per capita compared to those with large families.

3. How do you evaluate education access levels in developing countries?

Education access in the DCs appears low compared to those of the MDCs. Most families in the DCs secure low income and face the burden to pay for their extended children. Families in the MDCs have a small number of children. Their income is also high, and hence, they have better access to improved education.

Feedback to Activity 7.1.4

1. How do you evaluate the linkage between population and economic growth rates?

Students may give different answers based on their reading exposures. Some of them may say population and economic growth have a direct relationship. Others may report that they have an inverse relationship. As their answers are influenced by their reading exposure, their answers are respected. But, ask them to give examples for their answers and tell them to read more about it.

2. Have you ever heard about Malthus's theory of population growth and food production?

The answer to this question may be also 'Yes' or 'No' depending on the information they have. Please tell them to read about Malthusian and anti-Malthusian theories from books or internet sources and encourage them to speak and debate in class.

Feedback to Activity 7.1.5

Why is unemployment becoming such a critical problem in society; particularly in DCs?

Unemployment is a critical problem in society because being unemployed leads to dependency. Employment is the means of harvesting income and material goods for household livelihoods. It is therefore critical to support one's living in society. Joblessness or having no occupation to harvest money or products for supporting self-living or household livelihoods leads people to be vulnerable to health and related problems. Unemployment is critical principally in developing countries (DCs) because they are characterized by higher rates of population growth and urbanization. They lack the necessary economic structure to engage the growing job demand beyond agriculture.

Feedback to Activity 7.1.6

1. How do you explain the linkage between family size and level of socio-economic development?

The answer to this question is debatable. Some scholars (Malthusians & neo-Malthusians) often argue that large family size leads to increased resource demand and thereby poses a burden to households and the development endeavors of countries. Households with large families incur higher costs for child nutrition, education, and health facilities. Other scholars (ant-Malthusians) perceive large family sizes to be an opportunity than a challenge. Households with large families tend to have huge human labor and could collect more income. Discuss the issue with students because they may raise different ideas.

2. What is the difference between unemployment and underemployment?

Unemployment is joblessness or having no occupation to harvest money or products for supporting self-living or household livelihoods. It is the occasion when an active working person or persons lack the opportunity to get an appropriate occupation for producing livelihood support resources. Underemployment on the other hand refers to the condition where productivity and duration of occupation remain below the expectations, preferences, and capacities of employed persons. It includes the inadequacy of time to cover the work (time-related underemployment); and/or incompatibility of 'occupational skills' and payments (inadequate employment situations) to the employed persons. Under-employment, in general, refers to the 'under-utilization of the worker's capacities'.

3. Why has participation in the global labor market been steadily declining?

Participation in the Global labor market has been steadily declining due to technological advances that substitute some forms of human labor with machines. In addition to this, many of the university graduates in the DCs lack the necessary 'employable skills' in the international labor market.

4. Why does addressing youth employment remain a daunting policy challenge in Africa?

Developing countries are characterized by higher rates of population growth and urbanization. Nevertheless, their economy is less diversified to absorb the growing unemployed youth population. Most of the DCs lack the necessary policy and economic structure to engage the growing job demand beyond agriculture. Large numbers of university graduates in those countries lack employment opportunities due to deficiencies in 'employable skills' (skill discrepancies) with the demands of the employment market.

Section Summary

The problems of growing populations and food supplies have been the main concern of people since historical times. Scholars like Thomas Robert Malthus argued that rapid rates of population growth could lead to resource scarcity and limited food supplies. Other scholars (e.g. anti-Malthusians) on the other contend that population growth rates shall not cause resource scarcities and never slow down food production activities. Many scholars today suggest that the highest population growth rates experienced in the DCs would probably worsen the poverty levels of people in those countries and may result in severe socioeconomic and environmental challenges. These scholars advise thinking of remedial measures to narrow the gap between the rates of population and economic growth. Resource distribution, polarization, and marginalization are among the acute problems facing DCs today. For instance, only 5% of the world's population enjoys 23% of the world's energy supplies. Conversely, 40% of the world's population has no access to suitable hygiene services. Another 1.2 billion people lack basic facilities at all.

Population and economic growth, family sizes and household incomes, employment, and underemployment are contemporary geographic issues and concerns of the current world. Mean household numbers in the world range from 2 to 9 persons. The minimum and maximum sizes range from ‹3 individuals per household in Europe and North America to ›5 individuals per household in Africa and the Middle East, respectively. Income distribution is uneven across the world levels. Mean income gaps (inequalities) between citizens of DCs are likewise too large. Income from wealthy countries emerges from 16% of the population and accounts for 55% of the world's total. DCs account for 72% of the world population but contribute only 1% to the global total income. For instance, mean incomes from North America and the European Union are about 16 and 11 times larger than that of SSA, respectively. Nevertheless, the per-capita incomes of DCs are increasing faster than the MDCs. Nonetheless, the absolute average per-capita income gap between DCs and MDCs had increased from about $27,600 in 1990 to over $42,800 in 2018. The lower household incomes in the DCs could have negative impacts on the nutrition, education, health, and livelihood of the people in those countries.

Employment and unemployment hold also the basic life affairs of individuals and households in society. For instance, unemployment poses distressing effects on individuals' and households' livelihoods. It upsets not only the unemployed individual but also household members as well as the broader community. Unemployment mainly distresses the living conditions of elders at the retirement age. These are so among the basic contemporary geographic issues of the current world. Lower economic growth rates and more employment losses excessively affect people in the DCs. Enormous employment and income losses rapidly push an immense rise in poverty. Low-income households often hold a large number of children and investment is low on human capital. They are frequently exposed to a meager food supply and poor health. Households with fewer children and more income, invest more money per child for nutrition, health, and education.

✓ Checklist 1.1

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

№	Questions	Yes	No
1	Did you identify major population growth-related challenges of the Developing Countries (DCs)?		
2	Did you assess remedial measures for the population dynamics in the DCs?		
3	Have you evaluated the relationship between family size and education access in the developing and developed world?		
4	Did you describe the mismatch between population growth and the rate of economic growth?		
5.	Can you illustrate how population growth affects economic growth (living standards of people) in the developing world?		

Self-test Exercise 7.1

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

Part I) True/False

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

1. Highest population growth rates are experienced today in the more developed countries.
2. Most rapid population increases in the coming decades are expected to occur in the cities and towns of developing countries.
3. Households with large family sizes in developing countries pay less money for schools and teachers; and for the purchase of educational materials.
4. Households with fewer children and more income, invest more money per child for nutrition, health, and education.
5. Unemployment is the condition where productivity and duration of occupation remain below the expectations, preferences, and capacities of employed persons.

Part II) Multiple Choices

Instruction: For questions 6-10, choose the best answer from the given alternatives (5 points)

6. Which of the following is not a population-related concern of the current world?

   A) Household income and family size

   B) Unemployment and underemployment

   C) Child health and quality of education

   D) Zonation of the Earth's components

7. Which part of the world will face the most rapid rate of population growth in the coming decades?

    A) Sub-Saharan Africa

    B) South and East Asia

    C) Central Latin America

    D) Mediterranean Europe

8. Which of the following challenges is never caused by increased population growth and rapid urbanization?

    A) Land degradation, resource depletion, and scenic disruption

    B) Biodiversity loss, habitat destruction, and species contraction

    C) Better social equity, good governance, and salient democracy

    D) Food insecurity, chronic poverty, malnutrition, and inequality

9. Which of the following is a promising strategy to resolve the challenges posed by growing populations in developing countries?

    A) Promoting births, unemployment, and underemployment

    B) Ensuring better education, employment, and health services

    C) Giving more support to the wealthy and richer households

    D) Restricting births and limiting the rural-to-urban migration

10. Which of the following scholars argued that rapid population growth can be compensated by induced technology adoption?

    A) Easter Boserup

    B) Karl Ritter

    C) Thomas Malthus

    D) Karl Marx

Part III) Short Answer Writing

Instruction: Give a short meaning (definition) to the terms (phrases) given from 11-15 (10 points)

11. Household

12. Family

13. Multi-generational households

14. Household income

15. Employment

🔑 Answer Key to Self-test Exercise 7.1

Dear learner; we hope you did well in the self-testing. You are now at the stage of completion of the first section of module seven. Now, please compare your answers with the feedback given and make corrections if there are errors in your answers.

Part I) True/False		Part II) Multiple Choices	
1	False	6	D
2	True	7	A
3	False	8	C
4	True	9	B
5	False	10	A

	Part III) Short Answer Writing
11	Household refers to groups of persons who are living together and make common supplies of food, shelter, and other essentials required for living. It refers to people who share similar shelter or housing units.
12	Family refers to members of households who have kinship or blood relationships and/or those bound together through marriage. It includes all related individuals (parents, children, aunts, uncles, grandparents, etc.).
13	Multi-generational households belong to housing units hosting co-residence of families of three or more generations.
14	Household income refers to all earnings, whether monetary or in-kind (such as goods and services), collected by households or their members annually or at frequent intervals.

Dear learner; how did you find the lesson? We think you enjoyed it and found it very interesting and exciting. We 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
LAND DEGRADATION AND DESERTIFICATION
(3 Hours)

❖ Section overview

Land degradation is the long-term alteration of the quality and quantity of the land over a given geographic area. It leads to the loss of the biological mass including forests, pastures, and meadows. Land degradation affects soils and water resources as well as causing air pollution and scenic deterioration. Extreme climatic patterns, droughts, plagues, pathogens, and floods are manifestations of land degradation and desertification. This topic thus focuses on these pressing issues.

Section Learning Outcomes

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

◈ identify the forms of land degradation;

◈ describe consequences of land degradation; and

◈ evaluate the relations between land degradation and desertification.

Keywords:

◈ Desertification;

◈ Causes of land degradation;

◈ Impacts of land degradation

1. 2.1 The Forms of Land Degradation

Land degradation refers to the long-term lessening of productivity of land resources, ecological integrity, and the worth of humans. It involves the deterioration of physical, chemical, and biological processes. Dear learner; please attempt the following activity questions and try to integrate your understanding with ongoing notes. Refer to Figure 7.3 and try to relate it to the environment you are living in.

> **Activity 7.2.1**
> 1. What is land degradation?
> 2. What is desertification?
> 3. How do you explain the cause and effect relationship between land degradation and desertification?

A physically & chemically degraded light-colored soil in Tigray, Ethiopia (Haile et al., 2006)

Severely degraded land near Alaba Kulito along the Soddo-Shashemene road, rift valley region, Ethiopia (Billi, 2015)

Physical degradation: this involves the physical breakdown and alteration of land resources. Land resources are often physically deteriorated as a result of mechanical damage through detachment, translocation, pollution, wastage, and excessive use. This type of degradation manifests itself through compaction, crusting, hardening, thinning, and sealing of soils. It causes textural and structural changes in soils including color changes (e.g. see Figure 7.3). Water dries up and shows a physical change of color when degraded. The size, density, and composition of plant species also decrease with excessive use.

> (?) Dear learner; could you please differentiate the three forms of land degradation?

Chemical degradation: this introduces a relative change in the constituent components of the Earth's resources. Chemical degradation causes a chemical change in the constituent minerals of land resources. It involves the loss of nutrients from soils; eutrophication of freshwater and quality alteration in the biomass. When soils are chemically altered, they become acidic or alkaline due to changes in Hydrogen (H+) and Hydroxide (OH-) ions, respectively.

Biological degradation: biological degradation comprises the alteration of the biological mass due to human and natural causes. Natural forests can be altered by the excessive use of humans. Deforestation, overgrazing, and spraying harmful chemicals degrade forest resources. It results in the contraction of the sizes, species composition, and quality of the forest resources.

7.2.2 The Causes and Impacts of Land Degradation

Land degradation is caused by several biophysical and socioeconomic factors and poses severe damage to the natural and social environment. Dear student; this section presents the causes and impacts initiated by the degradation of land resources.

> (?) What are the causes and impacts of land degradation? Dear learner; please refer back to Unit Three of your Module Three and identify the causes and consequences of land resource degradation.

Land degradation is caused by natural and human factors. The natural factors include the alteration of landscapes by volcanic eruption, flooding, and tsunami. The human factors are population pressure and anthropogenic-induced climate change; improper farming practices; land use/cover changes; rapid urbanization; weak policies and institutions, and unsustainable use and management of environmental resources.

Land degradation damages freshwater and marine ecosystems plus the livelihood of households and communities. It drives climate change through the release of greenhouse gases (GHGs) and minimizes rates of carbon sequestration. Humans whose livelihoods directly depend on raw resources are more affected by land degradation. Those people with lower adaptation choices will be more susceptible to climate changes posed by the degradation of land resources. Land degradation and climate change cause risky livelihoods accompanied by food insecurity and poverty. The hazards of land degradation and climate change further instigate ever-increasing harms and unwelcome vagaries like forced resource conflicts, poverty, and migration.

(?) How is land degradation minimized?

Dear learner; land degradation can be minimized through:

◈ afforestation and reforestation: planting trees in barren and deforested areas;

◈ controlling unsustainable tree cutting for fuel and construction;

◈ limiting the expansion of farming to marginal lands; and

◈ using alternative energy sources to reduce tree cutting for fuel.

7.2.3 Desertification

Desertification is land degradation in dry, arid, semi-arid, and dry sub-humid areas. Its variation from land degradation is mainly geographic for the latter can occur including in the wetter areas of the Earth. The size and intensity of desertification have been increasing in recent decades mainly in the dry, and arid areas (see Figure 7.4).

(?) Dear learner; what do you understand from the foregoing reading? What is desertification and how it differs from land degradation?
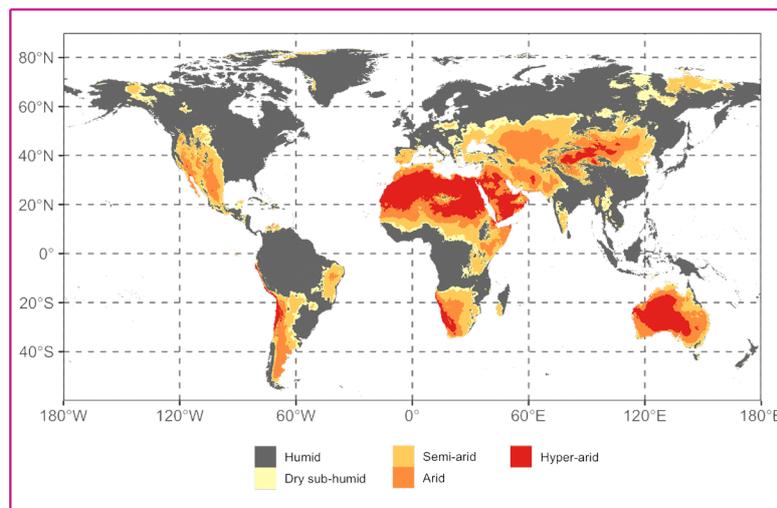

Figure 7.4 Geographical Distributions of Drylands
Delimited based on the Aridity Index (AI): humid AI > 0.65; dry sub-humid 0.50 < AI ≤ 0.65; semi-arid 0.20 < AI ≤ 0.50; arid 0.05 < AI ≤ 0.20; hyper-arid AI < 0.05. (Abatzoglou et al., 2018 in IPCC, 2019).

Deserts often occur naturally adjacent to cold ocean currents and at the interior of continents. Desertification posed by land degradation is rather derived from anthropogenic forces. Population pressure; policy and socioeconomic settings; expansion of farming to drylands; forest burning; and inappropriate land use and management practices are among the anthropogenic causes of desertification. Human-derived climate change exacerbates the intensity of desertification. Desert landscapes are characterized by increased aridity, barren and saline soils, and sparse vegetation (e.g. see desert and drought-affected environments in Ethiopia; Figure 7.5).

Jigjiga town; Red sand plains (eastern Ogaden); Mustahil plateau (south central Ogaden); & Wabishebelle River canyon (Billi, 2015)

Hilly landscapes in the Danakil depression, https://www.wildfrontierstravel.com/en_GB/blog/places-to-visit-in-ethiopia

Desert plain in Afar lowlands (Enrique et al., 2018) https://hal.archives-ouvertes.fr/hal-02888183/document

Figure 7.5 Desert landscapes in Ethiopia's Afar & Somali Region

Like land degradation, desertification poses several impacts on the environment and human livelihoods. For example, it:

◈ lessens the productivity of agriculture and household incomes;

◈ minimizes the provision of dryland ecosystem services;

◈ causes contraction of biological diversity;

◈ leads to the expansion of invasive plant and animal species;

◈ increases soil salinity (accumulation of dissolved salts in groundwater); and

◈ rising greenhouse gas (GHG) emissions.

> **(?)** Referring Figure 7.4 and the foregoing notes:
> 1. Which part of the world is affected by hyper aridity?
> 2. What anthropogenic forces cause desertification?
> 3. What are the impacts of desertification?
> 4. Explain how desertification can be minimized?

As you can see desertification causes many ecological and socioeconomic impacts. So, how can it be minimized? The following measures are suggested to restrain its effects:

◈ application of indigenous and local knowledge: e.g. dry farming and irrigation;

◈ using site-specific technological options (e.g. water harvesting);

◈ diversification of farming and income sources;

◈   growing drought-resilient and short-maturing crops;

◈   application of terracing, relay cropping, intercropping, and reduced tillage practices;

◈   livelihood diversification: non-farm and off-farm work; and

◈   enhancing early-warning mechanisms.

Activity 7.2.2

Dear learner; attempt the following questions by referring to the foregoing notes.

1.   Why is land degradation such a critical problem for rural households in DCs?

2.   How do you distinguish between desertification and land degradation?

3.   What are the major strategies that can be used to reduce land degradation and desertification?

Feedback to Activity Questions

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

Feedback to Activity 7.2.1

1. What is land degradation?

Land degradation is the long-term reduction of the productive capacity of land resources due to the loss of quantity and quality. Land degradation causes the loss of ecological integrity and value to humans

2. What is desertification?

Desertification is land degradation in the drylands (in the arid, semi-arid, and dry sub-humid areas).

3. How do you explain the cause-and-effect relationship between land degradation and desertification?

Land degradation is the long-term reduction of land productivity, ecological integrity, and value to humans. Desertification is land degradation in the drylands. Land degradation exacerbates desertification. So, they are related. The difference between the two is geographic.

Feedback to Activity 7.2.2

1. Why is land degradation such a critical problem for rural households in developing countries?

Land degradation is a critical problem for rural households in DCs because:

◈   it damages the livelihood resources of rural households;

◈   it distorts (upsets) the harvesting seasons by causing climate change;

◈   expose the rural households to drought, flooding, famine, and plague;

◈   erode the livelihood capacity of rural households; and

◈   because rural households are easily vulnerable to degradation hazards and have a low capacity to cope-up with the hazards.

2. How do you distinguish between desertification and land degradation?

Land degradation is the long-term reduction of land productivity, ecological integrity, and value to humans. Desertification is land degradation in the drylands. Land degradation exacerbates desertification. So, they are related. The difference between the two is geographic.

3. What measures can be used to reduce land degradation and desertification?

Land degradation can be minimized through:

◈ afforestation and reforestation: planting trees in barren and deforested areas;

◈ controlling unsustainable tree cutting for fuel and construction;

◈ limiting the expansion of farming to marginal lands; and

◈ using alternative energy sources to reduce tree cutting for fuel.

The following measures are used to restrain the effects of land degradation and desertification:

◈ application of indigenous and local knowledge (ILK): e.g. dry farming and irrigation;

◈ using site-specific technological options;

◈ water harvesting (planting pits, micro-basins, micro-ponds);

◈ diversification of farming and income sources;

◈ growing drought-resilient and short-maturing crops;

◈ application of terracing, relay cropping, intercropping, and reduced tillage practices;

◈ livelihood diversification: non-farm and off-farm work; and

◈ enhancing early-warning mechanisms.

Section Summary

This topic was about land degradation and desertification, their causes, impacts, and control measures. Land degradation is the long-term reduction of the productive capacity of land resources due to the loss of quantity and quality. It is caused by natural and human factors. The natural factors include the alteration of landscapes by volcanic eruption, flooding, and tsunami. The human factors are population pressure and anthropogenic-induced climate change; improper farming practices; land use/cover changes; rapid urbanization; weak policies and institutions, and unsustainable use and management of environmental resources.

Land degradation damages freshwater and marine ecosystems plus the livelihood of households and communities. It drives climate change through the release of greenhouse gases (GHGs) and minimizes rates of carbon sequestration. Land degradation and climate change cause risky livelihoods accompanied by food insecurity and poverty. The hazards of land degradation and climate change further instigate ever-increasing harms and unwelcome vagaries like forced resource conflicts, poverty, and migration.

Land degradation can be minimized by afforestation and reforestation; controlling unsustainable tree-cutting for fuel and construction; limiting the expansion of farming to marginal lands; and using alternative energy sources to reduce tree-cutting for fuel.

Desertification is land degradation in the drylands (in the arid, semi-arid, and dry sub-humid areas). Deserts often occur naturally adjacent to cold ocean currents and at the interior of continents. Desertification posed by land degradation is rather derived from anthropogenic forces. Population pressure; policy and socioeconomic settings; expansion of farming to drylands; forest burning; and inappropriate land use and management practices are among the anthropogenic causes of desertification.

Like land degradation, desertification poses several impacts on the environment and human livelihoods.

Desertification lowers the productivity of agriculture and household incomes; minimizes the provision of dryland ecosystem services; causes contraction of the biological diversity; leads to the expansion of invasive plant and animal species; increases soil salinity (accumulation of dissolved salts in groundwater); and rising greenhouse gas (GHG) emissions.

Application of indigenous and local knowledge: (e.g. dry farming and irrigation); using site-specific technological options (e.g. water harvesting); diversification of farming and income sources; growing drought-resilient and short maturing crops; construction of terraces; practicing intercropping and minimum tillage; diversification of livelihoods (e.g. non-farm and off-farm work); and enhancing early-warning mechanisms are among the measures suggested to minimize the effects of desertification.

Generally, the degradation of land and its resources is happening at a wider scale all over the world; yet, the impacts are much worse in developing countries like Africa. The devastating damages of land degradation and desertification are more evident from loss of land productivity, water and air pollution, and contraction of vegetation cover over an area. It is commonly connected with other environmental and socioeconomic hazards such as climate change and widespread poverty. This has an important implication on the health of the total environment of the Earth and peoples' livelihoods.

Checklist 1.1

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

№	Questions	Yes	No
1	Did you identify the forms of land degradation?		
2	Did you describe the consequences of land degradation?		
3	Have you evaluated the relationship between land degradation and desertification?		

Self-test Exercise 7.2

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

Part I) True/False

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

1. Chemical degradation results in only the physical alteration of land resources.
2. Land degradation is caused by only anthropogenic factors.
3. Land degradation drives climate change through the release of greenhouse gases (GHGs).
4. Deserts commonly occur adjacent to cold ocean currents and at the interior of continents.
5. Desert landscapes are characterized by increased aridity, barren and saline soils, and sparse vegetation.

Part II) Multiple Choices

Instruction: For questions 6-10, choose the best answer from the given alternatives (5 points)

6. Which of the following is not an anthropogenic cause of land degradation?

      A) Overstocking, intensive plowing, and improper agricultural practices

      B) Alteration of landscapes by volcanic eruption, flooding, and tsunami

      C) Tenure insecurity, faulty government policy, and fragile institutions

      D) Urban expansion, forest burning, and tree cutting for fuel and timber

7. Which of the following is not a typical impact of land degradation and desertification?

      A) Loss of the biological diversity

      B) Expansion of invasive species

      C) Emission of greenhouse gases

      D) Loss of land by armed conflict

8. Which of the following community groups are more affected by land degradation and desertification?

      A) Poor people who primarily depend on raw resources

      B) The urban wealthy rural commercial farmers

      C) The diplomatic community and government officials

      D) Teachers and people with higher adaptation choices

9. In which of the following parts of the world hyper aridity dominantly prevails?

      A) The vast area of North America and Western Europe

      B) The western coast of Central and Equatorial Africa

      C) The Sahara Region of Africa and a large part of Arabia

      D) Southeast Asia and the Caribbean region of America

10. Which of the following help to minimize land degradation?

      A) Expansion of farming into intact forest areas

      B) Planting trees on barren and deforested areas

      C) Promoting urban expansion in the rural areas

      D) Stop practicing agriculture in the rural areas

Part III) Short Answer Writing

Instruction: Give short answers to questions 11-12 (10 points)

11. What are the forms of land degradation? (3 points)

12. List down the possible measures that should be taken to minimize desertification? (7 points).

⚷━🔨 Answer Key to Self-test Exercise 7.2

Dear learner; we hope you did well in the self-testing. So now, you are at the stage of completion of the second section of module seven. Thank you for doing the self-test questions. Now, please compare your answers with the feedback given and make corrections if there are errors in your answers.

Part I) True/False		Part II) Multiple Choices	
1	False	6	B
2	False	7	D
3	True	8	A
4	True	9	C
5	True	10	B

Part III) Short Answer Writing	
11	The forms of land degradation are physical, chemical, and biological
12	The measures that should be taken to minimize desertification include the following: - application of indigenous and local knowledge: e.g. dry farming and irrigation; - using site-specific technological options (e.g. water harvesting); - diversification of farming and income sources; - growing drought-resilient and short-maturing crops; - application of terracing, intercropping, and reduced tillage practices; - livelihood diversification: non-farm and off-farm work; and - enhancing early-warning mechanisms.

Dear learner; how did you find the lesson? We think you enjoyed it and found it very interesting and exciting. We 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
RECURRENT DROUGHTS AND FAMINES
(3 Hours)

✴ Section Overview

Droughts are prolonged deficiencies of moisture and water shortage for certain activities. They are often associated with rainfall abnormalities that cause serious hydrological imbalances. Droughts can be categorized as metrological, hydrological, agricultural, environmental, and socioeconomic, depending on purpose and domain. Famines are also associated with severe and prolonged hunger due to a lack of edible items. Droughts and famines are interrelated; when drought occurs, famine follows. Both cause a wide range of devastations to the environment, population, health, and livelihoods. Dear learner; this topic is about the environmental problems mentioned above. Hence, please continue reading the notes with doing the activity questions and try to relate your learning with the issues discussed in the foregoing section.

Section Learning Outcomes

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

🌍 illustrate areas prone to droughts and famines; and

🌍 evaluate the relationship between droughts and famines.

Keywords:

■ Famines;

■ Impacts;

■ Mitigation measures;

■ Recurrent droughts.

7.3.1 Drought

Drought is a prolonged deficiency of moisture and water for certain activities. It is often allied to rainfall abnormality that commonly causes a serious hydrological imbalance. Drought can be categorized as metrological, hydrological, agricultural, environmental, and/or socioeconomic based on intended specific purposes.

❓ By reading the foregoing notes, how you define drought?
How drought is defined by different professionals?

Dear student; please think over the question given above and try to relate your thinking with the proceeding notes.

As can be seen from the preceding paragraph, drought is the persistent absence of rainfall that causes water shortage for certain activities. It results in hydrological imbalance and abnormal dry spells due to long periods of dry weather. As mentioned earlier, the definition of drought can vary with the variations of the intended objectives of different professions. For instance, in the science of metrology, drought is primarily defined as an extended shortfall of rainfall.

Hydrological drought on the other hand relates to the under-normal water flow in the lakes, streams, and underground sources. Agricultural drought is defined as the deficit of moisture on the topsoil. This is because the absence of moisture on the topmost part of the soil affects the growth of crops. The aforementioned three drought types in combination form the environmental drought. They together lead to the imbalance between demand and supply in society; commonly named socioeconomic drought. Socioeconomic drought thus links to the supply and demand of material goods (like water, fodder, food crops, fish, and energy). It has also strong links with the features of meteorological, hydrological, and agricultural droughts.

> **(?)** In which areas drought frequently occurs?
> Why is the reason?

Droughts are very common in arid drylands. They frequently happen in those areas through the occurrences of extreme climatic events. The persistent occurrence of anticyclones or advection of hot and dry air masses exacerbates the conditions of the drier areas. Rainfall reductions and excessive moisture losses because of high-temperature levels in the drier areas causally drive the occurrence of droughts.

> **(?)** How are the global trends and patterns of drought?
> Explain using examples?

The global trends (frequency & intensity) of droughts have been increasing in West Africa and the Mediterranean region since the 1950s. Conversely, droughts have been showing decreasing trends in Central America, North America, and northwest Australia. Due to climate change, the intensity and frequency of droughts have also been shown to exacerbate the severity of meteorological and agricultural droughts over the drylands of the world.

> **(?)** What are the impacts and mitigating measures of drought?

The following are the direct and indirect effects of drought:
   ◈   droughts directly affect agricultural production (e.g. see Figure 7.6);
   ◈   they reduce water supply (dry-up wetlands);
   ◈   reduce plant diversity and composition;
   ◈   cause the loss of biodiversity and natural ecosystems;
   ◈   droughts indirectly affect business, employment opportunities, and income;
   ◈   they cause health hazards to humans and animals;
   ◈   cause a rise in food prices, food insecurity, malnutrition, widespread famine, starvation, & poverty;
   ◈   raise school dropout rates; and
   ◈   migration, social unrest, and even conflict in extreme cases.
   The responses for drought occurrence include the use of:
   ◈   improved drought monitoring services;
   ◈   better water and crop management strategies (e.g. the use of groundwater supplies);
   ◈   creation of public awareness and education;
   ◈   watershed management and local planning strategies; and
   ◈   developing early-warning capacities.

The aforementioned drought mitigation measures and responses can be accomplished through:

◈ soil and water conservation (SWC) practices: (e.g. crop rotation, row cropping, terracing, minimum tillage, trenches, shallow wells, shelterbelts, mulching, and reclamation of salt-affected soil; see Unit Three of this text); and

◈ herd management: raising improved breeds and parasite control.

Drought-affected livestock (Eastern Ethiopia)

Famine victims waiting for food aid (Ethiopia)

Crop failure due to drought in Ethiopia

Water crisis due to drought (Ethiopia)

Figure 7.6 The effects of climate change-induced drought and famine in Ethiopia.

Dear learner; analyze the figures representing the degraded land and dry area and suggest what should be done by humans both in short and long-term schemes in your perspectives.

Activity 7.3.1

Attempt the questions listed below before reading the descriptions given.

1. How do you understand the linkage between drought and famine?
2. Why are drylands highly vulnerable to recurrent droughts?
3. Why are developing countries highly vulnerable to famines?

7.3.2 Famine

Famine is persistent and acute hunger or starvation caused by food and water scarcity over a geographic area. It is accompanied by severe and prolonged hunger due to a lack of edible items as a result of drought or any other risk. It is commonly linked to drought or perhaps the two complement each other. Both cause a wide range of devastations on the environment, population, health, and livelihoods. Dear student; this topic thus focuses on the causes, impacts, and prevention measures of famine.

> **(?)** What is famine?
> How it differs from drought and for how long it persists?

Famine is persistent and acute hunger or starvation caused by food and water scarcity over a geographic area. It is a widespread and severe state of malnourishment, starvation, illness, and death of a significant part of the population. It is caused by natural and human factors. Recurrent droughts, landslides, floods, tsunamis, locust invasions, epidemics, an unfair share of resources, inequalities, plus wars, and conflicts result in famines and starvation among human beings. Famines may cover considerable periods lasting from some months to a few years.

> **(?)** From the foregoing reading; how do you characterize the causes of drought?
> How is famine prevented and minimized?

Famines can be minimized by using the following strategies:

- ❖ accessing humanitarian aid: this involves the donation of food and other necessities including healthcare to address the immediate and basic needs of the victims (e.g. see Figure 7.6);
- ❖ rebuild communities: taking rehabilitation and restoration measures;
- ❖ strengthen local food system resilience: working on sustainable food access options;
- ❖ focus on long-term economic strategies: promotion of long-term socio-economic development measures (e.g. diversification of the economy; expansion of employment options; liberalizing the market and product distribution patterns; etc.).

> **Activity 7.3.2**
>
> These questions listed below help you discuss drought occurrence, types of droughts, and mitigation strategies. Thus, attempt them by writing the answers on a piece of paper.
> 1. How does drought occur?
> 2. How do you relate and differentiate the drought types?
> 3. What are the key strategies for famine prevention?

Feedback to Activity Questions

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

Feedback to Activity 7.3.1

1. How do you understand the linkage between drought and famine?

Droughts are prolonged deficiencies of moisture and water for certain activities. They are often associated with rainfall abnormalities and cause serious hydrological imbalances. Famines are also associated with severe and prolonged hunger due to a lack of edible items. Droughts and famines are thus interrelated; one supports the other. Both cause wider damage to the environment, population, health, and livelihoods.

2. Why are drylands highly vulnerable to recurrent droughts?

Drylands are highly vulnerable to recurrent droughts because they are characterized by erratic and low rainfalls.

3. Why are developing countries highly vulnerable to famines?

Developing countries are highly vulnerable to famines because they cannot properly use and manage their environmental resources and have a low capacity to cope-up with disasters.

Feedback to Activity 7.3.2

1. How does drought occur?

Drought occurs when prolonged deficiency of moisture and water emerges for certain activities. It is often allied to rainfall abnormality that commonly causes a serious hydrological imbalance.

2. How do you differentiate the drought types?

Droughts can be differentiated and categorized as metrological, hydrological, agricultural, environmental, and/or socioeconomic based on intended specific purposes.

3. What are the key strategies for famine prevention?

The key strategies for famines prevention are:
  ◈ accessing humanitarian aid: food donation;
  ◈ rebuilding communities: taking rehabilitation and restoration measures;
  ◈ strengthen local food system resilience: working on sustainable food access options; and
  ◈ focusing on long-term economic strategies: promotion of long-term socio-economic development measures (e.g. diversification of the economy; expansion of employment options; liberalizing the market and product distribution patterns; etc.).

Section Summary

Drought is a prolonged deficiency of moisture and water for certain activities. It is often linked to rainfall abnormality that results in serious hydrological imbalance and dry spells for a sizeable period. Drought can be classified into metrological, hydrological, agricultural, environmental, and socioeconomic, depending on purpose and domain. Drought is very common in arid drylands because of the frequent occurrence of extreme climatic events in those areas. The global trend (frequency & intensity) of drought has been increasing in West Africa and the Mediterranean region since the 1950s. Conversely, drought has been showing a decreasing trend in Central America, North America, and northwest Australia.

Drought directly affects agricultural production; reduces water supply (dry-up wetlands); shrinks the diversity and composition of biological mass; and disrupts the natural ecosystems. Drought indirectly affects business, employment opportunities, and income. It inflicts health hazards on humans and animals. Through affecting agricultural production, drought causes a rise in food prices, food insecurity, malnutrition, widespread famine, starvation, and poverty. Drought can raise school dropout rates; migration, social unrest, and even conflict in extreme cases.

Drought occurrences could be reduced through improved drought monitoring services; by using better water and crop management strategies (e.g. the use of groundwater supplies); via the creation of public awareness and education; through the use of watershed management and local planning strategies; and by developing early-warning capacities.

Famine is persistent and acute hunger or starvation caused by food and water scarcity over a geographic area. It is a widespread and severe state of malnourishment, starvation, illness, and death of a significant part of the population. It is caused by natural and human factors. Recurrent droughts, landslides, floods, tsunamis, locust invasions, epidemics, an unfair share of resources, inequalities, plus wars, and conflicts result in famines and starvation among human beings. Famines may cover considerable periods lasting from some months to a few years.

Famines can be minimized by using strategies like accessing humanitarian aid: rebuilding communities: strengthening local food system resilience: and promoting long-term socio-economic development measures (e.g. diversification of the economy; expansion of employment options; liberalizing the market and product distribution patterns; etc.).

✓ Checklist 7.3

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

№	Questions	Yes	No
1	Have you illustrated areas prone to droughts and famines?		
2	Did you evaluate the relationship between droughts and famines?		

Self-test Exercise 7.3

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

Part I) True/False

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

1. Droughts are very common over the wetlands.

2. Droughts directly affect agricultural production.

3. Socioeconomic drought links to the supply and demand of material goods in society.

4. Famines often end in short periods and never stay for months or years.

5. Famines never affect livestock populations.

Part II) Multiple Choices

Instruction: For questions 6-10, choose the best answer from the given alternatives (5 points)

6. In which of the following regions does the frequency and intensity of drought trends been increasing?

      A) West Africa and the Mediterranean region

      B) Central America and the Caribbean region

      C) Southwestern Australia and Southeast Asia

      D) North America, Central, and Southern Africa

7. An extended shortfall of rainfall is primarily considered as;

      A) Hydrological drought

      B) Agricultural drought

      C) Metrological drought

      D) environmental drought

8. In which part of the world drought has been showing a decreasing trend?

      A) West Africa and the Mediterranean region

      B) Central America, North America & Australia

      C) Central, South and North America and Europe

      D) Central, northern, eastern, and Southern Africa

9. Which of the following is a direct effect of drought?

   A) Social unrest and civil conflict

   B) Student drop-out from schools

   C) Drying-up of wetlands & ponds

   D) The rise of eatable food prices

10. Which of the following cannot be characterized as the cause of famine?

   A) Wars and conflicts

   B) Floods and tsunamis

   C) Recurrent droughts

   D) Better technology

Part III) Short Answer Writing

Instruction: Give short answers to questions 11-13 (10 points)

11. When below-normal water flow occurs over the rivers, lakes, and streams, it is commonly classified as _____ drought (2 points).

12. What are the key strategies for minimizing famine? (4 points)

13. Explain the differences and relations of drought and famine? (4 points)

Answer Key to Self-test Exercise 7.3

Dear learner; we hope you did well in the self-testing. So now, you are at the stage of completion of the third section of module seven. Thank you for doing the self-test questions. Now, please compare your answers with the feedback given and make corrections if there are errors in your answers.

Part I) True/False		Part II) Multiple Choices	
1	False	6	A
2	True	7	C
3	True	8	B
4	False	9	C
5	False	10	D

Part III) Short Answer Writing	
11	When below-normal water flow occurs over the rivers, lakes, and streams, it is classified as a Hydrological drought.
12	The key strategies used to minimize famine include the following: ◈ accessing humanitarian aid: the donation of food and other necessities including healthcare to address the immediate and basic needs of the victims; ◈ rebuild communities: taking rehabilitation and restoration measures; ◈ strengthen local food system resilience: working on sustainable food access options; and ◈ promotion of long-term socio-economic development measures (e.g. diversification of the economy; expansion of employment options; liberalizing the market and product distribution patterns; etc.).

Part III) Short Answer Writing	
13	◈ Droughts are prolonged deficiencies of moisture and water shortage for certain activities. Famines are associated with severe and prolonged hunger due to a lack of edible items. Droughts and famines are usually interrelated. When drought occurs, famine follows. Both cause a wide range of devastations to the environment, population, health, and livelihoods.

Dear learner; how did you find the lesson? We think you enjoyed it and found it very interesting and exciting. We 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 FOUR
DEFORESTATION (1 hour)

⚙ Section Overview

Dear learner, forest ecosystems provide a wide range of services. They stabilize local climates; control flooding, and filter human and natural wastes. Forest trees minimize soil erosion at local, regional, or global scales. They also uptake and store the world's carbon stocks and serve as heat and waste sequestration. Forest resources again serve as a habitat for the Earth's known terrestrial species. Nevertheless, deforestation (excessive tree cutting), encroachment of farming into the communal forest areas, and mismanagement largely reduce their services despite the enormous benefits that they provide. Dear learner; the topic at hand thus focuses on deforestation.

Section Learning Outcomes

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

🌍   identify the causes of deforestation; and

🌍   describe the consequences of deforestation.

Keywords:

■   Causes;

■   Consequences;

■   Deforestation.

Activity 7. 4.1

1. Distinguish between forest degradation and deforestation?

2. What are the direct and underlying drivers of deforestation?

3. What are the effects of deforestation?

Dear student; focus on these questions and try to address them in detail and get prepared for the next lesson.

7.4.1 Causes and Consequences of Deforestation

Deforestation refers to the removal of forest trees and their products through commercial logging; clearing and burning of vegetation for farmland expansion; and/or cutting trees for construction and fuel-wood demands (see Figure 7.7).

(?) What are the causes of deforestation?
Dear learner; please identify the underlying and proximate causes of deforestation.

The sources of deforestation can be classified as underlying and proximate causes. The underlying causes are indirect sources but play a principal role in deforestation to happen. One of these is climate change (change in rainfall levels & patterns). The other is purely anthropogenic. It includes population pressure, cultural and socioeconomic variables, and government policy types.

For instance, flawed policies cause tenure insecurities, weak law enforcement, and wrong allocation of rights. Regressive cultural practices lead to unsustainable use of forest resources. Weak economic policies push poor investment patterns and promote the rate of deforestation. High population growth transpires additional demand for resources and expansion of farming to the virgin lands through the emergence of new landless households.

The proximate causes are direct drivers of deforestation (see Figure 7.7). They include:

◈ clearing and burning of forest trees for farmland expansion;

◈ fuel-wood collection and timber production;

◈ expansion of new settlements and infrastructural developments;

◈ mining and quarrying activities;

◈ commercial logging practices; and

◈ overstocking and overgrazing.

Dear student; how do the causes of deforestation outlined here similar or different from what you have known in your locality? Please capitalize on this and answer the following questions.

(?) What are the consequences of deforestation?
How deforestation can be minimized?

When forests are removed:

◈ long-term carbon stock reduction may happen;

◈ loss of biodiversity and other products will occur;

◈ destruction of biomes and wildlife habitats happens;

◈ disruption of the natural hydrological cycle and river ecosystems may ensue;

◈ droughts and famines may transpire;

◈ erosion, flooding, and sedimentation can take place;

◈ soil nutrient depletion may take place; and

◈ global warming and climate change may become worse.

Figure 7.7 Ways of Deforestation and vegetation removal

Burning of forest vegetation using fire for agricultural land in shifting cultivation areas

Wood collection for household fuel

Tree cutting for furniture making (for home industries)

Vegetation removal through overstocking

In general, forests provide a wide range of services. They stabilize local climates; control flooding, and filter human and natural wastes. Forest trees minimize soil erosion at local, regional, or global scales. They uptake and store the world's carbon stocks and serve as heat and waste sequestration. Forest resources again serve as a habitat for the Earth's known terrestrial species. Nevertheless, deforestation (excessive tree cutting), encroachment of farming into the communal forest areas, and mismanagement largely reduce their services despite the enormous benefits they provide. The risks of deforestation can be minimized through the proper use of available forests and by planting trees in degraded areas. Running afforestation and reforestation programs; area closures; controlling forest burning; restricting commercial logging; using alternative energy in place of firewood, and using rubber panels in place of timber help to minimize the rapid loss of forests.

Activity 7.4.2

Dear learner; try the following questions after reading the foregoing notes.

1. Differentiate between deforestation and forest degradation.
2. How do you understand the connection between proximate and underlying causes of deforestation?
3. How do you justify sustainable forest management?

Feedback to Activity Questions

Feedback to Activity 7.4.1

1. Distinguish between forest degradation and deforestation

Forest degradation is a direct human-induced activity that causes long-term alteration of the tree species in the natural forests. It strongly alters the stock of forest carbon, woodlots, biological diversity, and other services provided by forests. Deforestation is simply the way of destroying forest plants by cutting, clearing, and/or burning for different purposes like agriculture and urbanization.

2. What are the direct and underlying drivers of deforestation?

Direct drivers of deforestation or forest degradation include:

- tree-cutting for agricultural expansion,
- mining and quarrying in forested areas,
- forest clearing for settlement space,
- commercial logging,
- fuelwood collection for heating and cooking,
- charcoal production,
- uncontrolled fires, and
- overgrazing in the forested areas.

The underlying causes are:

◈ socioeconomic, cultural, and political factors,

◈ unsound government policies,

◈ weak governance and lack of law enforcement,

◈ land tenure policies (landlessness),

◈ unfair allocation of rights,

◈ rural poverty,

◈ lack of investment and financial resources,

◈ population growth and migration, and

◈ civil conflicts.

3. What are the effects of deforestation?

The effects of deforestation are:

◈ habitat destruction and loss of biodiversity;

◈ disruption of the water cycle and river ecosystems,

◈ drought, famine, starvation,

◈ more erosion, flooding, and sedimentation,

◈ siltation of dams and reservoirs;

◈ loss of soil nutrients; and

◈ global warming and climate change.

Feedback to Activity 7.4.2

1. Differentiate between deforestation and forest degradation.

Forest degradation is a direct human-induced activity that causes long-term alteration of the tree species in the natural forests. It strongly alters the stock of forest carbon, woodlots, biological diversity, and other services provided by forests. Deforestation is simply the way of destroying forest plants by cutting, clearing, and/or burning for different purposes like agriculture and urbanization.

2. How do you understand the connection between proximate and underlying causes of deforestation?

The underlying causes are indirect sources but play a principal role in deforestation to happen. They are factors like climate change, population pressure, cultural and socioeconomic variables, and government policy types. The proximate causes are direct deforestation activities like tree cutting, burning, overstocking and commercial logging. The underlying factors cause proximate factors to happen. For instance, flawed policies cause tenure insecurities, weak law enforcement, and wrong allocation of rights. Regressive cultural practices lead to unsustainable use of forest resources. Weak economic policies push poor investment patterns and promote the rate of deforestation.

Section Summary

Forest ecosystems provide a wide range of services. They stabilize local climates; control flooding, and filter human and natural wastes. Forest trees minimize soil erosion at local, regional, or global scales. They uptake and store the world's carbon stocks and serve as heat and waste sequestration. Forest resources again serve as a habitat for the Earth's known terrestrial species. Nevertheless, deforestation (excessive tree cutting), encroachment of farming into the communal forest areas, and mismanagement largely reduce their services despite the enormous benefits they provide.

The sources of deforestation can be classified as underlying and proximate causes. The underlying causes are indirect sources but play a principal role in deforestation to happen. One of these is climate change (change in rainfall levels & patterns). The other is purely anthropogenic. It includes population pressure, cultural and socioeconomic variables, and government policy types. For instance, flawed policies cause tenure insecurities, weak law enforcement, and wrong allocation of rights. Regressive cultural practices lead to unsustainable use of forest resources. Weak economic policies push poor investment patterns and promote the rate of deforestation. High population growth transpires additional demand for resources and expansion of farming to the virgin lands through the emergence of new landless households.

Deforestation results in the destruction of habitats and the loss of biodiversity. It may lead to the disruption of the water cycle and river ecosystems. Drought, famines, starvations, soil erosion, flooding, and sedimentation may accompany the processes of deforestation. These conditions in turn may cause the siltation of dams and reservoirs; loss of soil nutrients; global warming and climate change.
The risks of deforestation can be minimized through the proper use of available forests and by planting trees in degraded areas. Running afforestation and reforestation programs; area closures; controlling forest burning; restricting commercial logging; using alternative energy in place of firewood, and using rubber panels in place of timber help to minimize the rapid loss of forests.

✓ Checklist 7.4

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

№	Questions	Yes	No
1	Did you identify the causes of deforestation?		
2	Did you describe the consequences of deforestation?		

Self-test Exercise 7.4

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

Part I) True/False

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

1. Forest destruction does not lead to long-term carbon stock reduction

2. Clearing and burning of forest trees for farmland expansion directly affect forests

3. Stop using forest trees for construction could be the best solution to conserve forests

4. Deforestation encourages sustainable use of forest resources.

5. Forests uptake and store the world's largest carbon stocks

Part II) Multiple Choices

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

6. Natural forests can serve as:

    A) Sink of wastes

    B) Natural habitat

    C) Source of food

    D) All of the above

7. Which of the following is not an underlying source of forest destruction?

    A) Defective government policy

    B) Tree cutting for construction

    C) Regressive cultural practices

    D) Change in the rainfall patterns

8. Which of the following is not resulting from deforestation?

    A) Destruction of the biodiversity

    B) Disruption of river ecosystems

    C) Flooding, droughts, and famines

    D) Rich biodiversity & intact forests

9. Which of the following help to minimize the risks of deforestation?

> A) Expanding commercial logging
>
> B) Converting forests to grasslands
>
> C) Running reforestation programs
>
> D) Stop using timber for building

10. Which is not true about the effect of deforestation?

> A) Deforestation stabilizes global and local climates
>
> B) Deforestation disrupts river/freshwater ecosystems
>
> C) Deforestation damages terrestrial ecological systems
>
> D) Deforestation disrupts the natural balance of heat waves

Part III) Short Answer Writing

Instruction: Give short answers to questions 11-13 (10 points)

11. List down at least three underlying causes of deforestation

12. Write three direct sources of forest destruction

13. What is sustainable forest management?

Answer Key to Self-test Exercise 7.4

Dear learner; we hope you did well in the self-testing. You are now at the stage of completion of the fourth section of module seven. Now, please compare your answers with the feedback given and make corrections if there are errors in your answers.

Part I) True/False		Part II) Multiple Choices	
1	False	6	D
2	True	7	B
3	False	8	D
4	False	9	C
5	True	10	A

Part III) Short Answer Writing	
11	Examples of underlying causes of deforestation: ● Climate change ● Population pressure ● Cultural practices ● Government policy
12	Examples of direct causes of deforestation: ● Tree cutting for timber ● Forest burning ● Farmland clearing through vegetation removal ● Fuel wood collection
13	Sustainable forest management is the wise use of available forests with not compromising their future potential to benefit the coming generations. Sustainable forest management does not mean discontinuing using forests. Available forests can be used with replacement through afforestation and reforestation.

SECTION FIVE
THE WORLDWIDE DIGITAL DIVIDE
(3 Hours)

⚓ Section Overview

The digital divide refers to the gap existing among persons, households, companies, and geographic areas with diverse socioeconomic backgrounds related to access to information about economic and political opportunities and the use of the internet for a wide variety of purposes. Access gaps to computers, televisions (TVS), mobile phones, and internet services are important indicators of the digital divide. On the international scale, telecommunication services provide universal access to narrow the gap of the digital divide. Dear student; this topic is thus aimed at familiarizing you with these disparities.

Section Learning Outcomes

Dear learner; at the end of this section, you will be able to:

🌍　explain the emerging digital divide between different regions of the world.

Keywords:

■ Advantages;
■ Disadvantages;
■ Digital divide;
■ ICT.

7.5.1 Digital Divide, Advantages, and Limitations

The digital divide is the breach between persons, families, companies, and geographic regions at varied socioeconomic levels concerning retrieving relevant information for getting access to a wide range of economic and political opportunities. It mainly relates to the difference in getting access to information communication technologies (ICTs) and the use of the internet for a wide variety of activities. On an international scale, availability of the universal telecommunication access plays an important role in narrowing the gap of the worldwide digital divide. Access to TVs, computers, mobile phones, and the internet is an imperative sign of the digital divide. Dear learner; please think over the ongoing question and try to integrate it with the notes that follow.

(?) Dear leaner; how you understand the digital divide after reading the foregoing notes?

Although ICT utilization has been vividly expanded over the past decades, access appears to diverge widely between regions; and also between countries. For instance, access and exposure to internet technology are at the lowest among the countries in South Asia, and SSA; is equated to MDCs. The possible reasons for the growing gaps are:

◈　income and financial shortages;
◈　poor quality Vs. expensive connections;

◈ low level of education (lack of digital literacy and poor technical knowhow);

◈ limited access to ICT;

◈ lack of knowledge and understanding of the technology; and

◈ absence of opportunity to learn how to use computers.

Dear student; we hope you are reflecting on your level of comprehension of the important concepts and issues covered and those ahead. Thus, identify and analyze important points emphasized, questions posed, and illustrative figures and strive to construct your understanding.

> **Activity 7.5.1**
> 1. What is a digital divide?
> 2. Identify factors intensifying the global digital divide.

The digital divide among the information "haves" and 'have nots' mainly relies on income and education. Factors such as family size, age, sex, cultural and linguistic experiences plus geographic location likewise play imperative roles. Governments should play the principal role in narrowing the breach by making and organizing reachable e-services and plausible ICT. Implementing a cohesive and citizen-oriented style might lead governments to enhance fair opportunities in the use of ICTs.

1. From the foregoing reading, which world countries have the lowest digital connections?
2. What factors cause the gap in accessing the digital technology?
3. What are the consequences of the digital divide?

Consequences of the digital divide:

◈ damage to old businesses takes away jobs (because digital works need more education);

◈ broadens income inequality (worsening income disparity among individuals & countries); and

◈ exacerbates the hazard of personal security (cyber terrorism, criminal networks, illegal money, hate speech, fake news, etc.).

What are the advantages of the digital divide?

Advantages of digitalization:

◈ travel reservations, translations, support and customer services, telemedicine and e-learning,

◈ social networking,

◈ provision of affordable education and learning materials for students,

◈ real-time weather and market information for poor farmers and fishermen,

◈ training for teachers, medical diagnosis and information for those living remotely, and

◈ financial services for the unbanked services previously out of reach for remote areas and under-served populations.

> **Activity 7.5.2**
>
> 1. How could bridging the digital divide take place?
> 2. What are the opportunities and challenges of digitalization?

Feedback to Activity Questions

Feedback to Activity 7.5.1

1. What is a digital divide?

The Digital divide is the gap existing among persons, households, companies, and regions in socioeconomic and political development due to the differences in access to information; information communication technologies (ICTs); and use of the internet for a wide variety of purposes.

2. Identify factors intensifying the global digital divide.

The factors intensifying the global digital divide include:

◈ differences in digital knowledge and technology,

◈ gaps in socio-economic development,

◈ financial and material resource disparities,

◈ location disparities,

◈ the commitment of governments, and

◈ lack of access to digital services (computer, mobile phone, television, radio, etc.)

Feedback to Activity 7.5.2

1. How could bridging the digital divide take place?

Bridging the digital divide could be made by enhancing financial, educational, and technological capacities. Accessing TVs, computers, mobile phones, and the internet can narrow the gap of the digital divide between MDCs and DCs.

2. What are the opportunities and challenges of digitalization?

Opportunities or advantages of the digital divide are:

◈ travel reservations, translations, support and customer services, telemedicine, and e-learning;

◈ social networking;

◈ provision of affordable education and learning materials for students;

◈ real-time weather and market information for poor farmers and fishermen;

◈ training for teachers, medical diagnosis and information for those living remotely; and

◈ financial services for the unbanked services previously out of reach for remote areas and underserved populations.

The possible challenges of the digital divide are:

◈ income and financial shortages;

◈ poor quality Vs. expensive connections;

◈ low level of education (lack of digital literacy and poor technical knowhow);

◈ limited access to ICT;

◈ lack of knowledge and understanding of the technology; and

◈ absence of opportunity to learn how to use the computer;

◈ damage of old business takes-away jobs (because digital works need more education);

◈ broaden income inequality (worsening income disparity among individuals & countries); and

◈ exacerbate the hazard of personal security (cyber terrorism, criminal networks, illegal money, hate speech, fake news, etc.).

Section Summary

The digital divide refers to the gap existing among persons, households, companies, and geographic areas with diverse socioeconomic backgrounds regarding access to information; economic and political opportunity; information communication technologies (ICTs); and use of the internet for a wide variety of purposes. Access gaps to computers, television, mobile phones, and internet services are important indicators of the digital divide. On the international scale, telecommunication service provides universal major access to narrow the gap of the digital divide. Although ICT utilization has been vividly expanded over the past decades, access appears to diverge widely between regions; and also between countries. For instance, access and exposure to internet technology are at the lowest among the countries in South Asia, and SSA; is equated to MDCs. Travel reservations, translations, support and customer services, telemedicine and e-learning, social networking, provision of affordable education and learning materials for students, real-time weather and market information for poor farmers and fishermen, training for teachers, medical diagnosis and information for those living remotely, and financial services for the unbanked services previously out of reach for remote areas and underserved populations are among the advantages of the digitization.

Differences in digital knowledge and technology; gaps in socio-economic development; financial and material resource disparities; location (geographical) disparities; the commitment of governments; and lack of access to digital services (computer, mobile phone, television, radio, etc.) intensify the global digital divide.

Checklist 7.5

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

№	Questions	Yes	No
1	Did you explain the emerging digital divide between different regions of the world?		
2	Did you identify factors intensifying the global digital divide?		

Self-test Exercise 7.5

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

Part I) Multiple Choices

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

1. Which opportunities could be more affected by the digital divide?

      A) Political opportunities

      B) Economic opportunities

      C) Cultural integrations

      D) All could be affected

2. Which of the following is not true about the digital divide?

      A) Governments should play the principal role in narrowing the breach of digitization

      B) Telecommunications provide universal access to narrow the gap of the digital divide

      C) All countries of the world have equal access to digital knowledge and technology

      D) The digital divide can have a vital impact on individual persons and farming households

3. Which of the following factors does not have an imperative role in digitization?

      A) Climate change

      B) Age and family size

      C) Sex and Culture

      D) Geographic location

4. In which regions of the world access and exposure to internet technology appears low?

      A) Western Europe

      B) South Asia and SSA

      C) Central America

      D) North America

5. What causes the global digital divide?

      A) Difference in digital education

      B) Economic and financial disparity

      C) Limited access to internet ICT

      D) All of the above are causes

Part II) Short Answer Writing

Instruction: Give short answers to questions 6-7 (10 points)

6. What are the advantages of digitization? (6 points)

7. What factors intensify the digital divide? (6 points)

🔑 Answer Key to Self-test Exercise 7.5

Dear learner; we hope you did well in the self-testing. You are now at the stage of completion of the last section of module seven. Now, please compare your answers with the feedback given and make corrections if there are errors in your answers.

Part I Multiple Choices	
1	D
2	C
3	A
4	D
5	B

Part II Short Answer Writing	
6	The advantages of digitization are: ● travel reservations, translations, support, and customer services; ● telemedicine and e-learning; ● social networking, provision of affordable education and learning materials for students; ● real-time weather and market information for poor farmers and fishermen; ● training for teachers, medical diagnosis and information for those living remotely; and ● financial services for the unbanked services previously out of reach for remote areas.
7	Dear learner; the factors intensifying the global digital divide include: ● differences in digital knowledge and technology; ● gaps in socio-economic development; ● financial and material resource disparities; ● location (geographical) disparities; ● the commitment of governments; and ● the lack of access to digital services (computers, mobile phones, television, radio, etc.) intensifies the global digital divide.

Dear learner; how did you find the lesson? We think you enjoyed it and found it very interesting and exciting. We 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 module. What do you think?

UNIT SUMMARY

The main themes of this unit were major geographic issues and public concerns of the current world. Accordingly, population-related concerns (like family size, education, and income; population and economic growth rates; unemployment and underemployment); environmental degradation and desertification; drought and famine; plus deforestation, and the worldwide digital divide were considered major current issues and each discussed separately.

From the contemporary population-related concerns of our present world, family sizes, household incomes, and education are influencing each other. Family sizes have a significant impact on household income and education access for children. Household incomes have also an influence on family nutrition and education access for children. The composition of families has a substantial impact on the well-being performance of individuals and households. Households with lower incomes often host many children. They invest very little in family nutrition and child education. This type of family structure is very common in DCs. High population growth in the affected countries impacts the quality of life through greater dependency ratios.

The relation existing between population and economic growth rates is viewed as inverse by Malthusian and neo-Malthusian theorists. The mentioned relationship on the other hand is considered positive by anti-Malthusian theorists such as Karl Marx and Easter Boserup. Present-day realities show that DCs have experienced the highest rates of population growth accompanied by rapid urbanization and emigration. They have also limited financial resources and weak institutional capacities. These conditions destabilize the capacity of the DCs to plan for and respond to the 'unfolding' population dynamics and seem to justify the Malthusian geometric theory of population growth and food production.

Employment and unemployment hold the basic life affairs of individuals and households in society. Unemployment poses a distressing effect on individuals and household livelihoods and communities. Unemployment problems are wider in DCs compared to the MDCs of the world.
Youth unemployment rates are very high in those countries. A large segment of the youth population engages in defenseless jobs in the affected countries. Sound policy, economic diversification, creation of more employment options, and fair distribution of resources are among possible solutions to the problem in the DCs.

Environmental degradation and desertification are other major worrying geographic issues at present. They are mainly promoted by growing population pressures on environmental resources and ecosystems. The competition for land resources (e.g. for cropland, grazing pasture, water, energy, settlement, etc.) exacerbates environmental degradation and desertification risks. Expansion of farming to marginal areas; conventional farming practices; non-responsive policies and overuse of resources are the main drivers of environmental degradation and desertification. Unsustainable land-use practices in the drylands aggravate desertification and push people into poverty. This in turn minimizes the capacity to invest in sustainable environmental management and leads to the syndrome of desertification. Coupled with climate change, these practices result in droughts and famines.

Climate change most possibly increases the incidence and harshness of meteorological and agricultural droughts in the drylands. Recurrent droughts, frequent floods, insect infestations, epidemics, unfair sharing of resources, conflicts, and wars cause and increase the severity of famines.

Deforestation and the digital divide are also other important geographical concerns in the present time. Deforestation characterizes the clearing of forest trees through careless actions. The digital divide widens information gaps among individuals, countries, regions, cities, and businesses. Exposure to the digital gap occurs due to variations in socioeconomic, cultural, and financial resources (i.e. level of the digital economy). Nonetheless, its impact is so great that it makes a difference in getting opportunities and benefits.

To generalize, population dynamics are closely linked with national and world development challenges and their solutions. The greatest challenge in the present-day world is to meet the needs of large and growing populations while ensuring the sustainability of environmental resources. The linkages between population dynamics, inequalities, and resource degradation have thus emerged to be major existing geographic issues of the world.

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UNIT EIGHT
GEO-SPATIAL INFORMATION AND DATA PROCESSING
(14 Hours)

UNIT INTRODUCTION

Dear learner, welcome to unit eight, which contains geo-spatial information and data processing. Exploring real-world issues in geography education is well-suited to make a significant contribution to your overall learning and development, particularly of 21st Century skills. For example, the discipline's name has been given to powerful computer-based data handling software as well as cartographic programs for displaying spatially referenced data. Contour lines are used to represent uneven landforms and reliefs with varying heights on maps. With this foundation, geography can provide a real context for the use of Geographic information systems in secondary schools. Geospatial information is a powerful mapping tool that allows you to draw, process, and analyze data. Dear learner, therefore, this module familiarizes you with how contour maps depict various landforms such as plateaus, mountains, hills, valleys, ridges, and others. Furthermore, the unit discusses the components, importance, and applications of GIS. Hence, we advise you to start your study by identifying the module learning outcomes and approach the section lessons carefully and thoughtfully to achieve those learning outcomes.

Unit Learning Outcomes

Dear learner, at the end of this unit, you will be able to:

- depict different relief features on a topographic map;
- explain the basic concepts of the geographic information system;
- describe the components of GIS;
- identify the main tools of available GIS software; and
- open, add, and display spatial data on Arc Map.

SECTION ONE
REPRESENTATION OF RELIEF FEATURES
ON TOPOGRAPHIC MAPS (4 Hours)

✤ Section Overview

Dear learner, relief can be depicted on a topographic map as contours and hachure. Hachures are short, disconnected lines that are drawn in the direction of the ground slope or water flow. Contour is a universal method for illustrating relief without hiding other topographic map features. As a result, in this section, you will be acquainted with the aforementioned conceptual matter and assisted in identifying and applying techniques for representing relief and built-up features on topographic maps. Please observe and prepare learning aid materials such as topographic maps or contour maps depicting various landforms, symbols, and signs portraying manmade and natural features in the settlement.

Learning Outcomes of the section

Dear learner, at the end of this section, you will be able to:

- 🌍 define relief in geography and topography map;
- 🌍 examine how contour lines are used to represent relief features on maps and types of contours; and
- 🌍 draw different relief features on a topographic map.

Keywords:

- ■ Contour;
- ■ Hachures;
- ■ Relief features;
- ■ Topographic map

8.1.1. Basic Concepts of Relief and topographic map

❓ Dear learner, what is relief? How do you relate relief and maps?

Dear learner, please compare your responses to the following note. Relief is typically defined as the difference in elevation between the highest point and the lowest point on the landscape in meters. Earth's surface is uneven in shape and elevation throughout the world. The physical shape or surface of the earth is referred to as a relief feature or landform of the earth. The major landforms (continents and oceanic) are formed due to the earth's movement of crustal plates (see Chapter One). Landform features are distinctive three-dimensional objects on the earth's surface formed by erosion and deposition processes. They are also a part of the earth's crust that has resisted erosion effectively and has remained somewhat in their original state. The landform features include plateaus, benches, escarpments, hills, mountains, volcanoes, peaks, structural domes, saddles, cliffs, valleys, gullies, washes, gorges, depressions, floodplains, and alluvial fans. Students, the ups and downs of the earth's surface already explained can be represented by a map. The following lesson poses questions about maps and addresses them for you briefly.

> **?** Dear learner, what is a map?

Dear learner, try comparing your responses to the next note. A map is the simplified, diminished, plane representation of all or part of the earth's surface as viewed from vertically above. Maps are always smaller in size than the environment they represent, the amount of size reduction is known as the map scale. Map scale represents the relationship between the distance on the map and the corresponding ground distance in the form of word scale or ratio form.

> **?** Dear learner, what is a topographic map?

Dear learner, please check whether your answer to the question is similar to (approximates) the lesson note explanation. A Topographic map is a detailed and accurate illustration of natural and man-made features on the ground, such as water bodies, rivers, lakes, forest areas, urban and settlement areas, roads, railways, power transmission lines, contours, elevations, and other human-made features. It is a two-dimensional representation of the Earth's three-dimensional landscapes. Colors, classes of features, lines, symbols, letters, numbers, and map scale are major elements of topographic map construction.

8.1.2. Methods of Representing Relief Features

> **?** Dear learner, what are the major methods used to represent relief features

(a) Hachures

> **?** Dear learner please explains what you mean by hachures.

Dear learner, cross-check your responses to the next note. Hachures are short disconnected lines that represent slopes drawn in the direction of the ground slope or water flows. They commonly illustrate the steepness of slopes. The hachure lines are drawn thicker and put close together when the slopes are steep, while the hachures are spaced wide apart and thinner when the slopes are gentle. Hachures representing steep slopes are shorter than those representing gentle slopes. Initially, they were used to represent mountain ranges and peaks, plateaus, and valleys on simple sketch maps or small-scale maps. Hachures are used to show gravel, piles of waste material, and small banks or escarpments that are prominent (see Figure 8.1) but not high enough to be shown by the selected contour interval; and similar relief features.
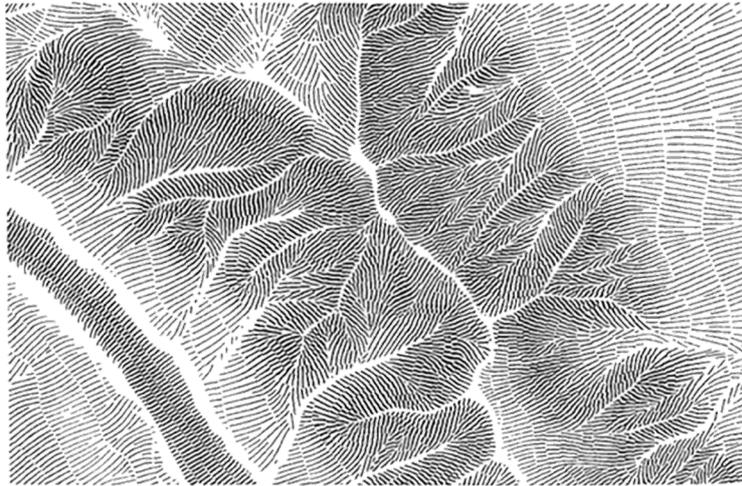
Figure 8.1 Landform relief representations by Hachures

Hachures have significant limitations. For instance, hachures do not indicate the height and exact gradients, and they give only qualitative information. Hachures are laborious to draw and can be difficult to read and interpret. They are not used alone; instead, they are used in combination with contour lines to illustrate escarpments, depressions, and craters.

(b) Contours or isohypses

(?) Dear learner, what do you mean by contour?

A Contour is an imaginary line connecting places having equal elevation on the ground surface above a datum or mean sea level.

> **☞** Note: Mean sea level (m.s.l.) is the average level of the sea, as calculated from a large number of observations taken at equal intervals of time. It is the most common standard level from which all heights are measured.

It is a universal method to illustrate the relief without hiding the other features drawn on the topographic map. Contours are commonly drawn at regular intervals in brown color and accurate way of illustrating relief on a topographic map. Generally drawn at 20 m intervals in 1:50,000 and 100 m intervals in 1:250,000 toposheets and never cut across each other.

In Figure 8.2, the index contour is started from zero elevation or mean sea level and represents every fifth heavier contour line than other contour lines. The finer or thinner contours falling between the index contours are intermediate contours or contour lines. In most cases, there are four contour lines between index contours, and their values are calculated by dividing the difference in elevation between two consecutive index contours by five if there are four intermediate contours.
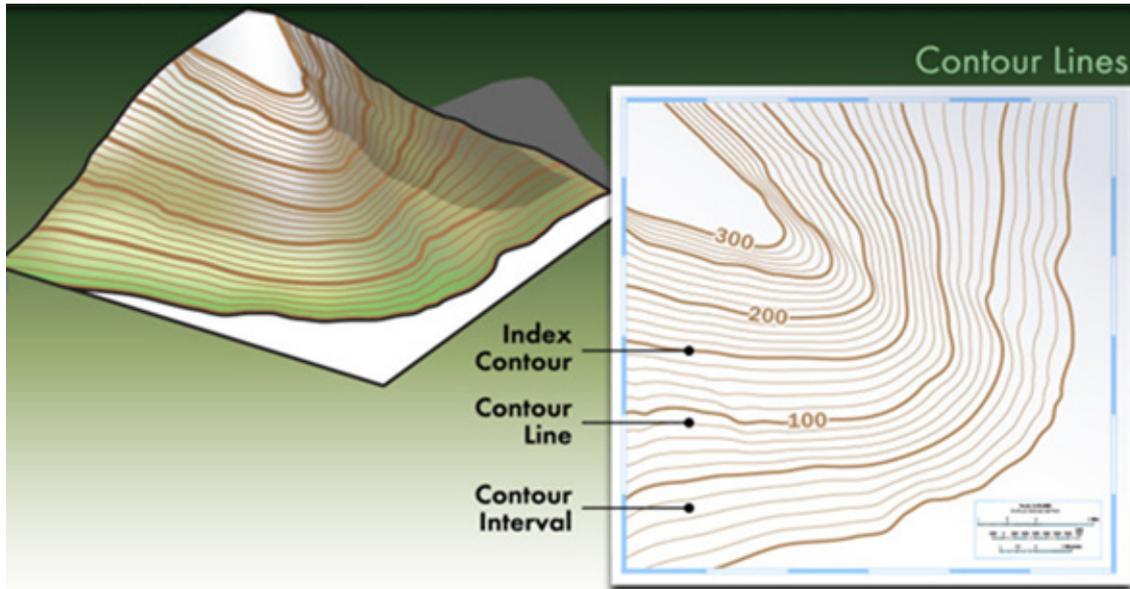
Figure 8.2 Contours representation of relief features

(?) Dear learner, please identify the general properties of contour

Dear learner, please substantiate your answer to the subsequent note. There are general properties of contours. Contours cannot merge or cross one another on maps except at vertical cliffs, waterfalls, and hanging cliffs. Contour lines never branch; rather branching lines on the map could represent rivers, roads, and boundaries. They are always numbered in the direction towards which altitude increases. Evenly-spaced contours represent a uniform slope, widely-spaced contours represent a gentle slope, and closely-spaced contours illustrate a steep slope. Contour lines are generated from spot heights. A spot height is a statistical point that represents the specific altitude of a place at that particular point. Reading contours is a skill that helps us to understand the actual landscape. Contours can illustrate different types of landform reliefs, such as mountains, hills, plateaus, valleys, ridges, gorges, spurs, and others. These landform reliefs can be recognized from the shapes of their contours. Learner, in between think back about what you have covered till now and make a summary of your understanding and get prepared for the next lesson study-'functions of contour line'.

(?) Dear learner, please identify the general pattern and the arrangement of each contour line and describe the major landform reliefs represented in Figure 8.3.

Figure 8.3. Contours represent major landform reliefs

8.1.3. Major Natural Relief features (Landforms) and Contour Representation
(a) Hill, Mountain, and Mountain Range

? Dear learner please makes the difference between a hill, a mountain range, and a mountain. Please also recognize the hill from the contour line in Figure 8.4.

A hill is one of the most basic landform features. It is a rounded surface rising above its immediate surroundings. From a high elevation point or hilltop, the ground slopes downward in all directions. A hill is shown on a map by contour lines forming concentric circles.
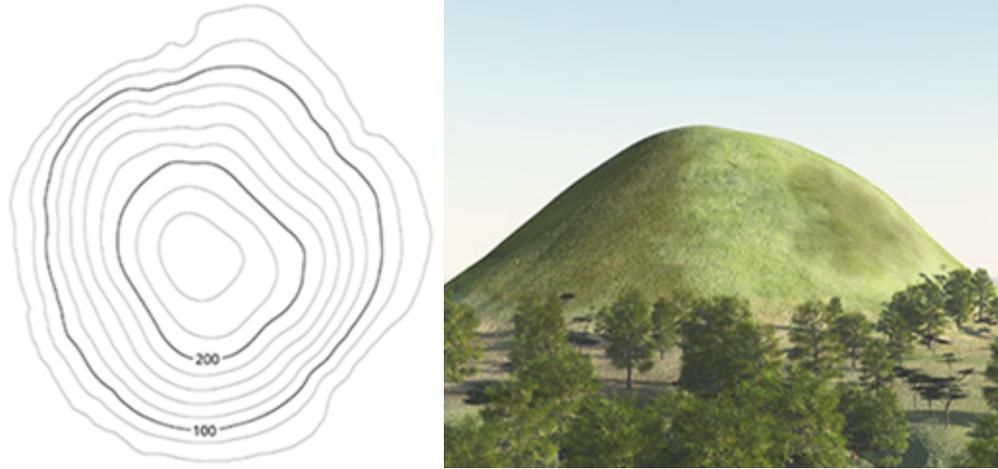
Figure: 8.4. Hill contours

A series of increasingly small, closed contours at higher elevations, with a height of less than 1,000 m indicates a hill. The inside of the smallest closed circle or contour at the highest elevation is the location of the hilltop. An inward-curving concave hillside has contours more closely spaced at the top of the hill with a progressive widening between contours downslope. An outwardly curving convex hillside has contours more widely spaced at the top of the hill and more closely spaced down the hillside. A mountain is a landmass that projects well above its surroundings, higher than a hill. The closed contours with elongated shapes with increasing values towards the center with no specific tips illustrate mountain ranges.

(b) Ridge

? Dear Learner, what is a ridge, and how to determine it from a contour line in Figure 8.5?

Dear learner, please validate your response to the following note. A long and narrow hillside or a sloping line of high ground with two or more peaks shown by an elliptical contour line is called a ridge. When you stand on the centerline of a ridge, you do have low ground in three directions and high ground in one direction with varying degrees of slope. The contour lines form a ridge that tends to be U-shaped or V-shaped as the closed end of the contour line point away from the high ground.
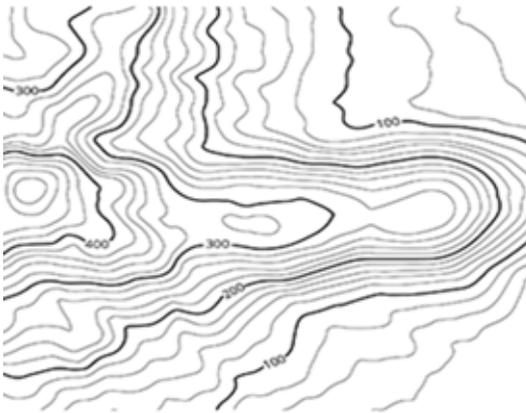
Figure: 8.5. Ridge contours

(c) Valley

? Dear learner, what does it mean by valley?
And how to identify it from Figure 8.6?

Dear learner, please verify your response to the note. A valley is a stretched-out long and narrow groove in the land usually formed by streams or rivers. It is a long depression with a slope formed by the vertical erosion of the river within the stretch of upland.
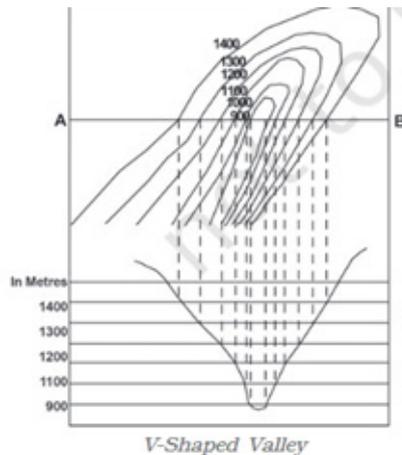

Figure: 8.6. Valley contours.

A valley is bounded by two higher-elevation areas. It begins with high ground on three sides, while the fourth direction offers low ground. The closed end of the contour line (U or V shape) always points upstream or toward high ground. Contours with "V" shapes, with upward bending and values increasing upward represent valleys. Contours in a valley are parallel to the stream until they cross it at the base of each V. The higher level of the valley, the longer contour parallels the stream before crossing it. In a very flat valley, the contour may parallel the stream across the topographic map without crossing it, making it difficult to determine the direction of water flow.

(d) Saddle

? Dear learner, what does the term "saddle" signify?
How can a saddle in Figure 8.7 be recognized?

A saddle is a dip or low point between two areas of higher ground. It is not necessarily the lower ground between two hilltops; it may be simply a dip or break along a level ridge crest and lower ground in the other two high ground directions.
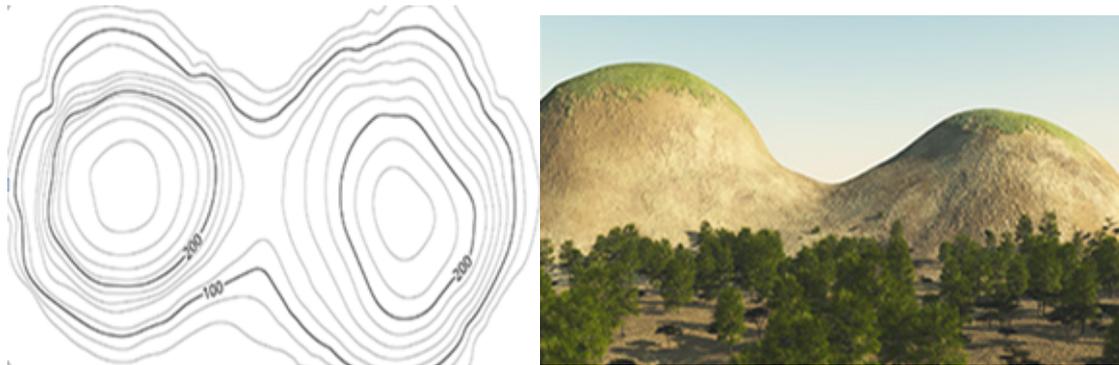

Figure: 8.7. Saddle contours

(e) Depression

Dear learner, what is meant by the word "depression"?
How can you identify the depression in Figure 8.8?

Depression is an area with low ground surrounded by higher ground in all directions. On maps, depressions are represented by closed contours with more or less circular shapes that have tick marks pointing toward the low ground. The values decreasing towards the center represent depressions. Depression contours merely represent special cases of the standard contours on the map and thus share the same interval and elevation values. Contoured depressions are different from hills by short ticks at right angles to the contours, pointing towards the center of the depression.
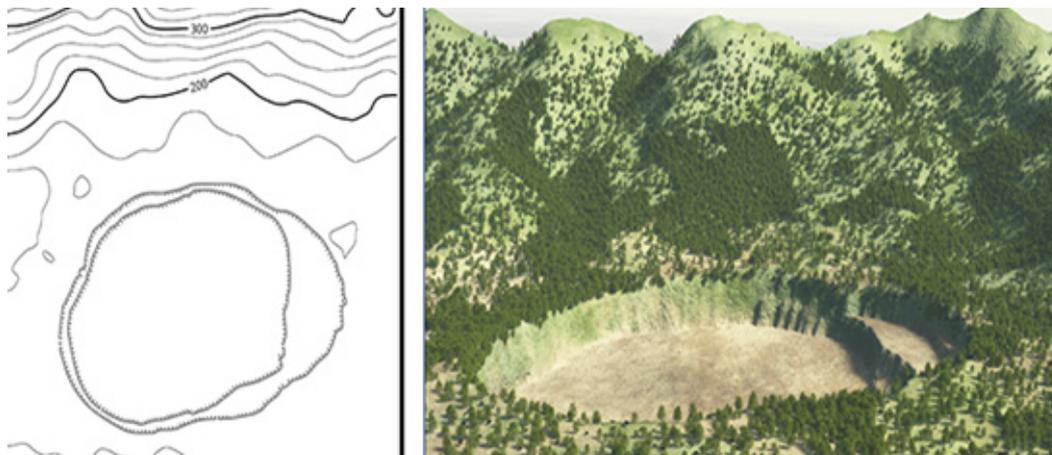

Figure: 8.8. Depression contours

A special type of depression contour called a cut contour is observed, when a roadway or railway cuts through the raised landscape, drastically lowering the terrain to form a level bed. Cuts are shown on a map when they are at least 10 feet high, and they are drawn with a contour line along the cut line. This contour line extends the length of the cut and has tick marks that extend from the cut line to the roadbed if the map scale permits this level of detail.

(f) Plateau

Dear learner, what is a plateau?

How can you identify it from Figure 8.9?

Dear learner, kindly check your response to the following note. A plateau is an elevated land represented by closed contours roughly rectangular in shape with increasing values towards the center. Plateau contours with the top being very wide closed. When the plateau is formed in the foothills is referred to as a piedmont plateau. If a plateau is enclosed by mountains, it is called an intermontane plateau. Plateaus are higher in altitude than plains.
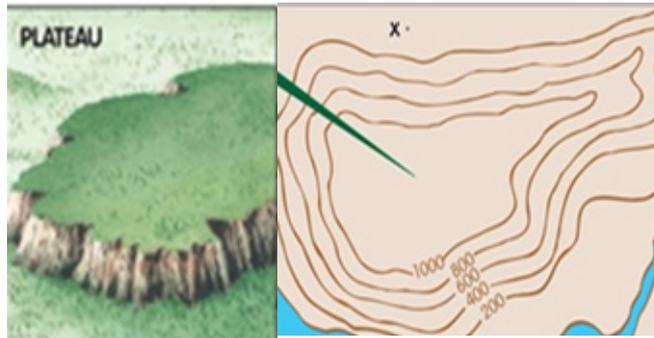

Figure: 8.9. Plateau contours

(g) A Gorge is a very steep valley at higher elevations formed by river erosion. It can be identified by closely converging contours in the river course.

(h) Spurs

A spur is a short continuous sloping line of higher ground, normally jutting out from the side of a ridge. It is a projection of land from higher to lower ground, often formed by two rough parallel streams, which cut draws down the side of a ridge. The ground sloped down in three directions and up in one direction. Contour lines on a map depict a spur with the U or V directing away from the high ground. Contours with "V" shapes, with downward bending and values increasing upward represent spurs.

Dear learner please differentiates between valleys and spur by referring to figure 8.10 and 8.6
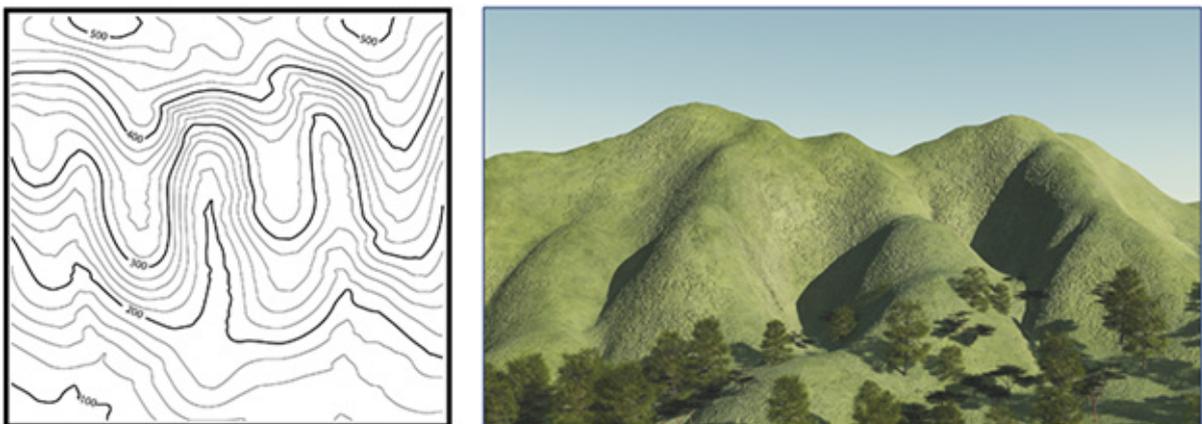

Figure 8.10. Spur contours

Dear learner please define a cliff and identify it from your local area using a contour map of Figure: 8.11

Dear learner, please check your response to the following note. A cliff is a steep-sloped or near-vertical feature exposure of a valley or coast. When the cliff slope is so steep or truly vertical, the contour lines on the slope merge into a single contour called the carrying contour of contours, to represent the vertical or near-vertical form of the hillsides. The last contour line has tick marks pointing toward low ground. If the cliff is overhanging, such as for the waterfall in this illustration, the lower-elevation contours cross behind those at the top of the cliff. In this special situation, the lower-elevation contours in the undercut are shown with dotted lines to indicate that they aren't visible from the top of the cliff. Cliffs are also shown by contour lines very close together and, in some instances, touching each other.
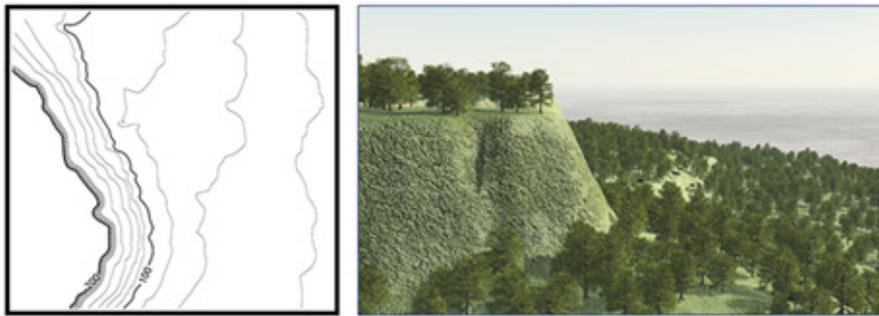

Figure: 8.11. Cliff contour

8.1.4. The Human-Made Features

(j) Fill

Fill is a man-made feature resulting from filling a low area usually to form a level bed for a road or railway. Fills are shown on a map when they are at least 10 feet high, and they are drawn with a contour line along the fill line. This contour line extends the length of the filled area and has tick marks that point toward the lower ground. If the map scale permits, the lengths of the fill tick marks are drawn to scale and extend from the baseline of the fill symbol. Student, reflect on your learning progress by analyzing what Figure 8.4—8.11 portray and contrast with the Figure 8.12 representations.

8.1.4.1 Catchment Representation on Contour Map

Dear learner, what a drainage basin refers to?

A drainage basin/catchment area refers to the entire geographical space that is drained by the major river and its tributaries. A drainage system is a system that is made up of all the river basins that flow in the same direction. The major river in a river basin is the longest of all the rivers in the basin. The other small streams that supply water to the main rivers are called tributaries. The point at which the tributaries meet with the major river is called confluence. The point at which the major river in a basin starts is called the source of the river. Likewise, the point at which the river empties itself into an ocean, a sea, or a lake is called the mouth of the river. A drainage basin and its watershed can be identified on a contour map. This can be done by observing the patterns and shapes of the contour lines that are used to represent the topography of the mapped area.

? Dear learner, what rules should be taken into account while drawing contour lines to define watershed boundaries?

Dear learner, please review your response to the following note. Some rules are considered when using contour lines to determine watershed boundaries. These include, a contour line never going up or downhill, contour lines never crossing each other, the steeper the slope the closer together the contour lines, and the rules of the "V"s. Water flows down on all sides of the hill. Water flows from the top of the saddle or ridge. The following steps can help you identify a drainage basin and its divide on contour maps.

- First, identify the course of the main river and the outlet point of the watershed on the map, and then draw a circle at the outlet or downstream points of the watershed.
- Second, highlight the watercourse of tributaries of the main river and their flow direction on the map.
- Third, look at the ridgelines and saddle or contour lines near the origin of the tributaries and find high points and ridges; and Put "X" at the high points.
- Fourth, visualize the surface flow direction from high points and draw arrows to indicate the direction of flow.
- Fifth, trace the outline of the watershed beginning at the outlet, connecting high points. Mark these points with solid or broken lines to show the river basin and its watershed.
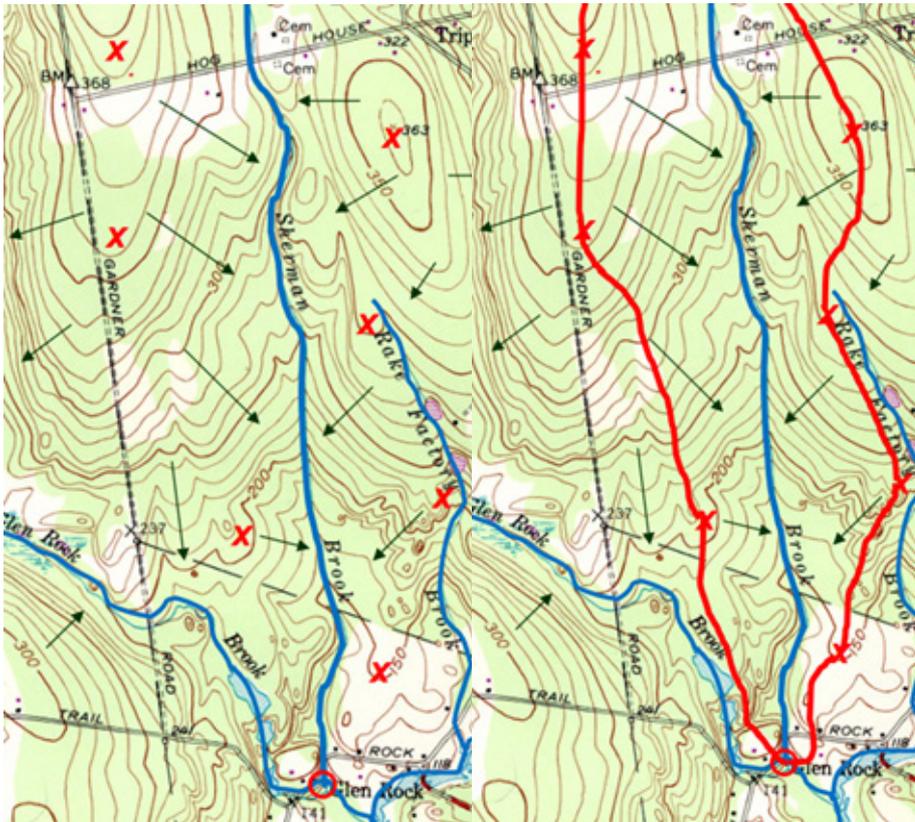

Figure: 8.12 Basin or catchment and associated drainage patterns"

? Dear learner, how do you identify different types of drainage patterns on the contour

Dendritic patterns are usually formed in areas of homogeneous rock which comprises horizontal strata rock masses. They are characterized by a tree-like shape with branches.

> **?** Dear learner, in which landforms are, trellis drainage patterns largely formed? Could you identify such drainage patterns using a contour map?

Trellis drainage patterns develop in areas where harder and softer rocks alternate. The pattern of this drainage pattern is greatly affected by tectonic forces (folding and faulting). The branches of the river system usually join one another at nearly right angles.

> **?** Dear learner, in which relief feature does the radial drainage pattern usually find?

A radial Drainage Pattern occurs when rivers flow in all directions away from a raised feature. Centripetal drainage patterns are found in areas where rivers flow from surrounding high ground toward a central basin.

Activity 8.1.

Dear learner, please attempt the following question

1. Describe the types of land reliefs represented by evenly spaced contours, widely spaced contours, and merging contours.
2. What is the difference between spur and valley?
3. Match the following figures from respective contour lines (Figure "A"):
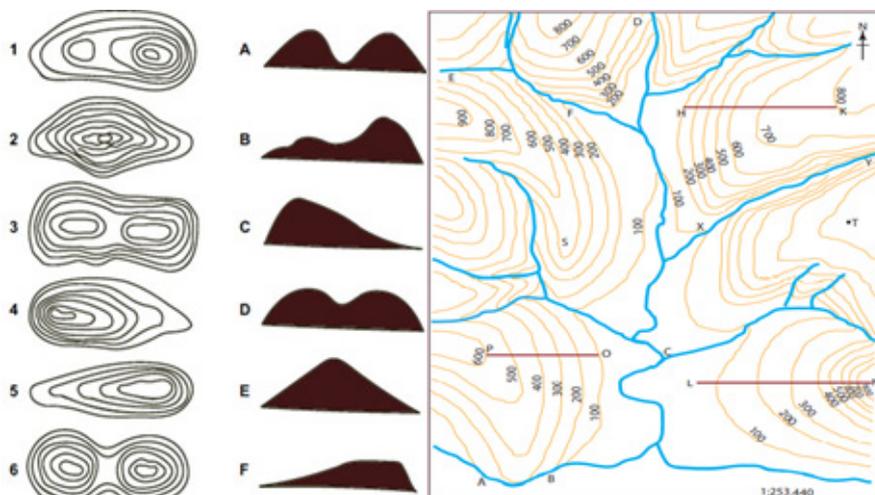
4. By referring to the above contour map (B), try to identify the relief features that are represented by the numbers indicated below and justify how you identified the feature.

|	Feature	Justification
The type of slope from L to M		
The type of slope from H to K		
What does letter C show?		
The type of slope A to B is		
The landform represented by the letter 'S' is		
The type of slope from 'O' to 'P'		

5.   Could you identify the drainage basin or catchment on the contour map?

6.   Identify different types of symbols and signs that represented different features in the urban settlement.

Dear learner, have you answered all of the questions in Activity 8.1 correctly? If you answered "no," return to this section and try again. If you answered yes, please revise your responses to activity 8.1 feedback.

Feedback to Activity 8.1

1. The spacing and direction of contour lines indicate the shapes of the landforms represented on the topographic map. Evenly-spaced contour lines represent a uniform slope. The widely spaced contour lines illustrate that the land is a relatively level slope. The merging contours represent steep or truly vertical slope features or the vertical or near-vertical form of the hillsides.

2. A valley is an extended dip in the landscape that is depicted by contour lines that are U or V-shaped and have their closed ends facing upward. Valleys are represented by "V"-shaped contours that bend upward and have values that increase upward. A spur is a lateral ridge, the tongue of land, or a mountain that descends from a mountain, hill, or main crest of the ridge. A spur with a U or V pointing away from the highland can be seen on a map as contour lines.

3. Match the following figures with respective contour lines
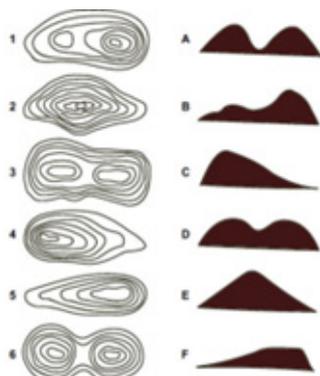
1/_B, 2/E, 3/ D, 4/ C, 5/ F, 6/ A

The following steps can help you identify a drainage basin and its divide on contour maps. First, identify the course of the main river and the outlet point of the watershed on the map, and then draw a circle at the outlet or downstream points of the watershed. Second, highlight the watercourse of tributaries of the main river and their flow direction on the map. Third, look at the ridge lines and saddle or contour lines near the origin of the tributaries and find high points and ridges; and Put "X" at the high points. Fourth, visualize the surface flow direction from high points and draw arrows to indicate the direction of flow. Fifth, trace the outline of the watershed beginning at the outlet, connecting high points. Mark these points with solid or broken lines to show the river basin and its watershed.

S.No.	Symbols and signs	Description
1		Bridge
2		Railway
3	PO	Post office
4		Church
5	T — T	Power line
6		Paved highway
7		Lake
8		Road
9		Temple
10		Well
11		Mosque
12		Settlements
13	PS	Police station
14	, and	Trees, and grass
15		Place of worship
16		Village
17		Railway station
18		Canal
19		Dame
20		Hospitals
21		Airport
22		River
23		Industry
24	PK	Park
25		School
26		Supermarket
27		Bank
28		ATM
29		Taxi station
30		Beach
31		Bus station
32		Government office
33		Pharmacy House
34		Café
35		Clinic
36		Shop
37		Swimming pool
38		City
39		Cemetery
40		University

Project activity 8.1:

Dear learners, please try the following project activities based on what you have learned so far.

1. Please observe the field and represent real physical features on the map.

2. Draw your local community or school maps and describe different symbols representing different features on the map.

Section Summary

Dear learner, you can summarize this lesson by focusing on the following points. Mountain ranges, hills, ridges, valleys, depressions, plateaus, and spurs are major natural relief features (landforms) and contour representations. A hill is shown on a map by contour lines forming concentric circles. The closed contours with elongated shapes with increasing values towards the center with no specific tips show mountain ranges. A long and narrow hillside or a sloping line of high ground with two or more peaks shown by an elliptical contour line is called a ridge. Mention that closed and elongated shape contours with increasing values toward the center, having no specific tips illustrate mountain ranges. Similarly, a ridge- a long and narrow hillside or a sloping line of high ground with two or more peaks is represented by an elliptical contour. The closed end of the contour line (U or V shape) always points upstream or toward high ground. A saddle is a dip or low point between two areas of higher ground. Depressions are represented by closed contours with more or less circular shapes that have tick marks pointing toward the low ground. A plateau is an elevated land represented by closed contours roughly rectangular in shape with increasing values towards the center. A spur is a short continuous sloping line of higher ground, normally jutting out from the side of a ridge. The contour lines on the slope merge into a single contour called the carrying contour of contours. This represents the vertical or near-vertical form of the hillsides as cliffs. The contour line extends the length of the filled area and has tick marks that point toward the lower ground. A watershed can be identified on a contour map by observing the patterns and shapes of the contour lines that are used to represent the topography of the mapped area. A settlement map can be represented on the topographic map by using different symbols and signs.

Checklist 8.1

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

№	Questions	Yes	No
1	Have you defined relief in geography and topography maps?		
2	Did you examine how contour lines are used to represent relief features on maps and types of contours?		
3	Did you draw different relief features on a topographic map?		

SELF-TEST EXERCISE 8.1

Part one: Multiple Choice item

Instruction: Dear learner, choose the best answer from the given alternatives to the following questions

1. Short, discontinuous lines called _____are used to depict slopes in the direction of earth slopes or water flows   A/ Hachures   B/ isohypses   C/ isobar   D/ None

2. Which one of the following is started from zero elevation or mean sea level and represents every fifth heavier contour line than other contour lines

   A. index contour   B/ intermediate contour   C/ thinner contours   D/all

3. The closed contours with elongated shapes with increasing values towards the center with no specific tips illustrate

   A. mountain ranges   B/ hills   C/ mountains   D/ Spur

4. of the following which one is a long depression with a slope formed by the vertical erosion of the river within the stretch of upland

   A/ Valley   B/ Spur   C/Hills D/ Saddle

5. which one of the following is a man-made feature resulting from filling a low area usually to form a level bed for a road or railway

   A/ Fill   B/ fill   C./ cliff   D/ Spur

Part Two: True/ False Item

Instruction: Dear learner, say True if the sentence is correct and False if it is incorrect.

1. The hachures for steep slopes are longer than those for gentle slopes.

2. On maps, contours can only intersect or merge at vertical cliffs, waterfalls, and hanging cliffs.

3. A spur is a short continuous sloping line of higher ground, normally jutting out from the side of a ridge

4. Dendritic drainage patterns develop in areas where harder and softer rocks alternate

Feedback on Self-test Exercises 8.1

Item one: 1. A   2. A   3. A   4. A 5. A

Item two: 1. False   2. True   3. True   4. False

SECTION TWO
BASIC CONCEPTS OF
GEOGRAPHIC INFORMATION SYSTEMS (3 hours)

⚙ Section Overview

Dear learner, a geographic information system (GIS) is a computer-based system that captures, prepares, stores, checks, retrieves, manipulates, analyses, and displays geographically referenced or geospatial data. GIS applications can be broadly classified into two types: physical science or environmental science and social science (population, public health, crime study, and market planning). GIS has enormous potential for addressing fundamental problems and issues such as climate change, increased food production, natural resource degradation, and natural disasters. Working with GIS requires the integration of five critical components: hardware, software, data, people, and methods. Therefore, ArcMap software, a computer, spatial data, figure layered vector and raster data types, and a GIS laboratory are required for understanding the concept and developing skills in this section.

Section Learning outcomes

Dear learner, at the end of this section, you will be able to:

- 🌍 Describe the basic concepts of GIS;
- 🌍 explain the importance of GIS;
- 🌍 examine the relationship between major components of GIS; and
- 🌍 explain how GIS is organized as a system.

Keywords:

- ■ Components;
- ■ GIS

8.2.1. Definition and application of GIS

? Dear learner, what is a geographical information system (GIS)? Why do we need GIS?

Please compare your reflections to the following note again. A geographical Information System (GIS) is a computer-based system for capturing, preparing, storing, checking, retrieving, manipulating, analyzing, and displaying geographically referenced data or geospatial data. GIS integrates hardware, software, and geospatial data to analyze relationships, patterns, and trends in the form of maps, and charts to support decision-making for planning and management of land use, natural resources, environment, transportation, urban facilities, and other administrative records.

? Dear learner, what applications can GIS be used for, and what are the benefits of GIS?

Please review your response to the following note. Applications of GIS can be environmental science and social science, including population, public health, crime study, and market planning. One of the major benefits of GIS is that it provides a platform to integrate complex and diverse information into a simple and illustrative format, a map. A GIS can be used to merge diverse data sources, such as project-specific information, socio-economic data, census, and statistical and spatial base data (administrative boundaries, roads, cities, infrastructure, etc.). A GIS is also used to manage critical data and to inform the decision-making process. It provides a platform for project planning, monitoring, reporting, and data sharing, as well as visualizes and disseminates information.

The potential for using GIS to promote teaching and learning in Geography within schools is considerable. GIS has immense importance to address fundamental problems and issues, such as climate change, increasing food production, vanishing natural resources, and natural disasters. It is important to address local geographical issues or problems, such as siting of facilities (schools, hospitals, and retail development), the management of emergency services, and the conservation of natural resources.

Furthermore, GIS is used to integrate information, propose solutions and visualize scenarios, such as the site of the new service center, the route of a controversial rail link, tourist information services, and health monitoring. Most of the time, GIS is applied for mapping and analysis of network services, suitable sites for urban development, transport management, suitable agriculture, disaster management, planning and community development, irrigation management, and wildlife management. It is important to examine the spatial relationship between deprivation and crime in parts of a city, determine the rate and extent of vegetation destruction, determine the relationship between rock type and relief in an area, and identify areas with a high risk of slope erosion in a region.

8.2.2. Components of GIS

(?) Dear learner, what are the major components of GIS?
How do you describe the linkage between major components of GIS by referring to Figure 8.13?

Learner, be focused and guided by the above questions while studying the forthcoming lesson. Working with GIS involves the integration of five key components, including hardware, software, data, people, and methods.

(a) Hardware

One major component of GIS is hardware. The hardware consists of the technical equipment needed to run a GIS task. The hardware part is divided into two i.e. Input and Output. The input includes a computer with high capacity in terms of processor speed, memory, and data storage capacity. GIS runs on a wide range of hardware types from centralized computer servers to desktop computers used in a standalone or networked configuration. Global position systems (GPS), mobile phones, scanners, and digitizers are also included in the input part of the hardware. The output port of the hardware includes the printer, plotter, and hard disc.

Figure 8.13: Components of GIS

(b). Software

GIS software provides the functions and tools needed to input, store, manage, analyze, and display geographic information. GIS software package provides means for deriving new geoinformation from existing spatial and attribute data. Environmental Systems Research Institute (ESRI) product software, such as ArcView, ArcInfo, and ArcGIS are commonly used. One popular software application is ArcGIS.

The ArcGIS desktop environment includes ArcMap, ArcCatalog, ArcScene, and ArcGlobe applications. A very capable open-source (free) GIS software is QGIS. It encompasses most of the functionality included in ArcGIS. The key software components are database management systems (DBMS), tools for the input and manipulation of geographic information, and tools that support geographic query, analysis, and visualization. A DBMS is a software package that allows the user to set up, use, organize, store, manipulate, maintain, and integrate a database. A Database is an organized collection of large data sets stored and accessed electronically from a computer system.

(b) Data

> ? Dear learner, what is data in GIS?

Kindly, appraise your response to the following note. Data is the most important component of GIS. Geographic /spatial / data and related tabular data can be collected from the field or acquired from a data provider organization. Any data bearing a definable relationship to space can operate in a GIS package. There are two main methods used to store data in a GIS: Raster images and vectors. Raster is used for the storage of aerial photographs and imagery of various kinds. In raster data format each object is represented in the form of a cell /grid and it has a separate reflectance value /color/. The data type consists of rows and columns of cells, with each cell storing a single value. The resolution of the raster data set is its cell width in ground units. Raster is used to represent continuous layers, such as elevation, slope and aspect, soil, vegetation, temperature, rainfall, and so on. ArcGIS can utilize raster data formats, such as jpg, tiffs, etc.

Spatial data refer to the shape, size, location, and orientation of geographical feature. They are generally multi-dimensional and autocorrelated. In a GIS, geographical features are often expressed as a vector representing discreet data. Different geographical features are expressed by different types of geometry.

For instance, geographical features, such as Wells, airports cities, schools, and health posts can be expressed by a single zero-dimensional point. There is no measurement of point features. Geographical features, including rivers, roads, railroads, trails, and others are expressed by one-dimensional lines or polylines. Line features can measure distance. Geographical features that cover a particular area of the earth's surface, including lakes, national parks, administration boundaries, watershed boundaries, buildings, or land uses are represented by two-dimensional polygons. Polygon features can measure perimeter and area. Data consisting of a single feature geometry type can be stored in the Shapefile format. A collection of feature classes such as points, polylines, and polygons within a geodatabase that shares a common coordinate system is called a feature dataset. Vector data are excellent for capturing and storing spatial details. Geographical or spatial data can be acquired from existing data in paper form through digitizing or scanning, survey data by the use of a global position system (GPS), and remotely sensed data/Arial Photography and Satellite images/.

Non-spatial data or attributes are associated with the feature but independent of all geometric considerations. Non-spatial data can also be stored along with the spatial data represented by the coordinates of a vector geometry or the position of a raster cell. Attribute data are additional characteristics of the spatial data or the features. For example, non-spatial data are independent of the location of the lake but describe further characteristics of the lakes, including lake depth, water quality, pollution level, name, area, volume, and others. Data input in GIS contains entering the spatial data, and non-spatial data, and linking the two together. Dear learner, Figure 8.14 shows how vector formats (polygon, polyline, and point's data) and raster formats (land use, elevation) can be combined to create a representation of the real world in the form of a map.
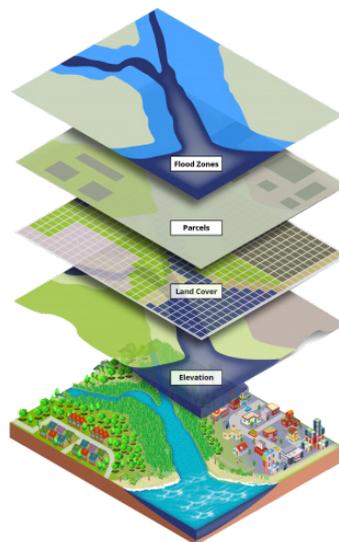

Figure: 8.14. GIS layered Vector and Raster data types

? Dear learner, how do you differentiate between GIS users and GIS specialists?

Please review your response and compare it to the following note for further comprehension. The people are the component that makes the GIS work. People associated with a GIS can be categorized into GIS users and GIS specialists. GIS Users are people who use and View GIS data to browse a geographic database for referential material, perform professional services, and make decisions. GIS specialists are the people who make the GIS work.

They are responsible for collecting, managing, and analyzing geographic data and providing technical support to others. Technical specialists who design and maintain the system and people who use GIS to perform their everyday activities are users of GIS. Without the people who manage the system and develop plans for using it, GIS technology has limited value.

(d) Methods

(?) Dear learner, what is a method in GIS?

Successful GIS operates according to well-designed plans and rules, which are the models and operating practices unique to each organization. Dear learner, please attempt the following questions to assess your level of understanding of the lesson in section two of the module. Try to answer the questions in activity 8.2 to demonstrate your understanding of this section.

Activity 8.2:

Dear learner, try to address the following questions.

1. How do you explain the difference between vector and raster data?
2. Describe the similarity and differences between spatial data and attribute data.
3. How do you understand the representation of the real world in the ArcMap (Figure: 8.14)?

Dear learner, have you correctly answered all of the questions in Activity 8.2? If you answered "no," go back and reread this section and try again. If you answered yes, please revise and check your responses against the feedback given for activity 8.2.

Feedback to Activity 8.2:

1. In raster data format each object is represented in the form of a cell /grid and it has a separate reflectance value /color/. The data type consists of rows and columns of cells, with each cell storing a single value. Raster is used to represent continuous layers, such as elevation, slope and aspect, soil, vegetation, temperature, rainfall, and so on. ArcGIS can utilize raster data formats, such as jpg, tiffs, etc. In a GIS, geographical features are often expressed as vectors representing discreet data. Different geographical features are expressed by different types of geometry like points, polylines, and polygons.
2. Geographical or spatial data can be acquired from existing data in paper form through digitizing or scanning, survey data by the use of a global position system (GPS), and remotely sensed data/ Arial Photography and Satellite images/. Non-spatial data or attributes are associated with the feature but independent of all geometric considerations. Non-spatial data can also be stored along with the spatial data represented by the coordinates of a vector geometry or the position of a raster cell. Attribute data are additional characteristics of the spatial data or the features
3. The layered vector and raster data types by using GIS represent the real world in the ArcMap

Section summary

Dear learner, you can summarize this section by focusing on the following points. A geographic Information System (GIS) is a computer-based system that captures, prepares, checks retrieves, manipulates, analyses, and displays geospatial data. GIS combines hardware, software, and geospatial data to analyze relationships, patterns, and trends in the form of maps and charts to aid decision-making for land use, natural resources, the environment, transportation, urban facilities, and other administrative records. GIS is useful in physical science, environmental science, and social science (population, public health, crime study, and market planning). The major components of GIS are hardware, software, data, people, and methods.

Checklist 8.2

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

№	Questions	Yes	No
1	Did you describe the basic concepts of GIS?		
2	Did you explain the importance of GIS?		
3	Did you examine the relationship between the major components of GIS?		
4	Have you explained how GIS is organized as a system?		

SELF-TEST EXERCISE 8.2

Part One: Multiple-Choice Item

Instruction: Dear learner, select the best answer from the given alternatives for each of the following questions.

1. Which one of the following is not included in the input part of the hardware

   A. Scanners   B/ digitizers   C/ plotter   D/ GPS

2. Which one of the following software is popular for application

   A. ArcGIS   B/ ArcView   C/ ArcInfo   D/ all

3. Of the following, one is different from the others

   A. ArcView   B/ ArcInfo   C/ hard disc   D/ None

4. Which of the following does not belong to the raster format?

   A. Satellite image   B/ Aerial photogram   C/ DEM   D/Polyline

Part Two: True /False Item

Instruction: Dear learner Say true if the sentence is correct, and false if the sentence is incorrect.

1. One of the main advantages of GIS is that it offers a platform for combining complicated and varied information into an easy-to-understand format.

2. Geographical features are frequently expressed as a raster of discrete data in a GIS.

3. Although not dependent on any geometrical considerations, non-spatial information or traits are linked to the feature.

4. GIS specialists use and view GIS data to complete professional tasks, make judgments, and browse a geographic database for reference material.

Feedback on self-test exercises 8.2

Item one: 1. C   2. A   3. C   4. D

Item two: 1. True   2. False   3. True   4. False

SECTION THREE
ARCMAP AND MAIN TOOLS (7 Hours)

Section Overview

Dear learner, ArcMap is the main application in ArcGIS for displaying and exploring GIS datasets. It depicts geographic information as a collection of layers and other map elements. ArcMap is a program that allows us to add data, create maps, conduct analyses, access the Arc catalog and ArcToolbox, use geoprocessing tools, integrate GPS field data, and so on. ArcMap document files contain maps; specify GIS data, and display information and other ArcMap elements. Dear learner, please use ArcMap software, computer, spatial data, and computer room to display spatial information in the form of a map and to show ArcMap Menus, and ArcToolbox.

Section learning outcomes

Dear learner, at the end of this section, you will be able to:

- apply the basic steps of opening, saving, and closing of ArcMap document on a computer;
- describe the functions of the main tools of ArcMap;
- use Arc Map menu to add, and display data; and
- produce a map of different geographical issues and distributions.

Keywords:

- Adding;
- ArcMap;
- Closing;
- Displaying;
- Opening;
- Removing;
- Saving;
- Tools

8.3.1. Opening, Saving, and Closing ArcMap Documents

? Dear learner, what is an ArcMap?

Please try to review and compare your response to the following note. ArcMap is a program in which we add data, make maps, perform analysis, edit GIS data, access Arc catalog and ArcToolbox, use geoprocessing tools, integrate GPS field data, etc. It is the primary application and interface associated with ArcGIS software.

? Dear learner, what is an ArcMap document?

Please validate your response to the note about map exchange documents. Map Exchange Documents (MXD) are ArcMap document files that contain a map, specify the GIS data used (including pointers to the file location for each dataset), display information (symbology and labeling), and other elements used in ArcMap. The ArcMap document does not store data but rather only refers to the data you use. Your map document only gains a reference to the original data source when you "Add Data" to it.

? How do you open ArcMap?

Please validate your response to the note about open ArcMap. The ArcMap application is accessible by single-clicking on the ArcMap Icon in your start menu to open the software. You can double-click an ArcMap document (.mxd file) on a desktop shortcut to start ArcMap with the desired map. By default, ArcMap begins with a new, empty map document.

? How do you save a map in ArcMap?

Dear learner, please review your response to ensure that you present the map-saving procedure in ArcMap. After you finish working on a map, you can save it and exit ArcMap. You save a map as a document and store it on your hard disk. ArcMap automatically appends a file extension (.mxd) to your map document name. You will need to provide a name and save it into a folder location if you haven't saved the map before. You can also save the map with its data using a map package, which can be used to share your map and its related data with other users.

? How do you close an opened map in ArcMap?

Click the File menu and click Close. Opening a new map also closes the current map. Think about the components of GIS you identified and reflect on their significance in the context of your learning.

8.3.2. ArcMap Main Tools and Their Role

? Dear learner, please identify ArcMap's main tools and explain their roles.

Dear learner, please familiarize yourself with the ArcMap menus and tools described below and displayed in Figure 15.

a. ArcMap Menus and Tools

1. New Project – Opens a new (blank) ArcMap Document. (This creates a new .mxd file)

2. Open Project – Opens an existing document.

3. Save project – Saves the current ArcMap document. Please note the mxd does not contain any data directly, rather it only links to the data being used. This may be important when sharing your .mxd file with others who may need internet access for base data.
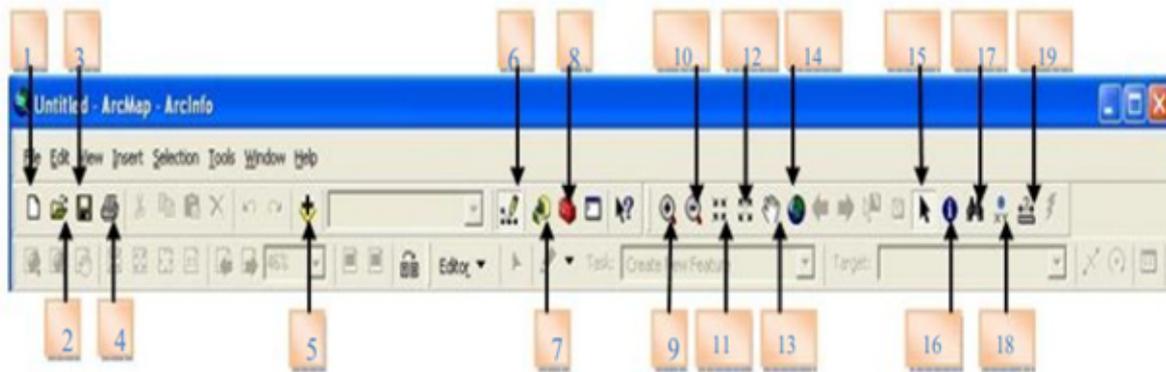
Figure: 8.15: ArcMap Menus and Tools

4. **Print** – Print the map view.

5. **Add layers** – This tool allows a user to add GIS data to the document. This data may be stored locally, accessed through a network, or provided as a service over the Internet.

6. **Edit function**

7. **Open ArcCatalog** is used for GIS Data management tasks such as creating new shapefiles, copying shapefiles, deleting shapefiles, and others.

8. Open ArcToolbox

9. **Zoom-in** – allows a user to zoom into an area either by clicking on the desired location or by holding the right mouse button and drawing a rectangular box over the desired area of interest.

10. **Zoom out** - allows a user to zoom out of an area either by clicking on the desired location or by holding the right mouse button and drawing a rectangular box over the desired area of interest.

11. **Fixed zoom out** -to indicate how much to zoom out to the feature.

12. **Fixed zoom-in** to indicate how much to zoom in on the feature.

13. **Pan** - Select the hand and pan the map view in the desired direction

14. **Full extent** allows a user to expand the map view to the full geographical extent of the data located within the project.

15. Select element allows a user to choose a selection shape (circle, rectangle, line, or polygon) to select features of an active data theme

16. Identify Select the identify button, and then select a data theme by clicking on that theme and making it active. Use the identify tool to query the active data theme.

17. Find tool allows a user to perform a string query on any data theme located within the map view.

18. Add XY- allows a user to drop a point and generate the X, and Y coordinates for a specific location on a map.

19. The measure tool measures distance in specified units from one location to another.

The following figure illustrates the ArcMap basic interface and explains the various menu items and features found throughout the viewer interface.
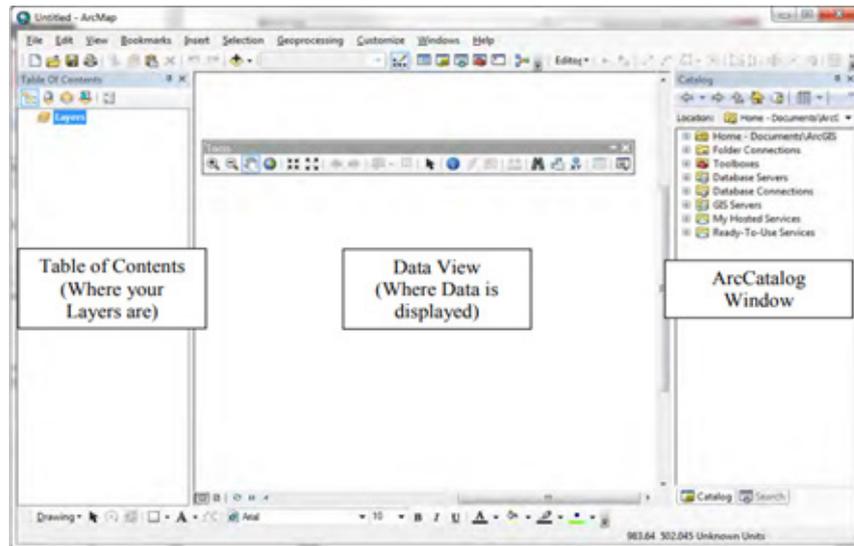
b. ArcToolbox

(?) Dear learner, what do you understand about ArcToolbox?

ArcToolbox is an integrated application developed by the environmental system research institute (Esri). It provides a reference to the toolboxes to facilitate the user interface in ArcGIS for accessing and organizing a collection of geoprocessing tools, models, and scripts. All ArcToolbox tools support all data types, including geodatabase, shapefiles, and coverage.

Toolboxes are containers for toolsets and tools required to perform any advanced geoprocessing tasks are organized logically. A toolbox cannot contain another toolbox. The common toolboxes present within ArcToolbox are:

◈ Analysis Toolbox provides a powerful set of tools to perform various geoprocessing operations, such as overlays, creating buffers, calculating statistics, and performing proximity analysis of all types of vector data.

◈ Cartography Toolbox is designed to produce data and support map production for specific maps in a way that meets a specific cartographic standard.

◈ Conversion Toolbox contains tools that convert data between various formats.

◈ Coverage Toolbox contains a powerful set of tools to perform various geoprocessing operations that only use coverage as input and will only output data as coverage.

◈ The data management Toolbox contains a rich and varied collection of tools that are used to develop, manage, and maintain feature classes, datasets, layers; and raster data structures grouped in this toolbox.

◈ Geocoding Toolbox contains tools to assist in accomplishing common geocoding tasks such as the creation, maintenance, and deletion of address locators, as well as the actual geocoding of addresses.

Source:https://desktop.arcgis.com/en/arcmap/10.3/main/analyze/a-quick-tour-of-geoprocessing.htm
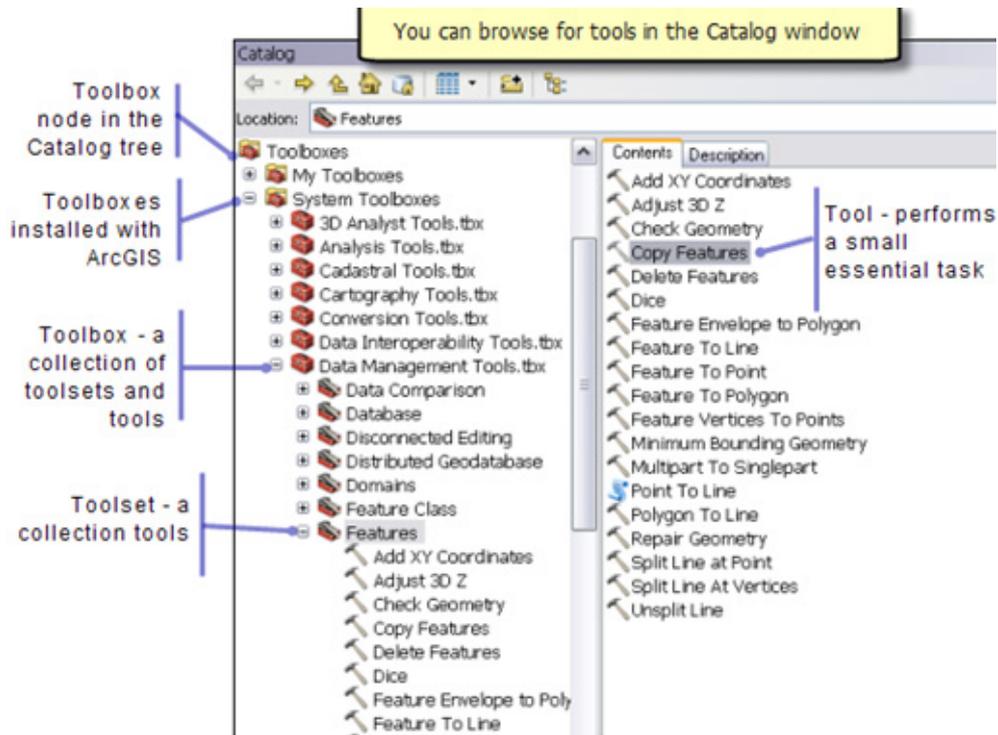
◈ Linear Referencing Toolbox contains a series of tools for creating, calibrating, and displaying the data used for linear referencing.

◈ Spatial Analyst Toolbox contains tools to create, query, map, and analyze cell-based raster data; perform integrated raster/vector analysis; derive new information from existing data; query information across multiple data layers; and fully integrate cell-based raster data with traditional vector data sources.

(?) Dear learner, what do you mean by toolsets?

Dear learner, please revise your response to the following note about toolsets and tools. Toolsets are logical containers of tools and other toolsets. Tools are a single geoprocessing operation, including dialog, models, and scripts. A tool can be stored at the toolbox level or within the toolset. The presence of Tools depends on the Extensions available. All the Toolboxes, Toolsets, and Tools within the ArcToolbox are sorted alphabetically.

(?) Dear learner, what are the main functions of ArcCatalog in ArcMap?

ArcCatalog is primarily used as a file manager, and to develop metadata for our GIS data. Metadata is information that explains your data to people who may want to use it and understand the different field attributes associated with the data set, the data projection, how the data set was created, any analysis performed on the data set, etc. There are two ways to access ArcCatalog: as a standalone application from the Start menu and on your desktop.

8.3.3. Adding, Removing, and Displaying Data
a. Adding Data

Dear learner, how do you add data in ArcMap?

One of the first steps performed when creating a new map document is to add GIS data. This data could be local data that you have previously created, or have been provided with; these formats could include shapefile, geodatabase, tabular data, or others. In addition, data can be sourced from the internet through data providers or streamed through online data services. There are two primary methods of adding data to your opened ArcMap Document. The first method is to use the ArcCatalog Window, browse your data, and drag and drop the file into your project. The second method is to use the Add Data button. To add data, we use the additional data pull-down menu which has three commands. Add Data opens the add data dialog box, where you can add local data, or connect to a known data server or service. Add Basemap opens the base map dialog box, where you can select from a variety of pre-made base maps published by ESRI and other groups. Add Data from ArcGIS Online opens the ArcGIS Online portal, allowing you to browse through numerous base maps and data services provided by any number of groups.

When you want to add local data, you can use the Add Data button on the ArcMap toolbar to add data to your map. Click Add Data, browse to and select the data you want to add, and then click Add. Once the data are added, you will notice that the data layers are placed into the Table of Contents (TOC) in a specific order. They are organized in the TOC by geometry type: Point features are on top of line features, which are on top of polygon features, and polygon features would be on top of raster datasets.
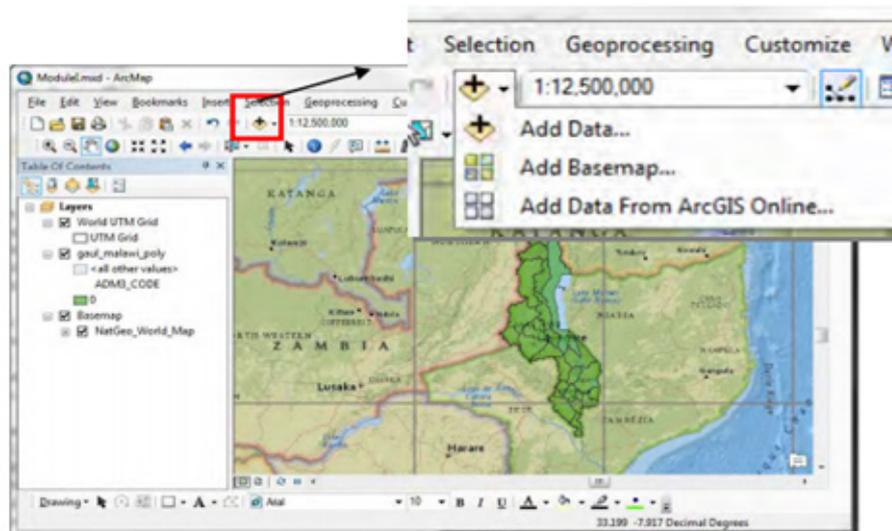
b. Removing Data

The instruction to remove data is given as follows. First, locate the file you wish to remove in the Table of Contents in ArcMap. The Table of Contents is the list of data layers that appears on the left side of the Arc-Map window. Secondly, make right-click on the file name for the layer that you wish to remove, and a context menu will appear. Choose Remove from the menu.

c. Displaying Data

Maps can be displayed in the data view and layout view. Each view allows you to view and interact with the map in different ways. Data view provides a geographic window for exploring, displaying, and querying the data on your map. You work in real-world coordinates and measurements in data view.

Layout view allows working with the map layout elements, such as titles, north arrows, and scale bars, along with the data frame, arranged on a page. In layout view, you work primarily in page space (typically, inches or centimeters) except when you are interacting with a data frame in your layout. An alternative way to switch your display is to click View › Data View or View › Layout View from the main menu in ArcMap. Dear learner, please attempt the questions in activity 8.3 to demonstrate your understanding of this section.

Activity 8.3.

1. How do you distinguish between ArcCatalog, ArcToolbox, Toolsets, and tools?
2. How do you distinguish between the Table of Contents, Data View, and ArcCatalog windows?

Dear learner, have you correctly answered all of the questions in Activity 8.3? If you answered "no," go back and reread this section and try again. If you answered yes, please revise your responses to the feedback on activity 8.3.

Feedback to activity 8.3

1. ArcCatalog is a geodatabase administration application to maintain geospatial data and the corresponding metadata. It delivers a catalog window to manage and organize large spatial information for ArcGIS for Desktop. ArcToolbox is a collection of geoprocessing tools for analyzing, editing and converting data. It organizes Toolbox, Toolset, and Tool. The toolbox is the main container for toolsets and tools. A toolset is a secondary container with tools. The tool is a single geoprocessing operation.

2. The Table of Contents is the list of data layers that appears on the left side of the ArcMap window. Data view provides a geographic window for exploring, displaying, and querying the data on your map. Layout view allows working with the map layout elements, such as titles, north arrows, and scale bars, along with the data frame, arranged on a page.

Section Summary

Dear learner, please concentrate on the major points listed below to summarize this section.

❖ The ArcMap application is accessible by single-clicking on the ArcMap Icon in your Start Menu to open the software. After you finish working on a map, you can save it, click the file menu and click close.

❖ ArcMap menus and tools, including new project, open project, save the project, print, add layers, edit function, open ArcCatalog, open ArcToolbox, zoom in, zoom out, fixed zoom out, fixed zoom in, pan, full extent, select element, identity, find a tool, add XY, and the measure tool.

❖ ArcToolbox provides a reference to the toolboxes to facilitate the user interface in ArcGIS for accessing and organizing a collection of geoprocessing tools, models, and scripts.

❖ The common toolboxes present within ArcToolbox are analysis, cartography, conversion, coverage, data management, geocoding, linear referencing, and spatial analysis.

❖ Toolsets are logical containers of tools and other toolsets.

❖ Tools are a single geoprocessing operation, including dialog, models, and scripts.

❖ ArcCatalog is primarily used as a file manager, and to develop metadata for our GIS data.

Project Activity 8.3:

Dear learner, attempt the following project activities related to laboratory-based GIS data.

1. Add point, polyline, polygon, and raster data in the data view window of the ArcMap.
2. Organize point, polyline, polygon, and raster data in the Table of a Content window of ArcMap.
3. Remove the added data from the data view window of the ArcMap.
4. Display the map through Layout view and work with the map layout elements, such as titles, north arrows, and scale bars, along with the data frame.

☑ Checklist 8.3

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

№	Questions	Yes	No
1	Did you apply the basic steps of opening, saving, and closing ArcMap documents on a computer?		
2	Did you describe the functions of the main tools of ArcMap?		
3	Did you use the Arc Map menu to add, and display data?		
4	Have you produced a map of different geographical issues and distributions?		

SELF-TEST EXERCISE 8.3

Part one: Multiple-Choice Item

Instruction: Please choose the most appropriate answer from the alternatives provided for the following questions.

1. Which one of the following is the primary application and interface associated with ArcGIS software

    A. ArcMap   C/ ArcGIS

    B. ArcMap document   D/ ArcView

2. Which is an integrated application developed by the environmental system research institute (Esri).

    A/ ArcToolbox   C/ Tools

    B/ Toolboxes   D/ ArcCatalog

3. Of the following, which one contains a series of tools for creating, calibrating, and displaying the data used for linear referencing

     A. Linear Referencing Toolbox   C/ Geocoding Toolbox

    B/ Spatial Analyst Toolbox   D/ None

4. Which of the following is primarily used as a file manager and to create metadata for our GIS data?

    A. ArcMap   C/ ArcCatalog

    B. ArcToolbox   D/ ArcView

Part Two: True/ False Item

Instruction: Dear learner, Please answer True if the sentence is correct and False if it is incorrect.

1. Working with the data frame and the map layout elements, such as titles, north arrows, and scale bars, on a page is possible with a data view.

2. Adding GIS data is one of the initial steps in producing a new map document

3. The ArcToolbox's toolboxes, toolsets, and tools are all arranged alphabetically

FEEDBACKS ON SELF-TEST EXERCISES 8.3

Multiple Item: 1. A   2. B   3. A 4. C

True/False Item: 1. False 3. True 4. True

UNIT SUMMARY

The height difference between different landform features in a given geographical area refers to relief. The uneven landforms with different heights are represented on topographic maps with the help of hachure and contour lines. Hachures are small straight lines drawn on the map along the direction of maximum slope, running across the contours. They are used in combination with contour lines to illustrate escarpments, depressions, and craters. Contours are an imaginary collection of lines connecting places having equal elevation on the ground surface above a datum, showing mountains, valleys, and landforms. Contour lines forming concentric circles on the map represent a hill.

The closed contours with elongated shapes with increasing values towards the center with no specific tips illustrate mountain ranges. A long and narrow hillside or a sloping line of high ground with two or more peaks shown by an elliptical contour line is called a ridge. Contours with "V" shapes, with upward bending and values increasing upward represent valleys. On maps, depressions are represented by closed contours with more or less circular shapes that have tick marks pointing toward the low ground. Contoured depressions are different from hills by short ticks at right angles to the contours, pointing towards the center of the depression. An elevated land represented by closed contours roughly rectangular in shape with increasing values towards the center is a plateau.

Contours with "U or V" shapes, with downward bending and values increasing upward represent spurs. The contour lines on the slope merge into a single contour or are shown very close together to represent cliffs. Contour lines extend the length of the filled area and have tick marks that point toward lower ground. A contour topographic map can be produced using a Geographic information system (GIS).

GIS is a computer-based system for capturing, preparing, manipulating, analyzing, and displaying geospatial data. Working with GIS helps to integrate hardware, software, data, people, and methods. ArcMap is one of the applications of the ArcGIS desktop environment. ArcMap is a program in which we add data, make maps perform analysis, access Arc catalog and ArcToolbox, use geoprocessing tools, integrate GPS field data, etc. The ArcMap application is accessible by single-clicking on the ArcMap Icon in your Start Menu to open the software. The ArcMap display window contains menu tools, ArcToolbox, ArcCatalog, and others. Once the ArcMap is opened, adding GIS data is one of the first steps performed when creating a new map document. Spatial data is added to the data view displaying window. The added data can be analyzed using different geoprocessing tools and tools from ArcToolbox. Layout view allows working with the map layout elements, such as titles, north arrows, and scale bars, along with the data frame, arranged on a page.

Feedback on the Review Exercise

1. Contours are commonly drawn at regular intervals by connecting places having equal elevation on the ground surface above a datum or mean sea level to illustrate the relief without hiding the other features drawn on the topographic map. Hachures are short disconnected lines that represent slopes drawn in the direction of the ground slope or water flows. They do not indicate the height and exact gradients, and they give only qualitative information. Hachures are laborious to draw and can be difficult to read and interpret. They are not used alone; instead, they are used in combination with contour lines to illustrate escarpments, depressions, and craters.

2. The general properties of the contour are:

◈ Contours cannot merge or cross one another on maps except at vertical cliffs, waterfalls, and hanging cliffs.

◈ Contour lines never branch; rather branching lines on the map could represent rivers, roads, and boundaries.

◈ They are always numbered in the direction towards which altitude increases.

◈ Contour lines are generated from spot heights and statistical points that represent the specific altitude of a place at that particular point.

3. Evenly-spaced contours represent a uniform slope, gentle slope hillsides are represented by widely separated contours that are equally spaced on the map, and steep-sloped hillsides are represented by more closely separated contours.

4. The relief features are represented by the numbers identified and justified as follows.

	Feature	Justification
The relief represented by the number 1	hill	1 rises higher than everything surrounding it
The relief is represented by the number 2	Valley	2 is the elongated depression between the ridge and spur
The relief is represented by the number 3	Ridge	3 is a continuous elevation crest with sloping sides
What does number 4 represent?	Saddle	4 is a low point between two hills
The landform represented by the number '5' is	Depression	5 represents a closed contour inside which the ground is at a lower elevation than that outside and hachures marked on the downslope or down-dip side.
The landform represented by the number '6' is	Draw	6 represents a steep gorge, gully, or ditch formed by water erosion on the mountainside
The landform represented by the number '7' is	Spur	7 represents a smaller ridge branching off a summit or the main ridge
The landform represented by the number '8' is	Cliff	8 represents vertical or near-vertical features
What does number 9 represent?	cut	9 represents a man-made feature resulting from cutting through the raised ground, usually to form a level bed for a road or railroad track
The relief represented by the number 10 is	fill	10 represents a man-made feature resulting from filling a low area, usually to form a level bed for a road or railroad track.

5. Trellis drainage patterns develop in areas where harder and softer rocks alternate. The pattern of this drainage pattern is greatly affected by tectonic forces (folding and faulting). The branches of the river system usually join one another at nearly right angles. A radial Drainage Pattern occurs when rivers flow in all directions away from a raised feature.

Module Project Activities

Dear learner, please try to attempt the project activities listed below.

1. Produce or display a map of Ethiopia on ArcMap.
2. Produce zonal or district maps using ArcMap software
3. Go to the fields and generate spatial data using the global position system (GPS), and try to produce a point, polyline, and polygon features using ArcMap software.

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MODULE TWO GLOSSARY

Advantage: refers to the benefit, favorable condition, or opportunity obtained (gained) by land users, beneficiaries, communities, or governments due to the occurrence of particular conditions like trade, business, agriculture, politics, policies, international relations, etc.

Agroecological intensification: Improving agricultural performance while avoiding negative effects on the environment and dependence on outside inputs by incorporating ecological concepts into farm and system management.

Age-Sex Structure: This text refers to the configuration of the population of the world (or of any region) based on the number or proportion of males and females within each age category.

Challenges: are difficulties, disadvantages or unlikely conditions faced by communities, countries, individuals, or groups of people.

Climate extremes: are the occurrences of excessive climatic or weather conditions (e.g. temperatures & rainfalls) below or above normal thresholds over specific geographic areas and times.

Critical thresholds: refer to the transition to acute ranges (limits) of normal climatic and poverty levels 'across which small changes in spatial pattern produce abrupt shifts in ecological responses'.

Digital divide: is the breach between persons, families, companies, and geographic regions at varied socioeconomic levels about retrieving relevant information for getting access to a wide range of economic and political opportunities. It mainly relates to the difference in getting access to information communication technologies (ICTs) and the use of the internet for a wide variety of activities.

Deserts: are places that receive less than 250 mm annual rainfalls.

Desertification: refers to land degradation in dry, arid, semi-arid, and dry sub-humid areas.

Disadvantage: in this text refers to loss (damage) or unfavorable conditions caused by rapidly growing populations, land degradation, wrong policies, etc.

Disadvantage: is 'an unfavorable' (negative) condition that decreases the likelihood of attainment or success of individuals, communities, or countries.

Doubling time: in this text refers to the time taken (length of time taken) for the population of the world (or any region) to grow two-fold or to double itself.

Drought: Drought is an extended period of dry weather (drier-than-normal) leading to acute water shortage and related problems. If prolonged, it causes crop failures, livestock deaths, and famines.

Economic development: is development where the welfare and quality of life of individuals, communities, and nations are improved when measured based on standard indicators like the HDI. It focuses on both qualitative and quantitative aspects of development, unlike economic growth.

Economic growth: is the quantitative growth of the production of goods and services in a country over a specific period. It is often measured using Gross Domestic Product (GDP).

Education: in this text refers to receiving (attending) formal and systematically designed knowledge and instruction at schools, universities, and other institutions.

Employment: employment refers to the occupation of individuals or groups of people in certain income-making activities for earning money or useable products to satisfy personal and household livelihood needs.

Environment: is the totality of the physical, social, and cultural conditions surrounding humans or other living organisms, and that can have significant effect on the development of the humans or organisms that it surrounds.

Environmental change: The alteration or disturbance of the natural environment, most frequently brought on by human activities and ecological processes.

Environmental degradation: is the long-term alteration of the quality and quantity of the environment over a given geographic area. It leads to the loss of the biological mass including forests, pastures, and meadows. Exports: are products or services sold to another country in terms of monetary basis or for the exchange of imports.

Famine: persistent and acute hunger or starvation caused by food and water scarcity over a geographic area. It is a widespread and severe state of malnourishment, starvation, illness, and death of a significant part of the population

Family: refers to members of households who have kinship or blood relationships and/or those bound together through marriage. It includes all related individuals (parents, children, aunts, uncles, grandparents, etc.).

Family size: the number of people living in the same dwelling unit in the family.

Flooding events: are conditions where excessive water flows inundate dry land surfaces. They are commonly caused by excess rainfalls, tsunamis, tornadoes, or sea waves.

Geographic location: the position of a place on the Earth concerning a specific geographic point. It is usually defined from the equator or prime Meridian when considered in absolute terms.

Geographic determinism: is a philosophy that assumes the stage of socioeconomic development of countries is exclusively determined by geographic location and the environment.

Geographic Information System (GIS): A computer system that analyses and presents spatially referenced data

Geographic location: the position of a place on the Earth concerning a specific geographic point. It is usually defined from the equator or prime Meridian when considered in absolute terms.

Geomorphology: is the science which studies the origin, processes, development, and structure of landforms

Household: refers to groups of persons who are living together and make common supplies of food, shelter, and other essentials required for living. It may comprise people with no blood or marriage relationships but sharing similar shelter or housing units.

Household income: is the total revenue of all earnings, whether monetary or in-kind (such as goods and services), collected by households or their members annually or at frequent intervals.

Imports: Imports are materials or services purchased from another country. They often lead to the outflow of money from a country through payments to the seller country.

Intra-regional trade: Intra-regional trade in this text means trade inside Africa. Goods and services are exchanged between African countries.

Landlocked countries: are countries that do not have direct access to the sea or those that do not have Sea ports.

Landslide: a destructive rock movement (rapid mass-wasting) from higher ground to lower ground

Overexploitation of resources: Exploiting a renewable resource until there are no more benefits left.

Political disadvantages: are challenges posed by unresponsive, volatile and none-secured political conditions in a region or a country.

Population change: the variation in the size of the population of any country or region between the initial and ending periods.

Population growth rate: is the percentage change (rate) at which the number of people in a community increases over a given period; expressed as a fraction of the original number of the population.

Possibilism: is a notion that argues geographic environment is not the only determinant factor on the lifestyle of people and socio-economic development. The belief considers humans are active actors in the environment.

Poverty trap: Poverty trap is an escalating situation where poor people repeatedly fall into recurrent poverty. It is a situation when it is very challenging for poor people to escape from poverty. In this situation people lack the necessary resource (finance & credit) to escape from poverty.

Rate of economic growth: the rate at which the values of material goods and services produced in a country or nation increase over a definite period, as compared to an initial period.

Reforestation: is the process of planting trees in deforested areas or on lands that were under forest cover previously but that have been converted to some other use in the latter periods.

Regional institutions: are geopolitical organizations established by nation states to deal on the sustainable management and mutual use of shared watercourses.

Sea access: refers to having direct access to the Sea for trading (communication) purposes

Settlement: a place occupied by resident houses or human shelters.

Service centers: Service centers are geographical areas serving as focal points of marketing, transportation, and administration.

Temporal dynamics: this text refers to the change in the number of humans, growing rates, doubling times, age, and sex structures of the world population over time.

Trade challenges: are barriers that hinder the smooth function of the exchange of goods and services between countries.

Trade policies: are laws and guidelines issued by a government to intervene in the domestic and foreign trade of countries to balance demand and supply and protect the 'internal market from the international competition through the use of tariff and non-tariff instruments'.

Transportation disadvantages: are challenges faced by the lack of developed and speedy transport networks.

Underemployment: is the condition when a person fails to engage in full-time work or is involved in a job that is not related to the actual training, skill, experiences, and financial needs. It is a situation in which individuals are enforced to involve in 'low-paying' or 'low-skill jobs'.

Unemployment: is the condition of being jobless or having no occupation to harvest money or products for supporting self-living or household livelihoods.

Well-being: refers to the state of existence that fulfills various human needs, including material welfare (living) conditions and quality of life, as well as the ability to pursue one's goals, thrive, and feel satisfied with one's life (IPCC, 2018; 2019).

SAMPLE ASSIGNMENTS OF MODULE TWO

Dear learner; we hope you enjoyed reading the module and doing the self-test questions. Now you are at the stage of completion of Module Two. You are required to do a sample Assignment of module two. General Direction: The assignment comprises a Short Answer item and project activities. Hence, read each item carefully and answer/complete all the questions according to their respective instruction.

1. Geography is one of the most important factors in development. Then, describe how geography influences economic development.
2. Differentiate between the thoughts of geographical determinism and possibilism.
3. Explain how climate extremes intensify poverty levels among communities, households, and individuals.
4. Identify three landlocked countries of Africa in which their trade is strongly affected by their geographical location.
5. How do you understand habitat loss?
6. How do you manage the habitat of a given organism?
7. How do you understand the phrase extinction debt?
8. How does agricultural intensification result in biodiversity loss?
9. What are the causes and effects of the overexploitation of natural resources?
10. What are the impacts of terrestrial and aquatic invasive species expansion?
11. How do you distinguish between land degradation and environmental degradation?
12. List out the types of environmental degradation.
13. Fieldwork Projects: Alternative One: Dear learner please carry out field observation on some degraded land, forest, or environment and write a report on why such a level of degradation happened. What are the effects of such degradation on local farmers' agricultural production, fauna habitat fragmentation, invasive species expansions, loss of biodiversity, and other ecological processes, such as erosion? Alternative two: dear learner, please observe landfills, river basins, and industrial and commercial areas and write a report on how these areas affect human health and biodiversity in the adjacent areas
14. Rapid population growth is emerging to be among the burning concerns of our contemporary world. Then, identify the principal population-related concerns of the present world.
15. Differentiate the Malthusian and Anti-Malthusian views of population and development.
16. Desertification is one of the natural disasters causing human suffering throughout the world. Can you identify areas in Ethiopia that are frequently affected by desertification?
17. What is drought? How it differs from famine? Explain?
18. The Digital divide is the gap existing among persons, households, companies, and regions in socioeconomic and political development due to the differences in access to information; information communication technologies (ICTs); and use of the internet for a wide variety of purposes. Then, identify the factors intensifying the global digital divide.
19. Compare and contrast the contour and hachure for representing relief features.
20. Describe the general properties of contours.
21. How do you identify different slopes on contour maps?
22. By referring to the following contour map, try to identify the relief features that are represented by the numbers indicated below and justify how you identified the feature.
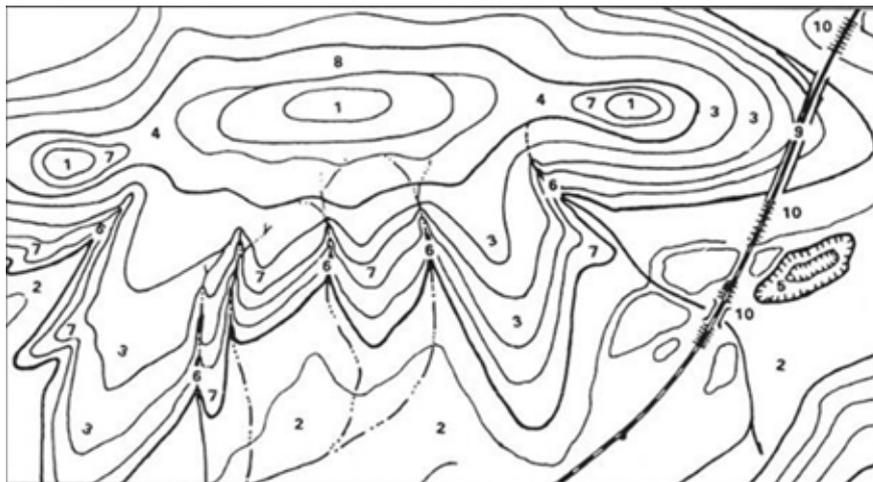
	Feature	Justification
The relief represented by the number 1		
The relief is represented by the number 2		
The relief is represented by the number 3		
What does number 4 represent?		
The landform represented by the number '5' is		
The landform represented by the number '6' is		
The landform represented by the number '7' is		
The landform represented by the number '8' is		
What does number 9 represent?		
The relief represented by the number 10 is		

GEOGRAPHY
GRADE 11

DISTANCE LEARNING MATERIAL

MODULE

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