F.Y.B.Com.

ENVIRONMENTAL STUDIES

SEMESTER - I

SUBJECT CODE : UBCOMFSI.5

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December 2020, F.Y.B.Com., Environmental Studies

Published by	:	Director Incharge Institute of Distance and Open Learning , University of Mumbai, Vidyanagari, Mumbai - 400 098.
DTP Composed	:	Ashwini Arts Gurukripa Chawl, M.C. Chagla Marg, Bamanwada, Vile Parle (E), Mumbai - 400 099.
Printed by	:	

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SEMESTER - I

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2) Natural Resources and Sustainable Development :

Meaning and definitions ; Classification and types of resources, factors influencing resource utilisation; Resource conservation- meaning and methods - conventional and non-conventional resources, problems associated with and management of water, forest and energy resources - resource utilization and sustainable development

3) Populations and Emerging Issues of Development :

Population explosion in the world and in India and arising concerns- Demographic Transition Theory - pattern of population growth in the world and in India and associated problems - Measures taken to control population growth in India; Human population and environment - Environment and Human Health – Human Development Index – The World Happiness Index.

4) Urbanisation and Environment :

Concept of Urbanisation – Problems of migration and urban environment- changing land use, crowding and stress on urban resources, degradation of air and water, loss of soil cover impact on biodiversity, Urban heat islands – Emerging Smart Cities and safe cities in India - Sustainable Cities.

5) Reading of Thematic Maps

Located bars, Circles, Pie charts, Isopleths, Choropleth, and Flow map, Pictograms - Only reading and interpretation.

Unit -1

ENVIRONMENT AND ECOSYSTEM

After going through this chapter, you will be able to understand the following features:

1.1. OBJECTIVES

By the end of this unit you will be able to –

- Understand the concept, definition, nature, scope and importance of environment and ecosystem
- Understand the relationship between man and environment
- Understand the importance of environmental studies

1.2. INTRODUCTION

Now a day the word Environment is often being used by allmost all the people surrounds us, on the television and newspapers are focusing different environment related news

regularly. Everyone is speaking about the protection of the environment. Global summits held regularly to discuss the environmental issues. During the last few years, the mutual relationship among the environment, social organization and culture has been discussed in sociology, geography and anthropology. All shows the increasing importance of the environment.

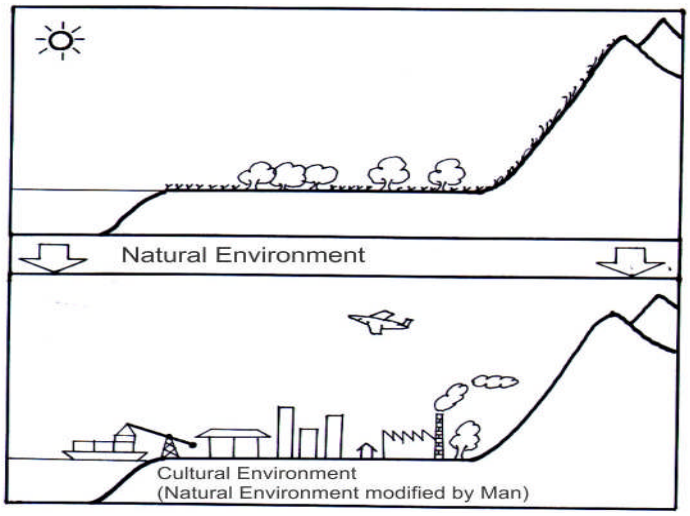


Fig. 1.1

Environment is the source of life on the Earth and determines the existence, growth and development of mankind and all its activities. Primitive man relied heavily on the nature for their survival. But man, among the all living being, is the most intelligent and capable to modify his surrounding to suit his requirements. Therefore, continuous interactions of man and environment cause different global, regional and local problems. With the development of modern technology, there is always a growing pressure on the environment. These dynamic relations between man and environment become the primary concern for every one for the survival of the future generation. The concern about the environment has existed for a long time but the development in last fifty years so have some environmental issues among the public. The concern of environment arises from the desire to improve the quality of life.

1.3. SUBJECT DISCUSSION

Throughout time, humans have learned to exist at many locations on the earth. The interaction of humans with the environment (surroundings) in these locations has often brought major changes in that environment. Some changes were good, some were bad. Many times, the bad changes were caused by humans making too much of a change in the environment, by using or abusing the natural resources (anything found in nature) present.

Every location where people have lived contained a community of plants, animals, insects, and other natural resources. A community of organisms, other natural resources, and their influence on each other is called an ecosystem. The plants and animals existing in an ecosystem are those most adapted to that environment.

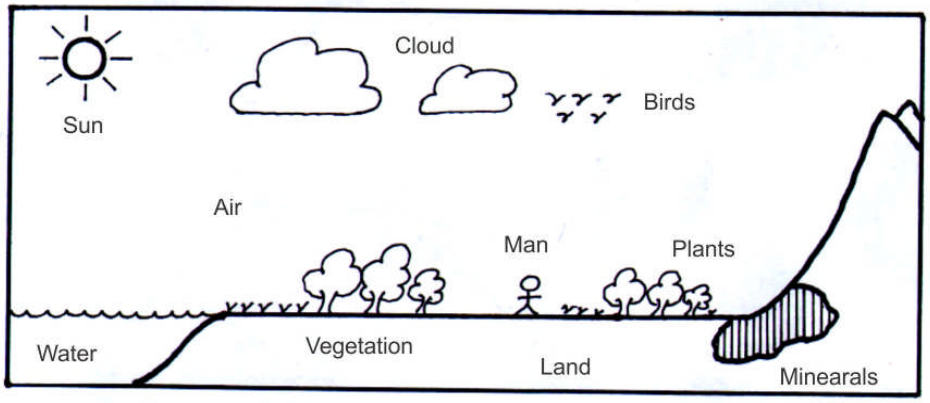


Fig. 1.2 Different elements in the environment

A growing human population presents increasing environmental challenges around the world. The study of Environment and Ecosystem helps in understanding the dynamics of ecology, environmental science, and conservation management of natural resources, wildlife and sustainable ecosystems and landscapes so that applicable solutions can be sought for.

1.4. ENVIRONMENT

a. Definition of Environment:

The word "**ENVIRONMENT**" originated from a French word "***Environia"***, which means "***around"*** or ***to surround*** or ***to encompass*** or ***to encircle***.

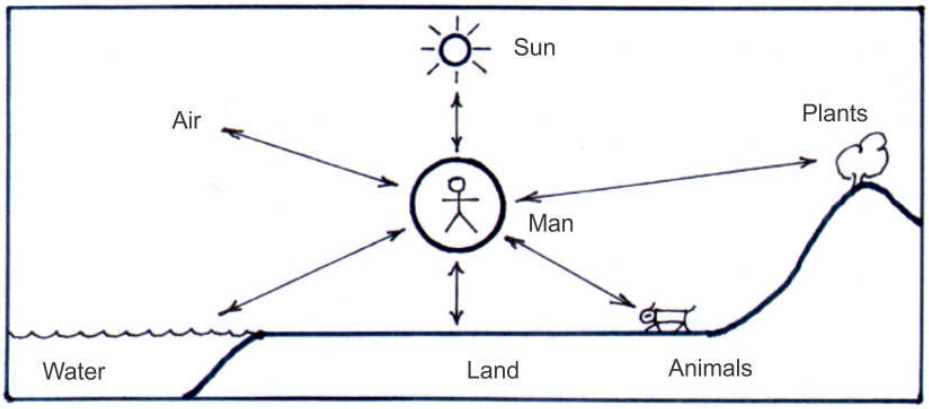


Fig. 1.3 Environment

This means that environment includes things or objects or events that surround us. It is believed that the subject has been introduced by the biologist **Jacob Van Enkul** in the early 1900s.

- "The environment is the sum total of all conditions, agencies and influences which affect the development, growth, life and death of an organism, species or race". **(The Universal Encyclopedia).**
- German scholar **Fitting (1922)** defined environment as "the totality of milieu factors of an organism".
- **Transley (1926)** a plant ecologist described the environment as the "sum total of those effective conditions in which organism live".
- According to the American anthropologist **Herskovits (1948)**, "environment is the sum of all those external conditions and influences, which affect the life and development of human being".

From the above definitions, we learn that:

- Environment refers to everything that surrounds us in which we live.
- Any external force which affects the life of an organism is a part of environment.
- Environment is a multi-directional system of interaction.
- Environment is the complex of many variables.
- Environment is a dynamic concept as it changes according to time and space.
- It is the sum total of conditions which affect the development and growth of any organism.

The environment is a complex of many variables which surrounds man as well as all living organisms. This means environment includes things or events surrounding us and their interaction.

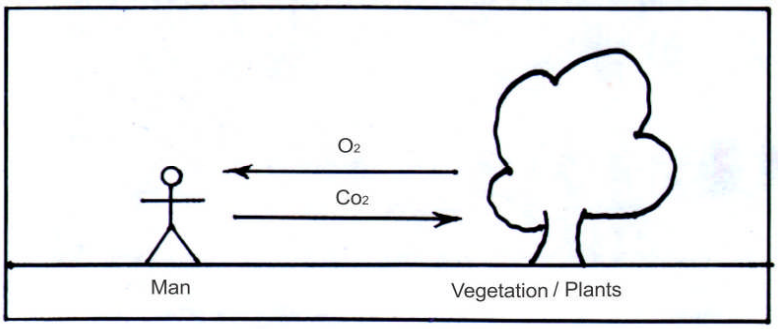


Fig. 1.4 Man-Environment Relationship

It is an interaction between living beings (plants/ animals) and their environment, which includes physical non-living

components like air, river, ocean or land, mountain, plateau etc. It also includes interaction among living beings. It is thus a multi directional system of interaction. The system is made of living and non-living physical components of Earth.

b. Nature and Scope of Environment:

The environment is very ***complex*** in nature. It is a mixture of living and non-living components that are interrelated to each other yet are independent. The environment is ***comprehensive*** in nature; as it includes everything surround us. The most important property of environment is its potential to ***change or dynamism***. Both biotic and abiotic components have the potential to change.

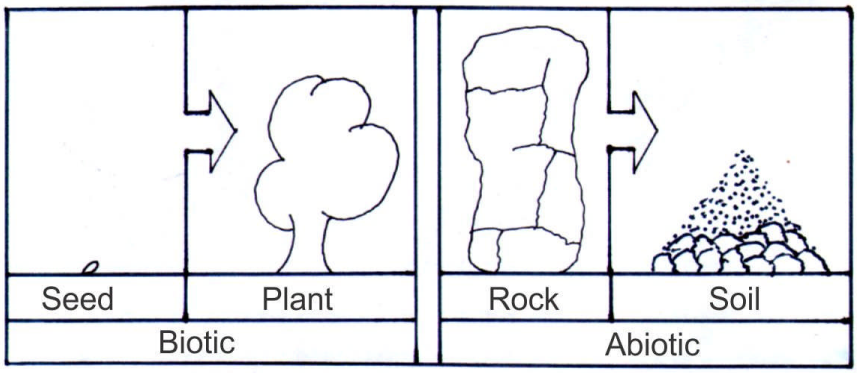


Fig. 1.5 Changes in the Biotic and Abiotic factors

The other character of environment is it lies in his system. The functioning of environment always follows a ***systematic*** order. The hydrological cycle is the best example of a systematic order or sequence of the events in the environment.

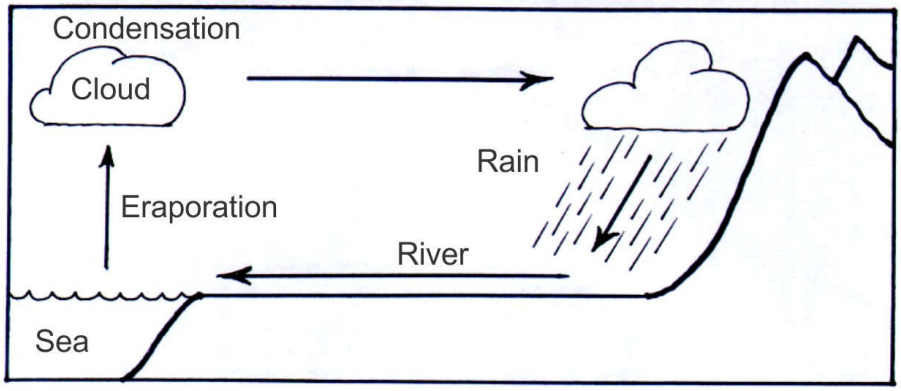


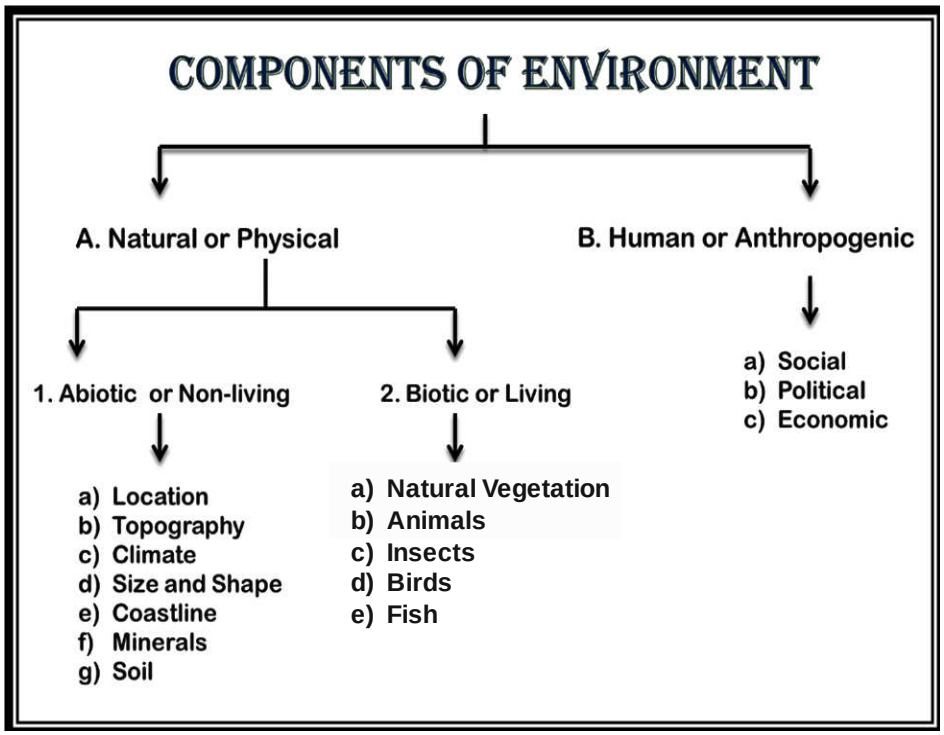
Fig. 1.6 Hydrological Cycle

The scope of environment lies in the components of environment. However, with alterations brought in the components, the scope has widened to include their necessary protection and

sense of proper utilization. It thus enables man to accept his environmental responsibilities.

c. Components of Environment:

Environment is a complex phenomenon of different factors which are the product of the forces and processes of nature. It comprises of number of factors that interact with each other in different ways to keep the planet alive and support the life on the earth. Environmental factors influence the living being in several



ways. Organisms continuously take the things they need from the environment and depend entirely on their environment for their survival. Different living beings live in different habitats due to differences, in needs for survival.

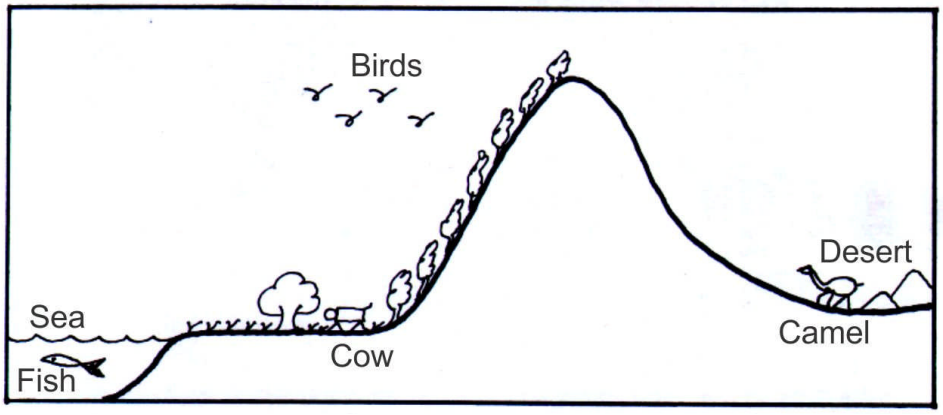


Fig. 1.7 Different biotic elements and their environment

The components of the natural environment can be classified into two broad groups:

- **ABIOTIC or Non-living.**
- **BIOTIC or Living.**

There is also a **Man-made environment**.

- **Abiotic or Non-living Components**

The abiotic or non-living components are all those physical and chemical factors which influence the life of the living beings.

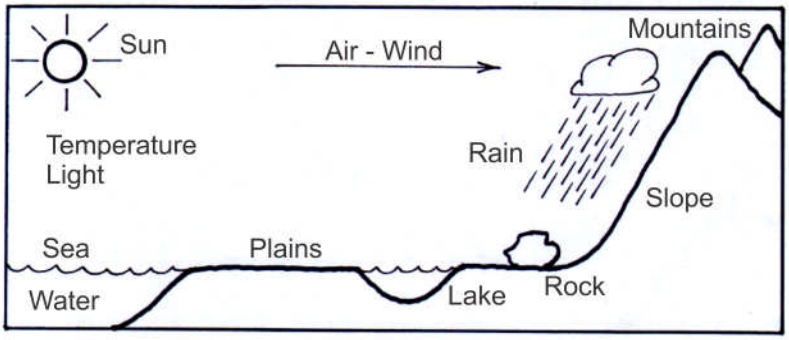


Fig. 1.8 Abiotic factors

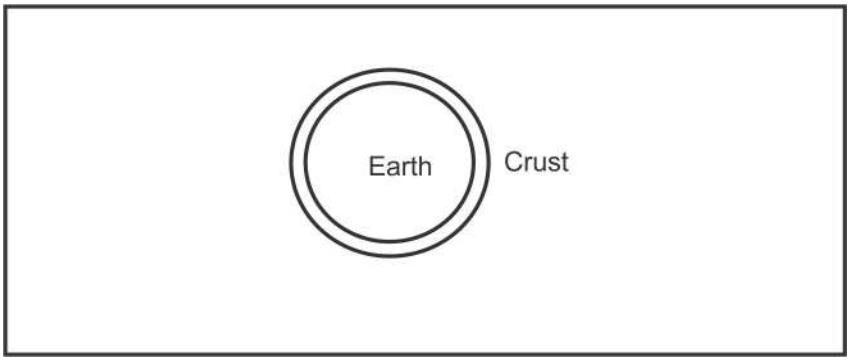


Fig. 1.9

o ***Lithosphere***:

Lithosphere is the outer Layer of the solid earth. It consists of minerals occurring in the earth's crust and the soil. For example: minerals, organic matter, air, water. The abiotic components associated with lithosphere are as follows:

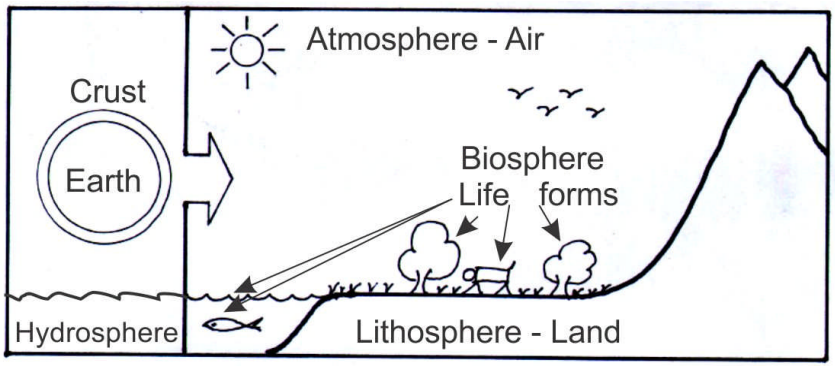
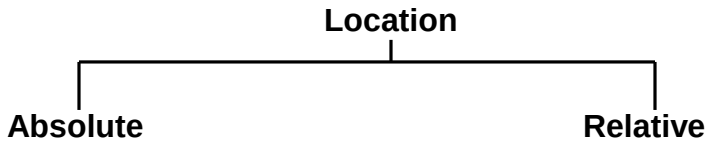


Fig. 1.10 Major components of the Earth

- **Location**: Location is the main factor as it influences the human activities. There are two types of location viz. Absolute location and Relative location.



- **Absolute location** is referred to the actual location on Earth's surface with respect to geographical coordinates (in terms of latitudes and longitudes).

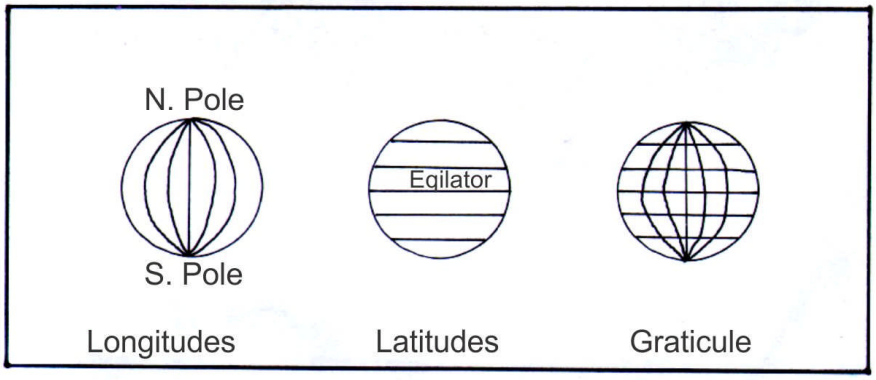


Fig. 1.11 Absolute location - Graticule

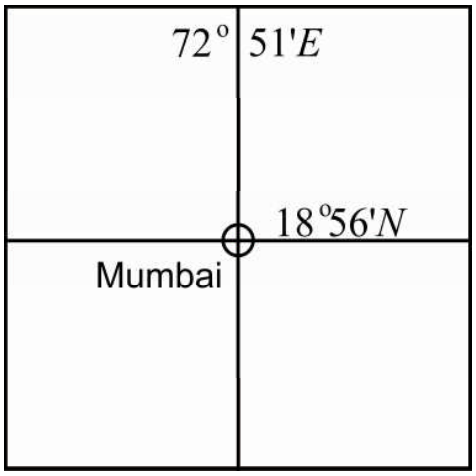


Fig. 1.12 Absolute Location of Mumbai

- **Relative location** can be defined as the location with reference to a reference point. The references may be natural or man-made.

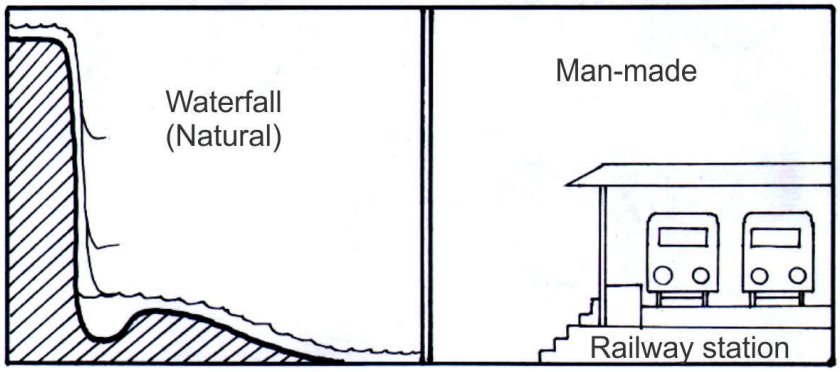


Fig. 1.13 Relative Location

- **Coastline**: The nature of the coastline also plays an important role as trade is dependent on waterways. The development of ports and harbours for international trade depends on the nature of coastline.

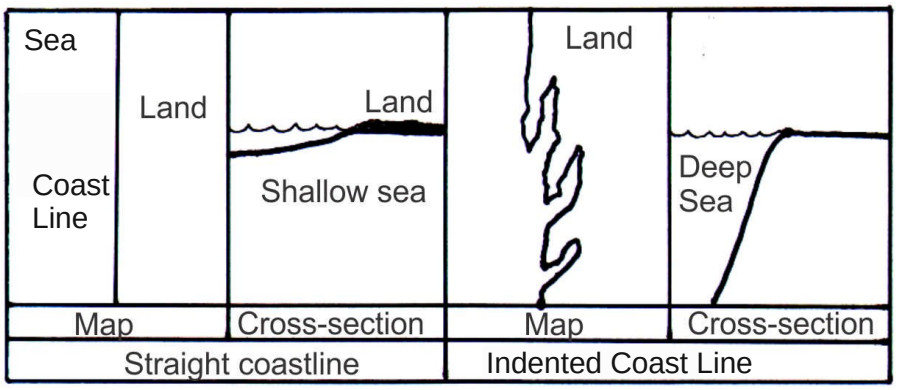
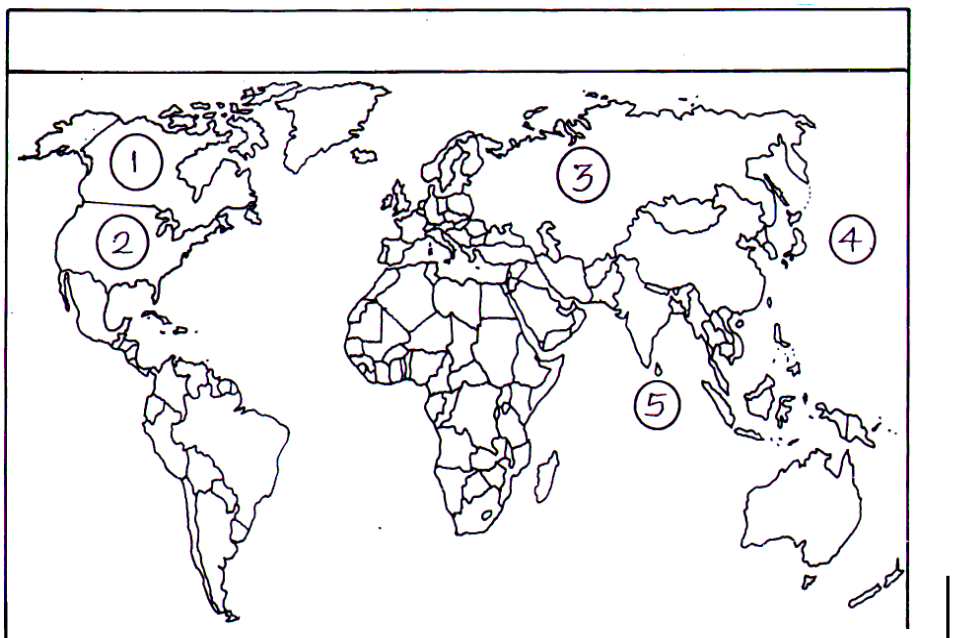


Fig. 1.14 Nature of coastline

- **Size and Shape of Country**: The countries vary in their shape and size. Some of the countries are large like U.S.A, Canada, Russia and they can enjoy the large amount of resources. Smaller countries like Japan, Sri Lanka have limitation in resource utilization.



Big Countries - 1) Canada 2) USA 3) Russia

Small Countries - 4) Japan 5) Sri Lanka

Fig. 1.15 Large & Small Countries

Shapes of the countries may be elongated, fragmented or compact.

Fig. 1.16 Shapes of the Countries

o ***Hydrosphere***:

The hydrosphere consists of all the water bodies on earth surface, ocean, seas, river and lakes that consists 71% of the earth surface. This includes water in liquid and frozen forms in groundwater, oceans, lakes and streams. Saltwater accounts for 97% of this amount. Fresh water accounts for only about 3%. Of this fresh water, 2% is in the form of ice and permanent snow cover in the Arctic, the Antarctic, and mountain glaciers. Only less than 1% of the fresh water on Earth is in easily accessible lakes, reservoirs and river systems. It is essential for living.

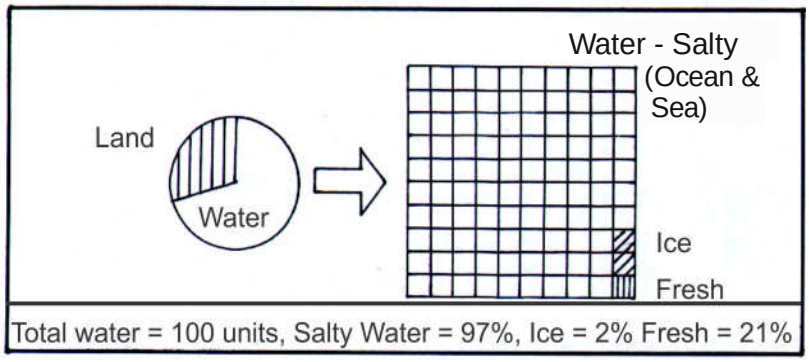


Fig. 1.17 Water on the Earth

o ***Atmosphere***:

The Atmosphere is a transparent envelope of gases and suspended particles that surround the Earth. Without atmospheric gases, life could not exist. Even the physical processes that operate in the atmosphere are of vital importance because they are responsible for the Earth's varied climates. The atmosphere of Earth is mostly composed of nitrogen. It also contains oxygen used by most organisms for respiration and carbon dioxide used by plants for photosynthesis. The atmosphere helps protect living organisms from genetic damage by solar ultraviolet radiation, solar wind and cosmic rays.

The Atmosphere is the source of every living thing in the world. It plays a very important role in serving the world's needs. The ozone layer in the atmosphere is a matter of tremendous concern as it profoundly influences the environmental conditions.

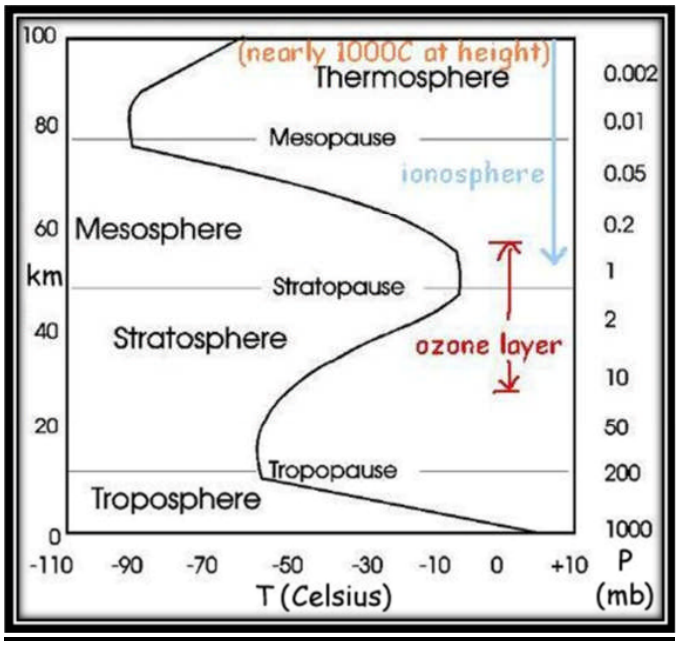


Fig. 1.18 layers of the Atmosphere

The Atmosphere is divided into layers according to major changes in temperature. Atmosphere consists of five main layers.

From highest to lowest, the five main layers are:

Height in Km	
	Space
10,000	Exosphere
700	Thermosphere
80	Mesosphere
50	Stratosphere
12	Troposphere
0	Earth's Surface

Fig. 1.19 Structure of the atmosphere

- **Biotic or Living Components**

Living components form the layer called Biosphere.

o ***Biosphere***

Biosphere is defined as that part of the Earth and atmosphere in which ecosystems exist and operate. The area of contact and interaction between these components is really

important for life, for it is here that the entire life is confined and the basic processes of life like photosynthesis and respiration occur.All the living organisms are, mostly, confined to the parts of biosphere that receive solar radiation during the day. Different living organisms are termed as:

I. ***Fauna*** includes all animals of lower and higher order.

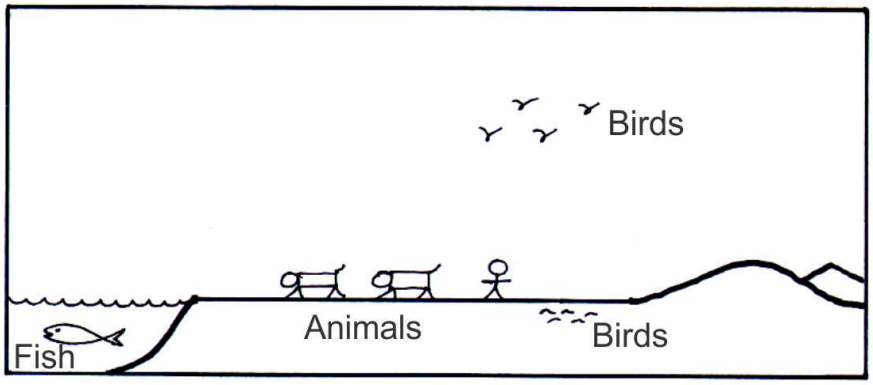


Fig. 1.20 Fauna

II. ***Flora*** includes vegetation, both under water and above land.

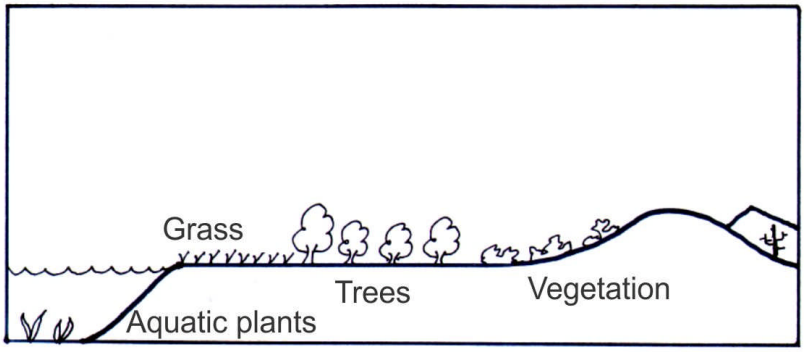


Fig. 1.21 Flora

III. ***Soil*** can be defined as the organic and inorganic materials on the surface of the Earth that provides the medium for plant growth. Soil develops slowly over time and is composed of many different materials.

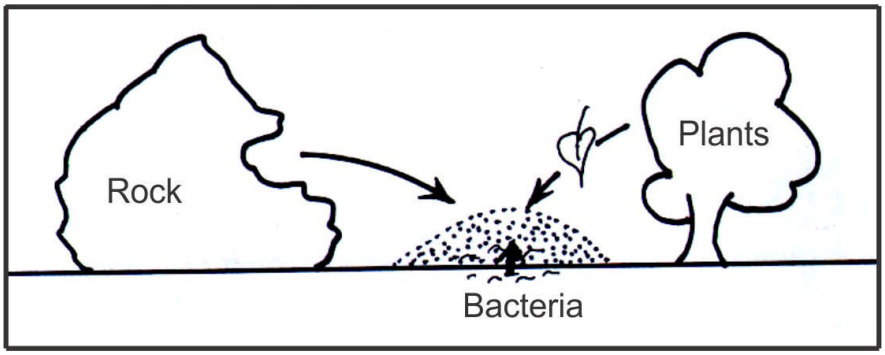


Fig. 1.22 Elements of soil

There are three main components of biosphere. They are:

- **Producers**: The autotrophic organisms who make their own food, mainly green plants.
- **Consumers**: The heterotrophic organisms who depend on producers for their food.
- **Decomposers**: Bacteria and fungi belong to this category. They breakdown the dead organic materials of producers (plants) and consumers (animals) for their food and release energy into the environment.

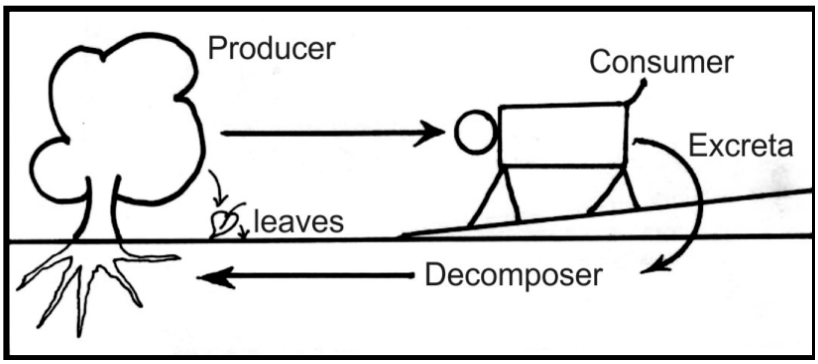


Fig. 1.23 Producer, Consumer & decomposer

➢ **Man-Made Environment**

Man can modify the surroundings according to his wants. Man has developed some environmental components using his intelligence, knowledge, skill and power. These Man-made environments are as follows:

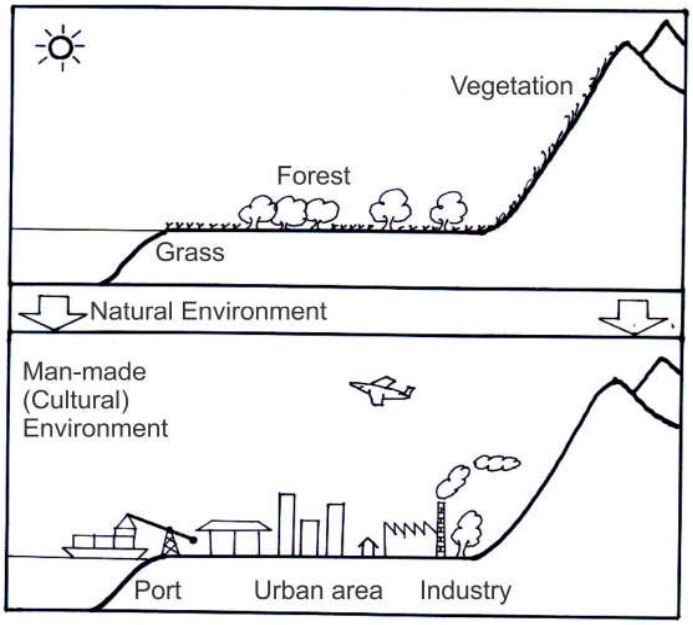


Fig. 1.24 Transformation of Natural Environment into Cultural Environment

o A **socio cultural environment** is a population, and it is described with special attention paid to **social** and **cultural** factors. It includes **cultural** norms, demographic information and religious information. A set of beliefs, customs, practices and behavior that exists within a population are a part of it.

o The **political environment** is the state, government and its institutions and legislations and the public and private stakeholders who operate and interact with or influence that system. The government plays a significant role in economic development of country. Different governmental systems are followed by the different Countries.

o **Economic Environment:** different countries follows different economic environment like capitalism, socialism and many others.

1.5. ECO-SYSTEM

a. Concept and Definition of Eco-system

An ecosystem includes all the living things (plants, animals and organisms) in a given area, interacting with each other, and also with their non-living environments (weather, earth, sun, soil, climate,).

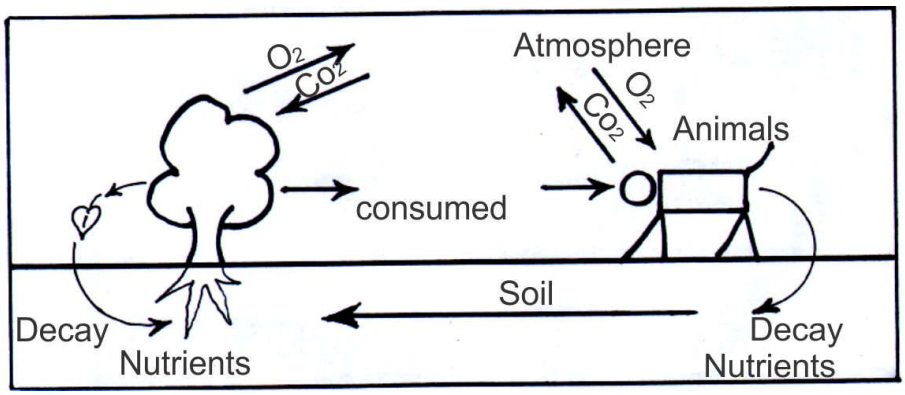


Fig. 1.25 Ecosystem

The term ecosystem was coined by **A. G. Tansley in 1935**, who defined it as “the system resulting from the integration of all the living and non-living factors of the environment”

According to **R. L. Lindeman (1942),** the term ecosystem applies to “any system composed of physical-chemical-biological processes within a space-time unit of magnitude.”

According to **Monkhouse and Small**, “ecosystem is an organic community of plants and animals viewed within its physical environment or habitat”.

From the above definitions of ecosystem, the following basic properties emerge:

- Ecosystem of any given spatial- temporal unit represents the sum of all living organisms and physical environment.
- It is a well-defined area.
- It is an open system characterized by continuous input and output of the energy.
- It is mainly powered by solar energy.
- It is a functional unit.
- There is a complex interaction between the biotic and abiotic components.
- Ecosystems are natural systems and are well organized.

b. Functioning and Structure of Eco-System:

Ecosystems maintain themselves by cycling energy and nutrients obtained from external sources. There are different trophic levels that exist in an ecosystem.

1. Primary producers (plants, algae, and some bacteria) use solar energy to produce organic plant material through photosynthesis.
2. Herbivores—animals that feed solely on plants—make up the second trophic level.

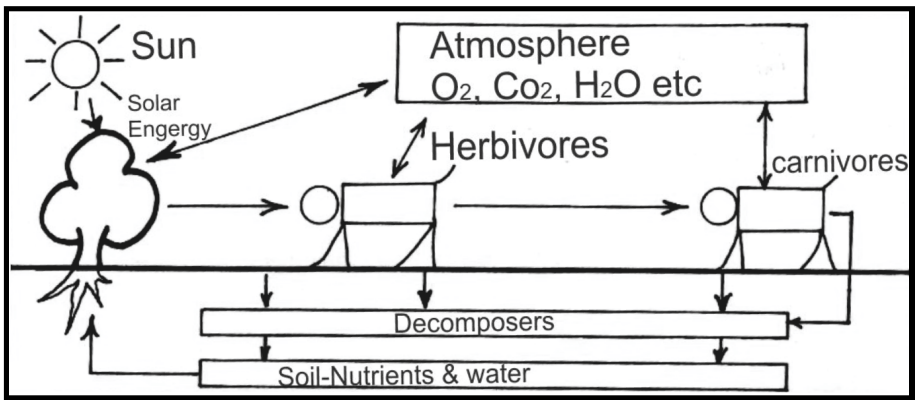


Fig: 1.26 Functioning of Ecosystem

3. Predators that eat herbivores comprise the third trophic level; if larger predators are present, they represent still higher trophic levels.

4. Organisms that feed at several trophic levels (for example, grizzly bears that eat berries and salmon) are classified at the highest of the trophic levels at which they feed.

5. Decomposers, which include bacteria, fungi, molds, worms, and insects, break down wastes and dead organisms and return nutrients to the soil.

Thus, the energy is obtained from the sun and then passed through the environment and the process is known as ***Energy Flow***. All the energy or nutrients flow through the ecosystem in a cyclic order, known as ***nutrient cycles***.

Any food chain or energy flow cycle includes three major components viz. producers, consumers and decomposers.

o ***Producers***

The green plants have chlorophyll with the help of which they trap solar energy and change it into chemical energy of carbohydrates using simple inorganic compounds namely water and carbon dioxide.

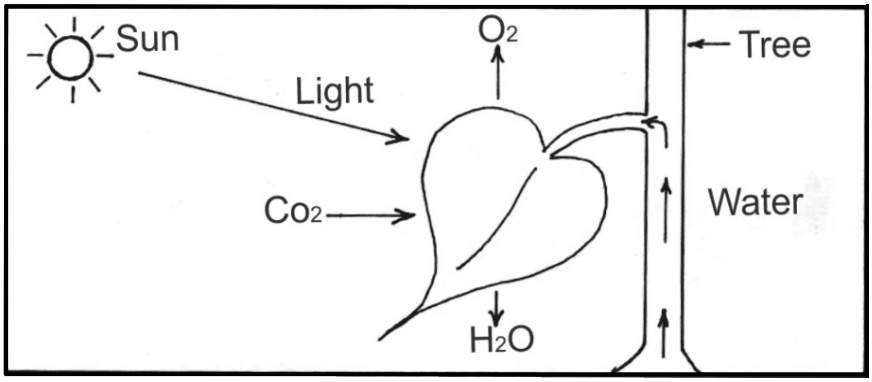


Fig. 1.27 Photosynthesis

This process is known as ***photosynthesis.*** As the green plants manufacture their own food they are known as Autotrophs (i.e. auto = self, trophos = feeder). The chemical energy stored by the producers is utilized partly by the producers for their own growth and survival and the remaining is stored in the plant parts for their future use.

o ***Consumers***

The animals lack chlorophyll and are unable to synthesize their own food. Therefore, they depend on the producers for their food. They are known as heterotrophs (i.e. heteros = other, trophos = feeder). Consumers can be classified into different orders:

- **Primary Consumers or First Order Consumers or Herbivores:** These are the animals which feed on plants or the producers. They are called herbivores. Examples are rabbit, deer, goat, cattle etc.

- **Secondary Consumers or Second Order Consumers or Primary Carnivores:** The animals which feed on the herbivores are called the primary carnivores. Examples are cats, foxes, snakes etc.

- **Tertiary Consumers or Third Order Consumers:** These are the large carnivores which feed on the secondary consumers. Example is Wolves.

- **Quaternary Consumers or Fourth Order Consumers or Omnivores:** These are the largest carnivores which feed on the tertiary consumers and are not eaten up by any other animal. Examples are lions and tigers.

o ***Decomposers or Reducers:***

Bacteria and fungi belong to this category. They breakdown the dead organic materials of producers (plants) and consumers (animals) for their food and release into the environment the simple inorganic and organic substances produced as by-products of their metabolisms.The decomposers are known as Saprotrophs (i.e., sapros = rotten, trophos = feeder)

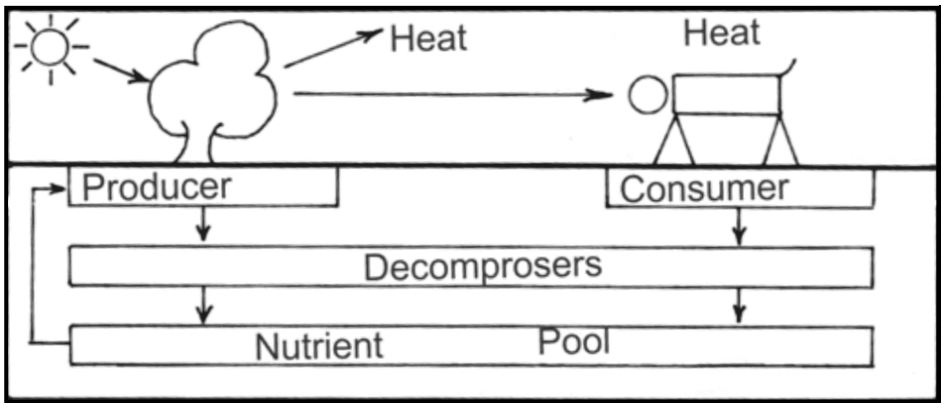


Fig: 1.28 Energy Flow in Ecosystem

On an average, only about 10 percent of net energy production at one trophic level is passed on to the next level. Processes that reduce the energy transferred between trophic levels include respiration, growth and reproduction, defecation, and non-predatory death (organisms that die but are not eaten by consumers).

Food Chain

A **food chain** is a linear network of links in a food web starting from producer organisms (such as grass or trees which use radiation from the sun to make their food) and ending at apex predator species (like grizzly bears or killer whales), detritivores (like earthworms or woodlice), or decomposer species (such as fungi). A food chain also shows how the organisms are related with each other by the food they eat. Each level of a food chain represents a different trophic level. A food chain differs from a food web, because the complex network of different animals and the chain only follows a direct, linear pathway of one animal at a time.

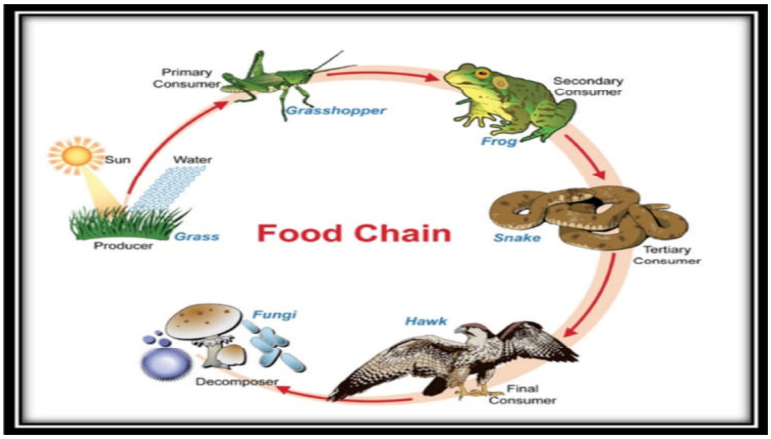


Fig:1.29 Food Chain

Generally, we find two types of food chains:

I. **Grazing food chain**: It starts with green plants and goes to grazing herbivores and on carnivores.

II. **Detritus Food chain**: It goes from dead organic matter into micro-organisms and then to organisms feeding on detritus and their predators.

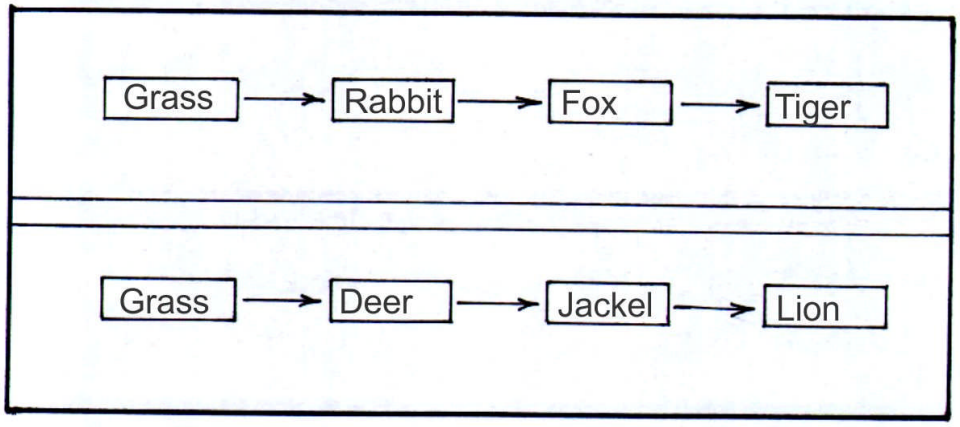


Fig. 1.30 Food Chains

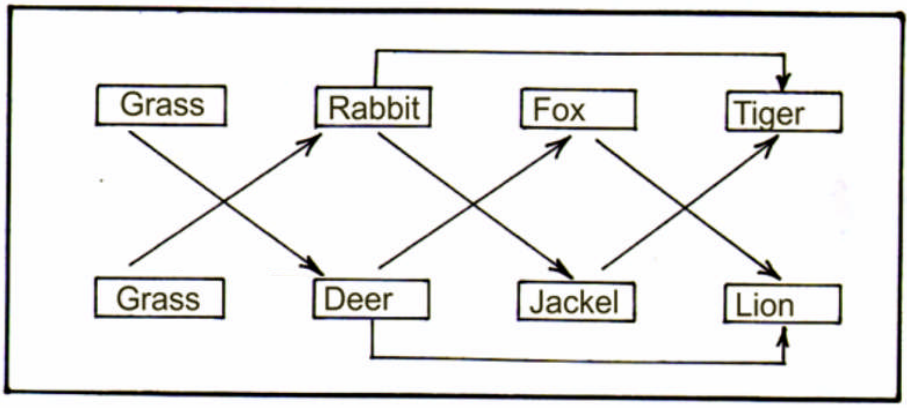


Fig. 1.31 Food Webs

Food Web

A **food web** (or **food cycle**) is the natural interconnection of food chains . For example, in grazing food chain of a grass land, in the absence of rabbit, grass may also have eaten by mouse. The mouse in turn may be eaten directly by hawk or by a snake first which is then eaten by hawk. Thus, in nature there exists an alternative, which all together constitute an interlocking pattern called food web.

In a food web in grass land:

I. Grass---Grasshopper—Hawk.
II. Grass---Grasshopper—Lizard-------Hawk.
III. Grass---Rabbit-----Hawk.
IV. Grass---Mouse—Hawk.
V. Grass---Mouse—Snake-Hawk.

Ecological Pyramid

An **ecological pyramid** is a graphical representation designed to show the biomass or bioproductivity at each trophic level in a given ecosystem. *Biomass* is the amount of living or organic matter present in an organism. *Biomass pyramids* show how much biomass is present in the organisms at each trophic level, while *productivity pyramids* show the production or turnover in biomass.

Energy pyramids begin with producers on the bottom (such as plants) and proceed through the various trophic levels (such as herbivores that eat plants, then carnivores that eat herbivores, then carnivores that eat those carnivores, and so on). The highest level is the top of the food chain.

An energy pyramid of biomass shows the relationship between biomass and trophic level by quantifying the biomass present at each trophic level of an energy community at a particular time. It is a graphical representation of biomass (total amount of living or organic matter in an ecosystem) present in unit area in

different tropic levels. (Typical units are grams per meter^2, or calories per meter^2.)

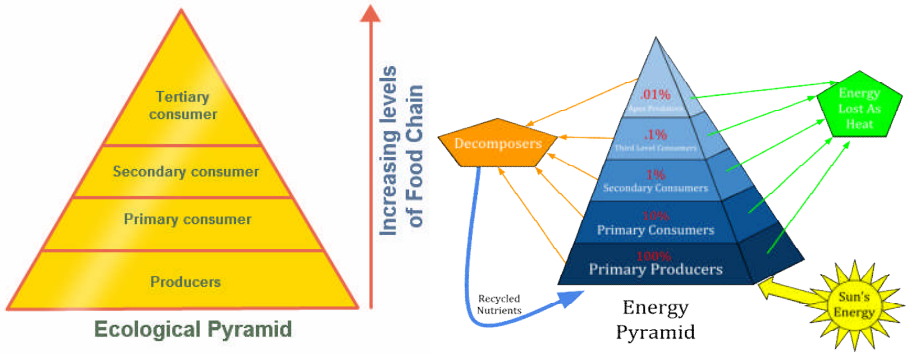


Fig: 1.32 Energy and Ecological Pyramid

Bio-Geo-Chemical Cycle

Biogeochemical cycle is a pathway by which a chemical substance moves through both biotic (biosphere) and abiotic (lithosphere, atmosphere, and hydrosphere) compartments of Earth. Water, for example, is always recycled through the water cycle, as shown in the diagram. The water undergoes evaporation, condensation, and precipitation, falling back to Earth. The other important cycles are the carbon cycle, nitrogen cycle, oxygen cycle, phosphorus cycle, sulfur cycle etc.

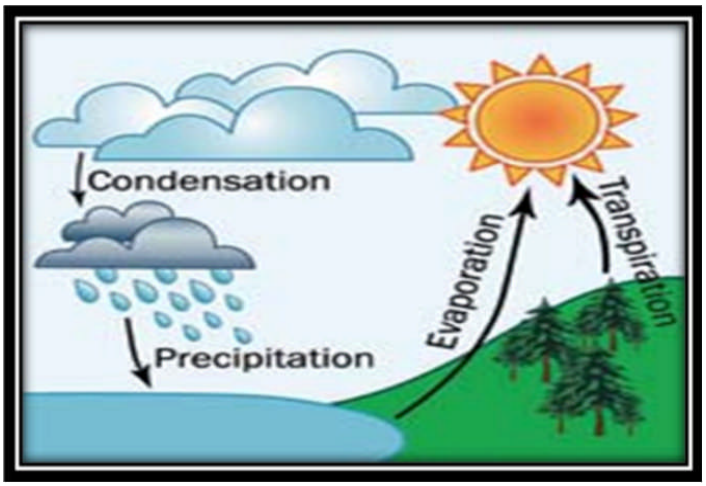


Fig. 1.33 Hydrological Cycle

c. <u>Types of Ecosystem</u>

There are many types of ecosystems, but the three major classes of ecosystems, sometimes referred to as 'biomes', which are relatively contained, are the following:

- Freshwater Ecosystems
- Terrestrial Ecosystems
- Ocean Ecosystems

o **Freshwater Ecosystems**

Freshwater ecosystems are found in sources of fresh water like the following:

- **Pond Ecosystems** – These are usually relatively small and controlled. Most of the time they include various types of plants, amphibians and insects and fishes.
- **River Ecosystems** – Because rivers always link to the sea, they are more likely to contain fish alongside the usual plants, amphibians and insects. These sorts of ecosystems can also include birds because birds often hunt in and around water for small fish or insects.

Freshwater ecosystems are the smallest of the three major classes of ecosystems, accounting for just 1.8% of the total of the Earth's surface. The smallest living part of the food web of these sorts of ecosystems is plankton, a small organism that is often eaten by fish and other small creatures.

o **Terrestrial Ecosystems**

Terrestrial ecosystems are many due to natural diversity on Earth. Some of the most common terrestrial ecosystems are as follows:

- **Rainforests** – Rainforests usually have extremely dense ecosystems because there are many different types of animals all living in a very small area.
- **Tundra** -Tundra usually have relatively simple ecosystems because of the limited amount of life that can be supported in these harsh conditions.
- **Deserts** –Desert also have harsh conditions, more animals live in the extreme heat than live in the extreme cold of Antarctica, for instance.
- **Forests** – There are many different types of forests all over the world including deciduous forests and coniferous forests. These can support a lot of life and can have very complex ecosystems.
- **Grasslands** – Grasslands support a wide variety of life and can have very complex and involved ecosystems.
- **Wetlands**-A **wetland** is a land area that is saturated with water, either permanently or seasonally, such that it takes on the characteristics of a distinct ecosystem. Wetlands are also considered the most biologically diverse of all ecosystems, serving as home to a wide range of plant and animal life.

o **Marine Ecosystem**

Marine ecosystems are among the largest of Earth's aquatic ecosystems, salt marshes, intertidal zones,

estuaries, lagoons, mangroves, coral reefs, the deep sea, and the sea floor. They can be contrasted with freshwater ecosystems, which have a lower salt content. Marine waters cover two-thirds of the surface of the Earth. Such places are considered ecosystems because the plant life supports the animal life and vice versa.

1.6. MAN AND ENVIRONMENT RELATIONSHIP

Since inception, man has been dependent on the environment for his food, clothing and shelter and other basic and luxurious needs. His relationship with the environment has shown dynamism. At times, he was and is friendly with nature and at times not, but, he never destroyed the environment. Lately, with changing nature of man's activities and style of living, environment has undergone certain negative changes. Thus, the relationship between man and environment is become painful.Man started changing the natural environment to suit his needs. So, he exploited, altered and modified his natural environment. Scientific and technological advancements enabled man to exploit his natural environment. This resulted in destruction, degradation and damage to the natural environment giving rise to disaster. The results are observed and experienced in the form of ozone depletion, global warming, threats to bio-diversity, acid rain, desertification, pollution, flooding, etc. only education, awareness and conscience can help restore the environment and stop further loss.

1.7. IMPORTANCE AND SCOPE OF ENVIRONMENTAL STUDIES

The scope of environmental studies is very large. Environmental studies constitute knowledge of many disciplines of natural sciences, social sciences and humanities, biology, chemistry, law, sociology, anthropology and ethics and many other disciplines. With this interdisciplinary knowledge environment studies involve developing a sense of the spirit of the environment or our surroundings, in a large context. Environmental studies is the scientific study of the environmental system and the status of its inherent or induced changes on organisms. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on environment.

According to UNESCO (1971), the objectives of environmental studies are:

(a) Creating the awareness about environmental problems among people.

(b) Imparting basic knowledge about the environment and its allied problems.

(c) Developing an attitude of concern for the environment.

(d) Motivating public to participate in environment protection and environment improvement.

(e) Acquiring skills to help the concerned individuals in identifying and solving environmental problems.

(f) Striving to attain harmony with Nature.

In today's world because of industrialization and increasing population, the natural resources has been rapidly utilised and our environment is being increasingly degraded by human activities, so we need to protect the environment. It is not only the duty of government but also the people to take active role for protecting the environment, so protecting our environment is economically more viable than cleaning it up once, it is damaged. Therefore, environmental studies also play an important role for sustainable development of environment.

The importance of environmental studies can be summarized as follows:

1. To clarify modern environmental concept like how to conserve biodiversity.
2. To know the more sustainable way of living.
3. To use natural resources more efficiently.
4. To know the behavior of organism under natural conditions.
5. To know the interrelationship between organisms in populations and communities.
6. To aware and educate people regarding environmental issues and problems at local, national and international levels.

1.8. SUMMARY

Environment is the source of life on the earth and determines the existence, growth and development of mankind and all its activities. The interaction of humans with the environment (surroundings) in these locations has often brought major changes in that environment. Some changes were good, some were bad. The environment is a complex of many variables which surrounds man as well as all living organisms. The environment is complex, dynamic and systematic in nature. The biotic components and abiotic components together make up the environments. There exists man made environment that is helping man to lead a smooth life.

The term ecosystem was coined by **A.G. Tansley in 1935**, who defined it as “the system resulting from the integration of all the living and non-living factors of the environment”. Ecosystems maintain themselves by cycling energy and nutrients obtained from external sources. There are different trophic levels that exist in an ecosystem. Any food chain or energy flow cycle includes three major components viz. producers, consumers and decomposers. A **food chain** is a linear network of links in a food web starting from producer organisms (such as grass or trees which use radiation from the sun to make their food) and ending at apex predator species (like grizzly bears or killer whales), detritivores (like earthworms or woodlice), or decomposer species (such as fungi). A **food web** (or **food cycle**) is the natural interconnection of food chains. An **ecological pyramid** is a graphical representation designed to show the biomass or bio productivity at each trophic level in a given ecosystem. **Biogeochemical cycle** is a pathway by which a chemical substance moves through both biotic (biosphere) and abiotic (lithosphere, atmosphere, and hydrosphere) compartments of Earth.

The relationship between man and environment is crucial to man’s existence and has always changed with time. This is resulting in disasters and loss of life, property and health. This needs to be controlled for sustainable living.

With its interdisciplinary knowledge environment studies involve developing a sense of the spirit of the environment or our surroundings, in a large context.

1.9. CHECK YOUR PROGRESS/EXERCISE

1. True or False

a. The relationship between man and environment has remained static

b. The term environment means interaction of all living and non-living things in the surroundings

c. The term ecosystem has been coined by A.G. Tansley

d. Marine ecosystems are found in rivers and ponds

e. Environmental studies has an interdisciplinary approach

2. Fill in the Blanks

a. _____ are among the largest of Earth's aquatic ecosystems

b. The word "**ENVIRONMENT**" originated from a French word "***Environia"***, which means _____

c. The Atmosphere is divided into layers according to major changes in _____

d. Energy pyramids begin with _____ on the bottom

e. _____support a wide variety of life and can have very complex and involved ecosystems.

3. Multiple Choice Questions

a.The topmost layer of the atmosphere at 700 to 10,000kms is_____

i. Ionosphere ii. Hydrosphere iii. Exosphere iv. Mesosphere

b. _____ helps in the decomposition of the dead matter in a food chain

i. Herbivores ii. Detritivores iii. Autotrophs iv. Carnivores

c. The energy flow from one trophic level to other trophic level is only _____

i. 50% ii. 100% iii. 20% iv. 10%

d. _____ order consumers are the largest carnivores which feed on the tertiary consumers and are not eaten up by any other animal

i. First order ii. Second order iii. Third Order iv. Fourth Order

e. The smallest living part of the food web of marine ecosystems is _____, a small organism that is often eaten by fish and other small creatures.

i. Small fishes ii. Plankton iii. Worms iv. Weeds

1.10. ANSWERS TO THE SELF-LEARNING QUESTIONS

1. True or False

1.a. False
1.b. True
1.c. True
1.d. False
1.e. True

2. Fill in the Blanks

2.a. Marine ecosystems
2.b. Around
2.c. Temperature
2.d. Producers
2.e. Grasslands

3. Multiple Choice Questions

3.a. Exosphere
3.b. Detritivores
3.c. 10%
3.d. Fourth order
3.e. Plankton

1.11. TECHNICAL WORDS AND THEIR MEANINGS

- **Environment:** The environment is the sum total of all conditions, agencies and influences which affect the development, growth, life and death of an organism, species or race
- **Ecosystem:** Ecosystem is an organic community of plants and animals viewed within its physical environment or habitat
- **Food chain:** A food chain is a linear network of links in a food web starting from producer organisms and ending at apex predator species detritivores or decomposer species
- **Food web:** A **food web** (or **food cycle**) is the natural interconnection of food chains
- **Ecological pyramid:** An ecological pyramidis a graphical representation designed to show the biomass or bio productivity at each trophic level in a given ecosystem
- **Biogeochemical cycles:** Biogeochemical cycle is a pathway by which a chemical substance moves through both biotic and abiotic compartments of Earth.

1.12. TASK

Collect examples of food chains from all types of ecosystems and represent them using pictures. Put some useful information and support your chart with a map of the location of the ecosystem.

1.13. REFERENCES FOR FURTHER STUDY

- Environmental Studies, Bagad Anjali
- Sustainable Urban Environments: An Ecosystem Approach, Beuren, Allan et. Al.
- The Sage Handbook of Environment and Society, Ward, Hugh eds.
- Environment and Sustainable Development, Sundar, I.

Unit -2

NATURAL RESOURCES

After going through this chapter, you will be able to understand the following features:

2.1 OBJECTIVES:

- To learn different types of resources
- To understand the resource utilization pattern
- To understand threats and solutions towards resource use

2.2 INTRODUCTION:

The modern economy is a resource-based economy and the development of a country or a region is based on its resources, specially the natural resource. We use a variety of materials derived from the environment. Nature has given us abundant resources in the form of water, air, soil, wild animals, metals, fossils, fuels etc. and man by his technical skill and knowledge using resource from the dawn of civilization.

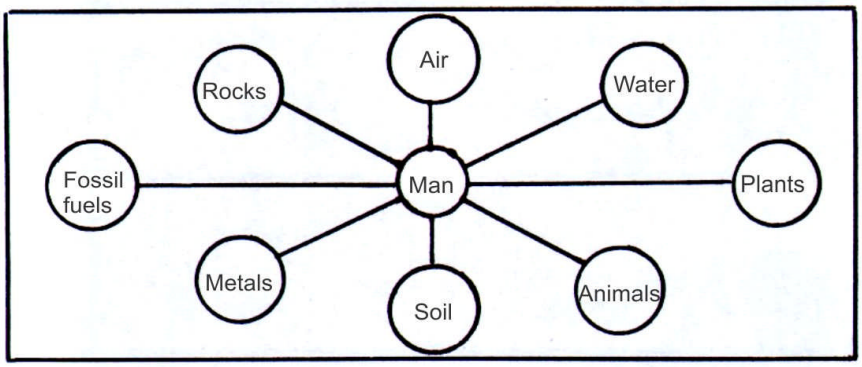


Fig. 2.1 Selected Natural Resources

A resource is anything that is used to satisfy human needs. Typically, resources are materials, energy, services, staff, knowledge, or other assets that are transformed to produce benefit and in the process, may be consumed or made unavailable. Proper utilization of natural resource may use to increased wealth, meeting needs or wants, proper functioning of a system, or enhanced well-being.

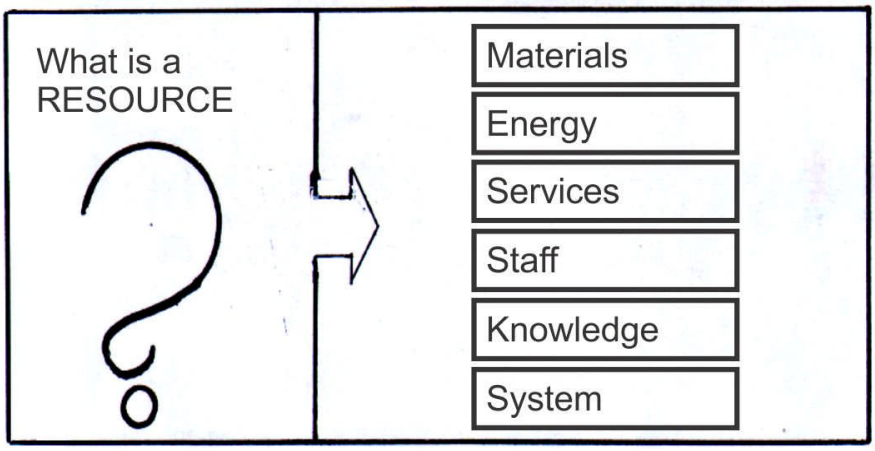


Fig. 2.2 What is a Resource

From a human perspective a natural resource is anything obtained from the environment to satisfy human needs and wants. From a broader biological or ecological perspective, a resource satisfies the needs of a living organism.

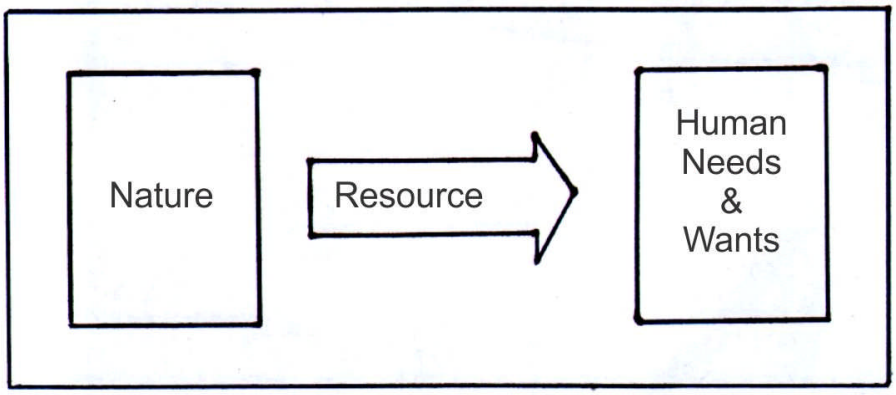


Fig. 2.3 Resource

2.3 SUBJECT DISCUSSION:

Typically, resources are materials, energy, services, staff, knowledge, or other assets that are transformed to produce benefit or satisfaction of the human being. Resource comes from an old French word meaning "relief" or "recovery," which certainly ties in with the idea of a resource being something that offers necessary aid. The exploitation of nature and natural resources can be dated back to the advent of humankind and the very start of civilization.

Some materials are existing in the environment, the use of which is not known to a man at present. This natural stuff is known as **endowment.**

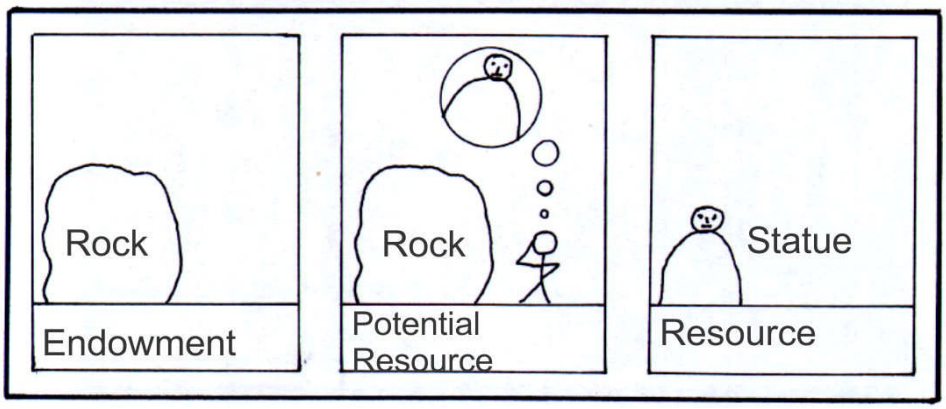


Fig. 2.4 Transformation : From Endowment to Resource

The potential resources are the natural materials that exist in the environment, whose use is known to man but not using the material to satisfy the human needs/wants. There are differences in the level of resource utilization in developed, underdeveloped and developing countries. As with the help of capital, knowledge and technology, developed countries are rich using the resources, backward countries in endowments and developing countries in potentials. Therefore, knowledge, capital and technology are important for the level of resource development.

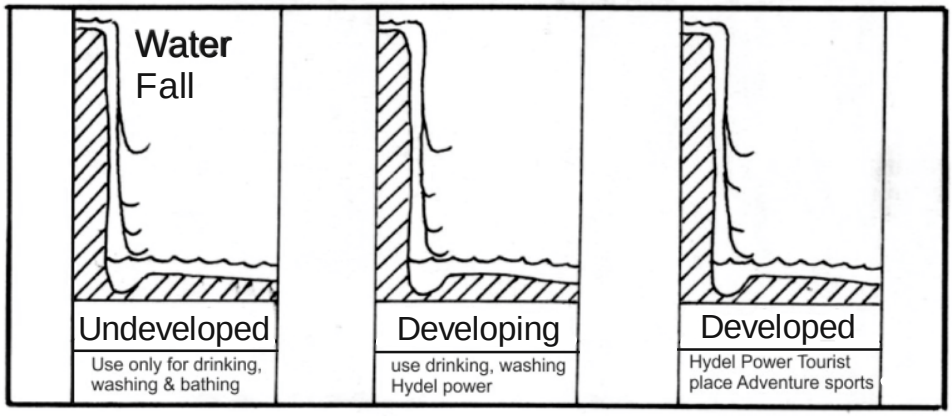


Fig. 2.5 Endowment same - Resources different

2.4 DEFINITION:

According to Enrich W. Zimmerman,

- "A man-less universe is void of resources; for resources are inseparable from man and his wants. They are the environment in service of man."

- "Resources does not refer to a thing or a substance but to a function which a thing or a substance may perform or to an operation in which it may take part, namely the function or operation of attaining a given end such as satisfying wants."

Resource is the ability to perform the work of satisfying the needs or wants of human being.

2.5 CHARACTERISTICS OF RESOURCES

Resources, natural as well as human, possess certain characteristics which are as follows.

- **Usefulness**: - Usefulness is one of the most important characteristics of all the resources. All resources are useful.
-

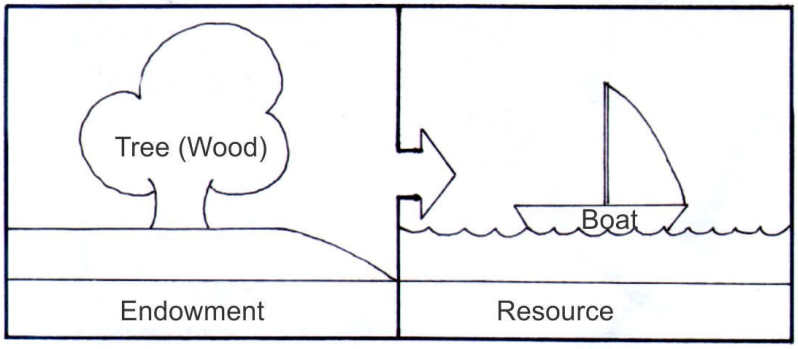


Fig. 2.6 Wooden Boat - Useful Resource

- **Limitedness**: -Resources are limited. Time has the unique characteristic of being the one resource constant in amount for all. Limitedness of resource is of two types namely Qualitative and Quantitative. Human Resources are Qualitatively limited where as Non-human resources are Quantitatively limited.

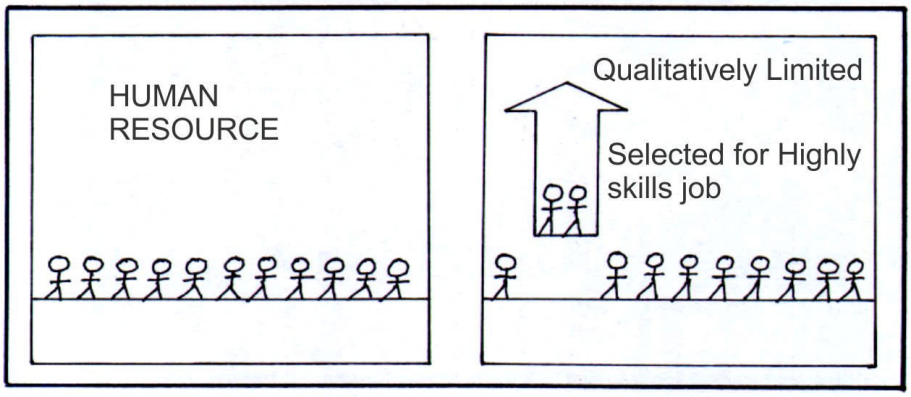


Fig. 2.7 Human Resources : Qualitatively Limited

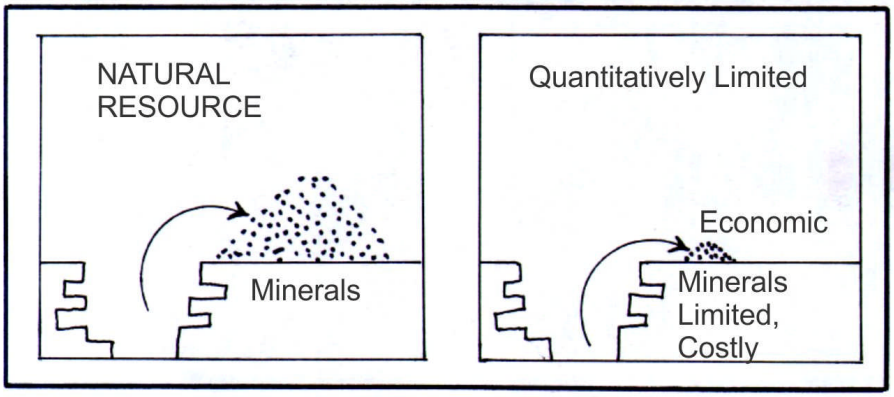


Fig. 2.8

- **Dynamic nature of resources**: the resource is not a static but dynamic concept. The types and quality of resources that the man has been using has changed considerably over time.

- **All resources are inter-related:** Inter-relatedness of resources is one of the important characteristics of resources.

- **Quality of life is determined by the use of resources**: As the man is knowledgeable and technologically sound can use more resources. Quality of life can be enhanced by using more amounts of resources.

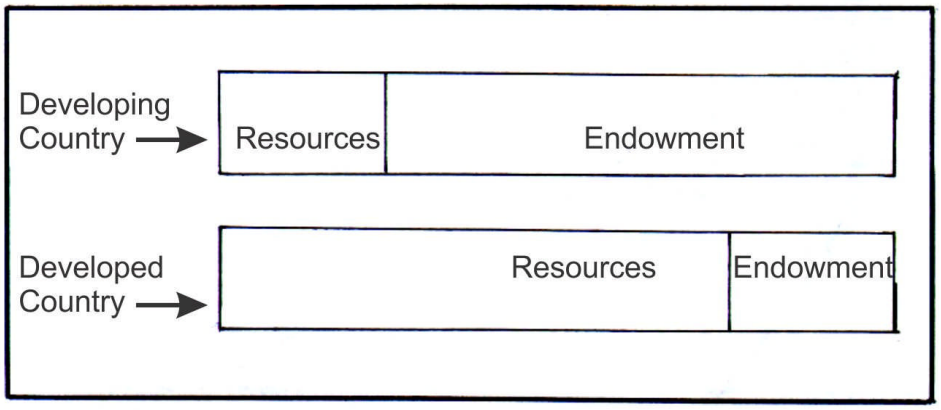


Fig. 2.9 Conversion of Endowment into Resources

2.6 CLASSIFICATION AND TYPES OF RESOURCE:

Resource can be classified on the basis of their nature, durability, ownership and distribution pattern. All the resources are derived from the environment. Many natural resources are essential for human survival, while others are used for satisfying human desire.

❖ **Natural Resources:**

A **natural resource** is anything that people can use which comes from nature. People do not make natural resources, but gather them from the earth.Resources can be categorized on the basis of origin:

A. On the basis of Origin of Resource:

- **Abiotic resources** comprise non-living things (e.g., land, water, air and minerals such as gold, iron, copper, silver).

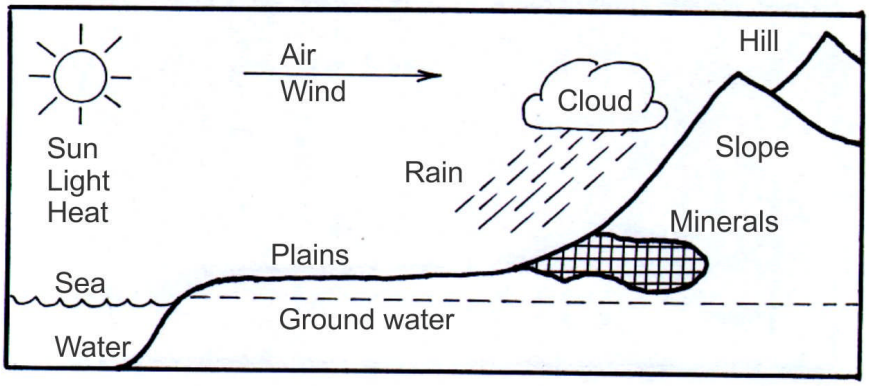


Fig. 2.10 Abiotic Resources

- **Biotic resources** are obtained from the biosphere. Forests and their products, animals, birds and their products, fish and other marine organisms are important examples. Minerals such as coal and petroleum are sometimes included in this category because

they were formed from fossilized organic matter, though over long periods of time.

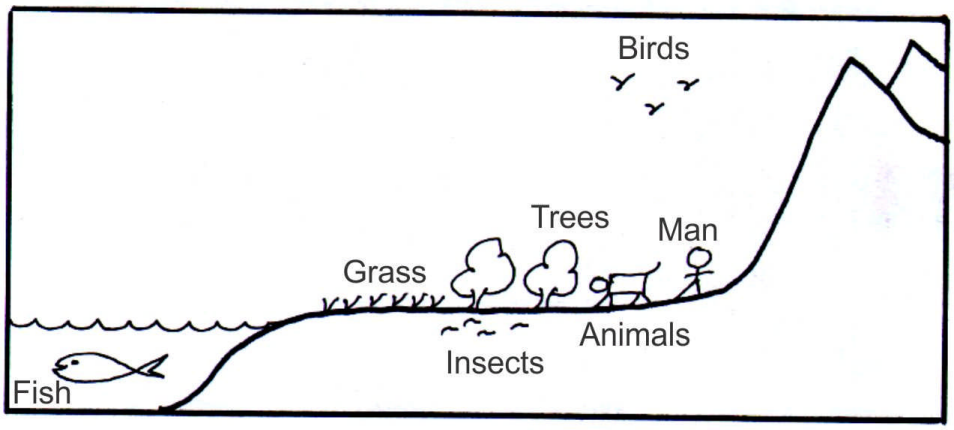


Fig. 2.11 Biotic Resources

B. On the basis of Stage of Development:

- **Potential resources** are known to exist and may be used in the future. For example, petroleum may exist in many parts of India and Kuwait that have sedimentary rocks, but until the time it is actually drilled out and put into use, it remains a potential resource.

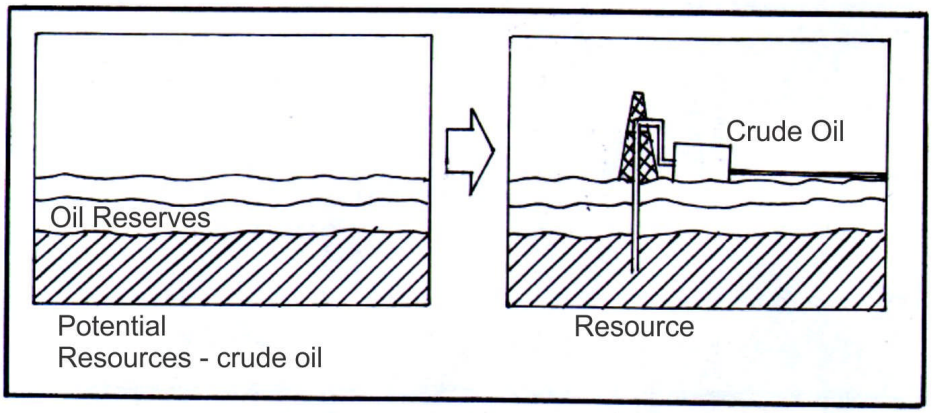


Fig. 2.12 Potential Resources & Actual Resource

- **Actual resources** are those that have been surveyed, their quantity and quality determined, and are being used in present times. For example, petroleum and natural gas is actively being obtained from the Mumbai High Fields. The development of an actual resource, such as wood processing depends upon the technology available and the cost involved. That part of the actual resource that can be developed profitably with available technology is called a reserve resource, while that part that cannot be developed profitably because of lack of technology is called a stock resource.

- **Stock resources** are those that have been surveyed but cannot be used due to lack of technology available for the proper use of resource. Example: Hydrogen.

C. On the Basis of Renewability:

- **Non-renewable resources** are formed over very long geological periods. Minerals and fossils are included in this category. Since their rate of formation is extremely slow, they cannot be replenished, once they are depleted. They are limited resource and once they are used reproduction is not possible. As these resources are known as **Exhaustible or Fund resources**. The exhaustible resources are recyclable and non-recyclable. The **recyclable resources** are those who's reproduction is not possible but the product can be recycled again and again. Some examples of recyclable resources are newspapers, cardboard, office paper, iron, steel, metal products and glass.

Some of the exhaustible resources are **non-recyclable**. They are of single use. Once they are used cannot be used again and again. The examples of non-recyclable resources are coal, natural oil, natural gas etc. All the fossil and fuel are the examples of non-recyclable resources. They are creating problems for the economic development of any nation as the growing industrialization and urbanization depends on the use of fossil fuels.

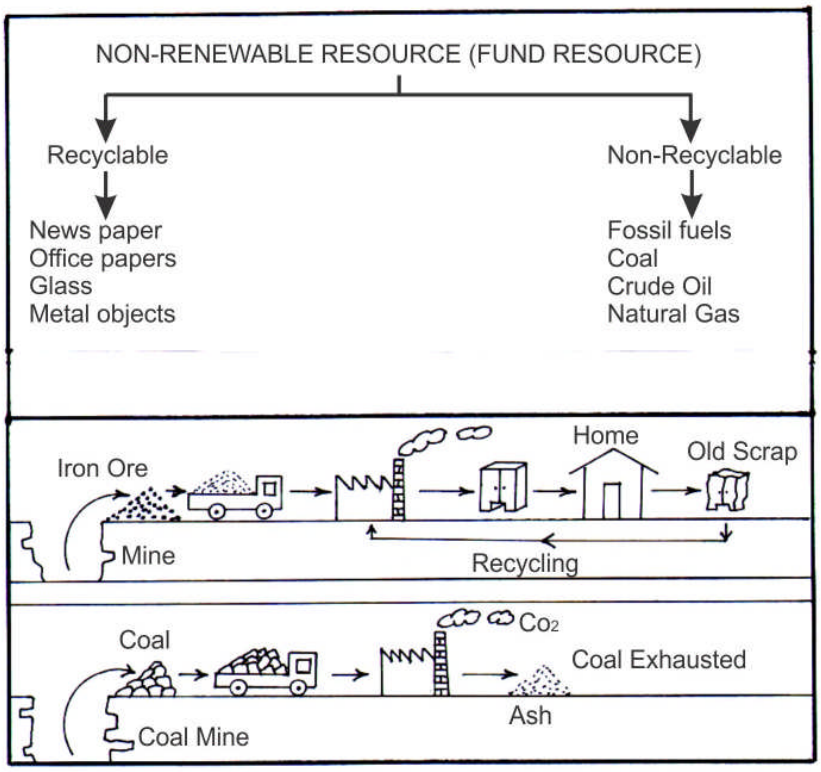


Fig. 2.13 Non-Renewable Resources

- **Renewable resources,** such as forests and fisheries, can be replenished or reproduced relatively quickly. The highest rate at which a resource can be used sustainably is the sustainable yield. Some resources, like sunlight, air, and wind, are called perpetual resources because they are available continuously, though at a limited rate.

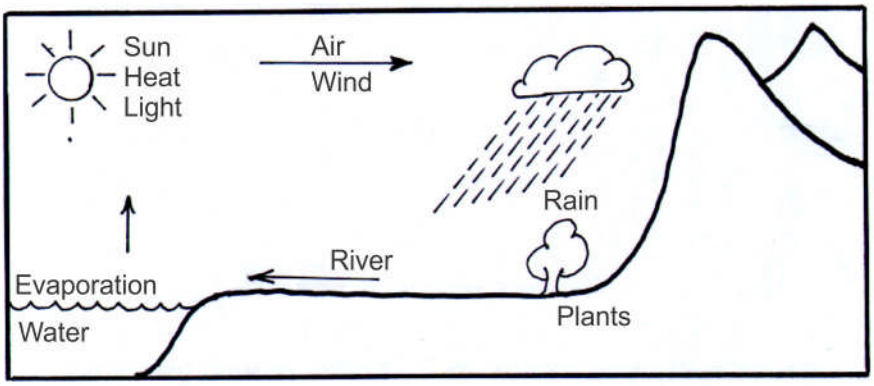


Fig. 2.14 Renewable Resources (Flow Resources)

- These types of resources are also known as **inexhaustible or flow resource**. Their quantity is not affected by human consumption. Many renewable resources can be depleted by human use, but may also be replenished, thus maintaining a flow. Some of these, like agricultural crops, take a short time for renewal; others, like water, take a comparatively longer time, while still others, like forests, take even longer. But at present we are facing the problems related to the quality of renewable resources like air, water. As air and water pollution is increasing every day, many countries facing a big problem to solve the problems. Dependent upon the speed and quantity of consumption, over consumption can lead to depletion or total and everlasting destruction of a renewable resources. Important examples are agricultural areas, fish and other animals, forests, healthy water and soil, cultivated and natural landscapes. Such conditionally renewable resources are sometimes classified as a third kind of resource, or as a subtype of renewable resources. **Conditionally renewable** resources are presently subject to excess human consumption and the only sustainable long-term use of such resources is within the so-called zero ecological footprint, wherein human use less than the Earth's ecological capacity to regenerate.

D. On the Basis of Distribution Pattern:

- **Ubiquitous resources** are found everywhere (e.g., air, light and water). These resources occur everywhere.

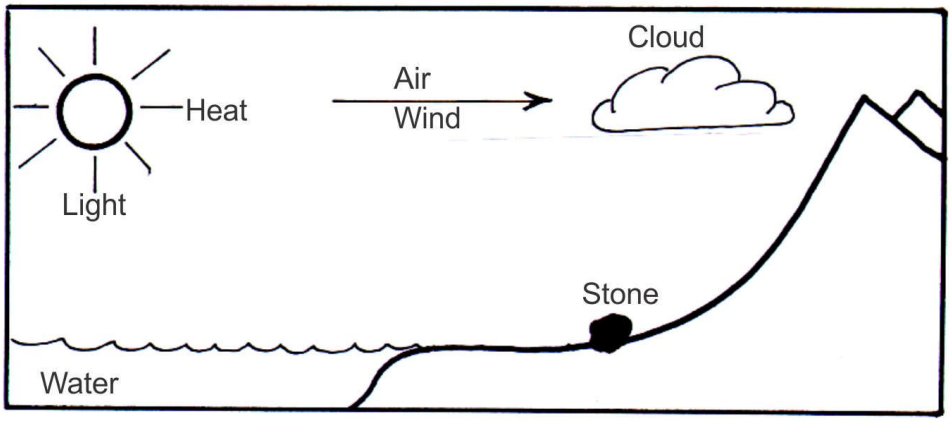


Fig. 2.15 Ubiquitous Resources

- **Localized resources** are found only in certain parts of the world (e.g., copper and iron ore, geothermal power).These resources are found in some specific places on earth and much valuable and also help in the economic development of any country.

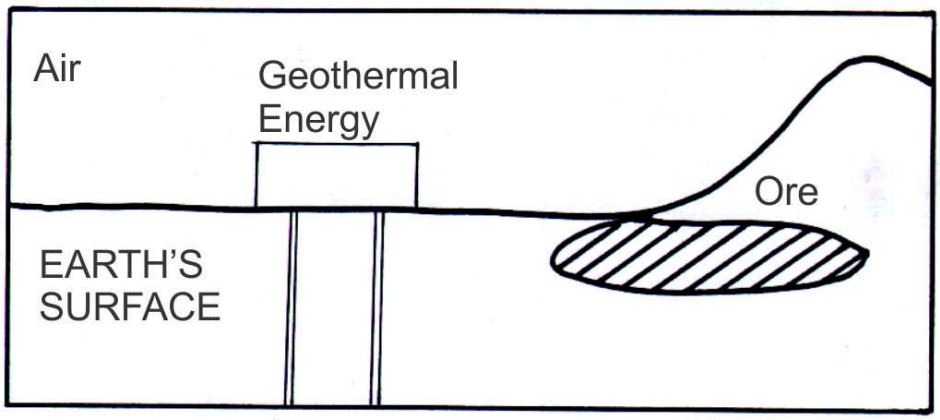


Fig. 2.16 Localized Resources

E. On the Basis of Ownership Pattern:

- **Individual resources** are also known as personal resources. As this type of resources are completely utilize or enjoyed by any individual or family. For example, land, house etc.

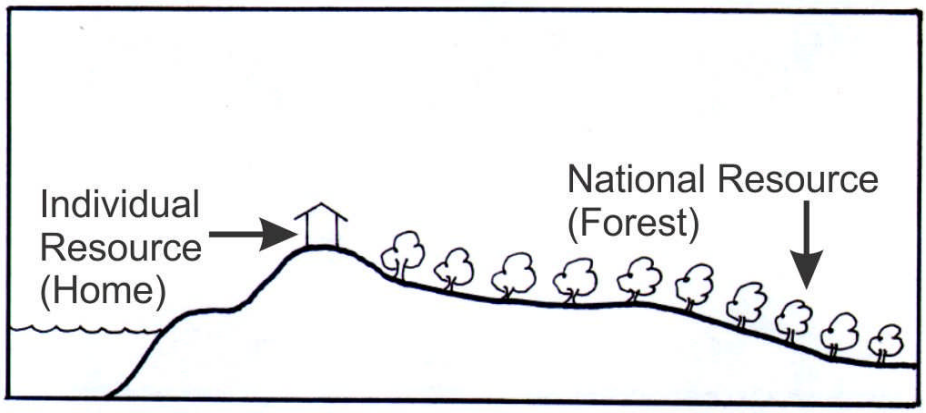


Fig. 2.17 Individual and Natural Resources

- **National resources** are the resources which can be collectively used by the people of any nation or country. They are used for the benefit of all the nation. e.g. river, forest etc.

- **International resources** are all the natural resources in the world which are common resources for every living being. e.g. atmosphere, hydrosphere and lithosphere.

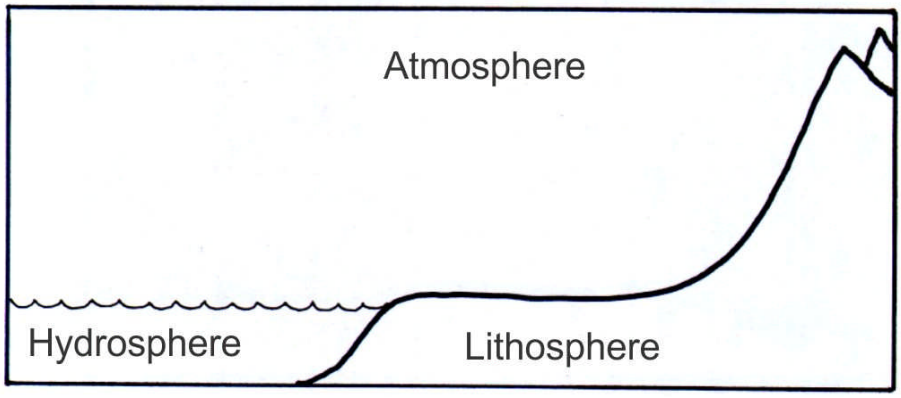


Fig. 2.18 International Resources

F. On the Basis of Physical Existence:

- **Tangible resources** such as equipments which have actual physical existence

- **Intangible resources** such as corporate images, brands and patents, and other intellectual property exist in abstraction.

❖ **Human or Cultural Resources:**

Human Resources refer to the individuals or personnel or workforce within an organization responsible for performing the tasks given to them for the purpose of achievement of goals and objectives of the organization which is possible only through proper recruitment and selection, providing proper orientation an induction, training, skill developments, proper assessment of employees

(performance appraisal), providing appropriate compensation and benefits, maintaining proper labor relations and ultimately maintaining safety, welfare and health concern of employees, which is process of the human resource management. Human resources like skill, knowledge etc. are very important. Many times, we are not aware of these resources. This group of resources are very important to the family, for not only are they the means of accomplishing desired ends, but in using them well the group acts together in such a way that common goals seem more real and attainable and the quality of interpersonal relations can be lifted.

2.7 FACTORS INFLUENCING RESOURCE UTILIZATION:

The amounts of resources utilized vary from one region to other. Many factors play important role in the process of resource utilization. Many problems have been experienced by developed and developing countries in the development and use of natural resources. Some of the important factors are:

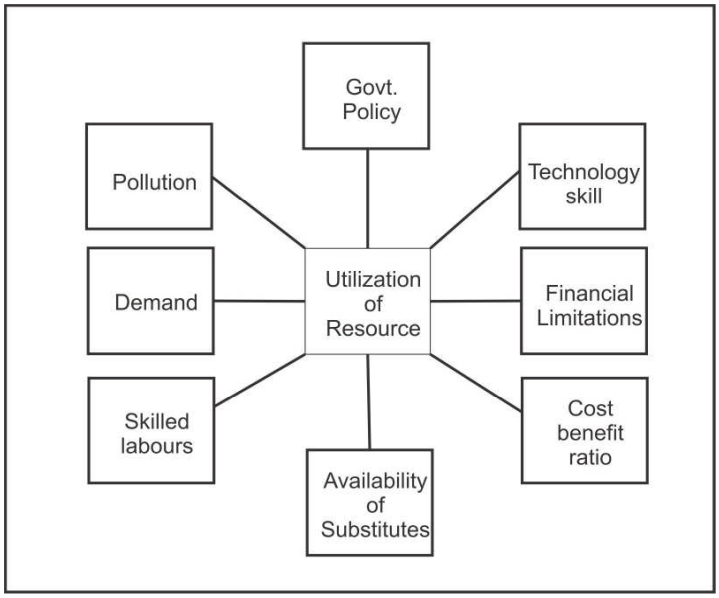


Fig. 2.19 Factors influencing resource utilization

- **Technological skill**: One limitation to maximize resources is technology. Many countries still lack the technology to tap new resources. Our country is blessed with natural resources. However, not all of them are being harnessed because some remain undiscovered, while others such as mineral resources are difficult to tap.

- **Financial Limitations**: This problem is also brought about by the lack of funds to support projects for discovering new resources. Exploitation of new resources depends on the

availability of capital. Most of the time developing countries not able to explore the new resources due to low amount of financial support.

- **Cost Benefit Ratio**: Production cost of the resource is an important factor in utilization process. In the areas where production cost is high resources are not exploited. Generally, the snow capped mountains and forest areas are not exploited up to optimum level due to high cost ratio.
- **Availability of Substitutes**: Availability of the substitute products is a factor for less utilization of resources. Sometimes cheap substitutes are available in market. For example, natural rubber is not use much as synthetic rubber which is cheap.

- **Availability of Skilled Labours**: Proper resource exploitation depends on the availability of skilled and unskilled labours. In underdeveloped and developing countries many potential and endowment resources are available but due to not availability of skilled manpower, they are not converted into resource.

- **Level of Demand**: Economic development and our expanding needs and wants result in an increase in the use of resources to produce goods and services. One example is the increased consumption of coal and oil brought about by the rise of electrical energy consumption (which is used to run appliances like television sets, and refrigerators).

- **Level of pollution**: Pollution can limit the potential of resources. Because of pollution natural resources are being degraded, making it difficult to harness them to their fullest potential. For instance, when bodies of water are polluted, the organisms living in it are affected. Air pollution, on the other hand, degrades air quality and may cause illnesses to human beings and animals and damage the environment.

- **Government Policy**: Governmental policies play an important role in resource development. Different countries follow different resource exploitation policies.

2.8 CONSERVATION METHODS OF NATURAL RESOURCES:

Conservation is the **protection, improvement, and wise use** of natural resources to provide the greatest social and economic value for the present and the future. Conservation is the management of natural resources with the goal of sustainability. Resources are features of environment that are important and

value of to human in one form or the other. However, the advancement of modern civilization has had a great impact on our planet's natural resources. So, conserving natural resources is very essential today. There are many ways that one can conserve natural resources. All you need to do is to look around and see what natural resources you are using and find out ways to limit your usage.

- **Recycling**: Many products such as paper, cardboards, and cups come from trees. In fact, trees are our natural assets, you can converse trees by recycling the paper products we can minimize the number of trees cut down a year. This is one form of waste recycling. One should understand and know the importance of recycling waste materials. One simple benefit of recycling is it saves our resources. It will be wise to reuse metal item as metal reserves may be depleting. You can sell old metal items for recycling. As mentioned earlier, recycling of waste papers can save our forests. Recycling waste not only save our natural resources but also help to save energy.

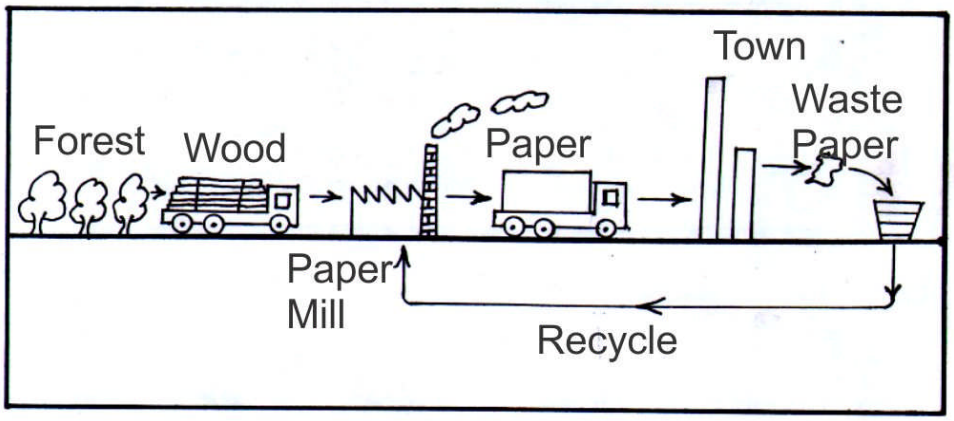


Fig. 2.20 Recycling of paper products

- By simply recycling an item or making a basic fix to it, we can save all the energy that would have been consumed in the process of making it. The same example can be taken with plastic items. A large amount of energy can be saved by simply reusing the plastic items. To recycle waste is to simply reduce pollution. By recycling plastic material, we can reduce air pollution as well as water pollution. Plastic factories produced large amount of smoke when producing plastic material at the same time if we don't have proper waste disposal system those waste emissions will cause water pollution. Recycling waste in a way helps to reduce pollution.In simple words, recycling or recycling waste is essential to both natural environment and humans.

2.9 NON-CONVENTIONAL RESOURCES:

Energy generated by using wind, tides, solar, geothermal heat, and biomass including farm and animal waste as well as human excreta is known as non-conventional energy. All these sources are renewable or inexhaustible and do not cause environmental pollution. Moreover, they do not require heavy expenditure.

1. Wind Energy:

Wind power is harnessed by setting up a windmill which is used for pumping water, grinding grain and generating electricity. Wind power is the use of air flow through wind turbines to mechanically power generators for electricity. The India has been rated as one of the most promising countries for wind power development. The gross wind power potential of India is estimated to be about 20,000 MW, wind power projects of 970 MW capacities were installed till March. 1998. India ranks fifth in the world in wind power generation. Areas with constantly high speed preferably above 20 km per hour are well-suited for harnessing wind energy.

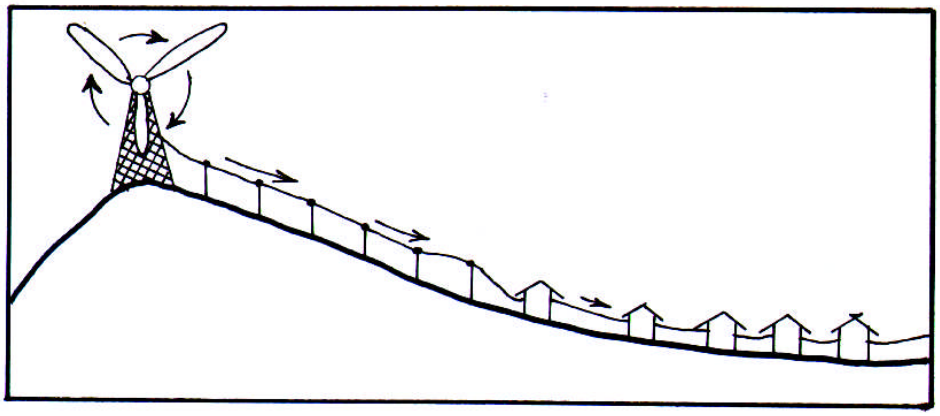


Fig. 2.21 Wind Energy

2. Tidal and Wave Energy:

Sea water keeps on rising and falling alternatively twice a day under the influence of gravitational pull of moon and sun. This phenomenon is known as tides. A difference or height of high and low tide water level spin the turbines. The tidal energy can be harnessed by constructing a tidal barrage. At the time of high tide, the sea water flows into the reservoir of the barrage and turn the turbine, which generates electricity. It is estimated that India possesses 8000-9000 MW of tidal energy potential. The Gulf of Kuchchh is best suited for tidal energy.

3. Solar Energy:

Sun is the source of all energy on the earth. It is most abundant, inexhaustible and universal source of energy. All the other sources of energy draw their strength from the sun. India is

blessed with plenty of solar energy because most parts of the country receive bright sunshine throughout the year except a brief monsoon period. India has developed technology to use solar energy for cooking, water heating, water dissimilation, space heating, crop drying etc.

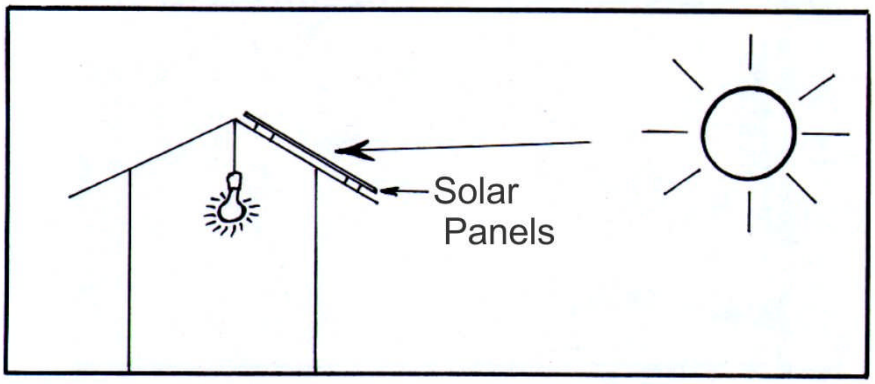


Fig. 2.22 Solar Energy

The technologies used in the solar energy are broadly classified as either passive solar or active solar depending on the way of capture, convert and distribute. Active solar techniques include the use of photovoltaic panels and solar thermal collectors to harness the energy. Passive solar techniques include the orienting a building to the sun, selecting materials with favorable thermal mass or light dispersing properties, and designed the spaces that naturally circulate air.

4. Geo-Thermal Energy:

Geo-thermal energy is the heat of the earth's interior. This energy is manifested in the hot springs. India is not very rich in this source,

5. Energy from Biomass:

Biomass refers to all plant material and animal excreta when considered as an energy source. Some important kinds of biomass are inferior wood, urban waste, bagasse, farm animal and human waste.

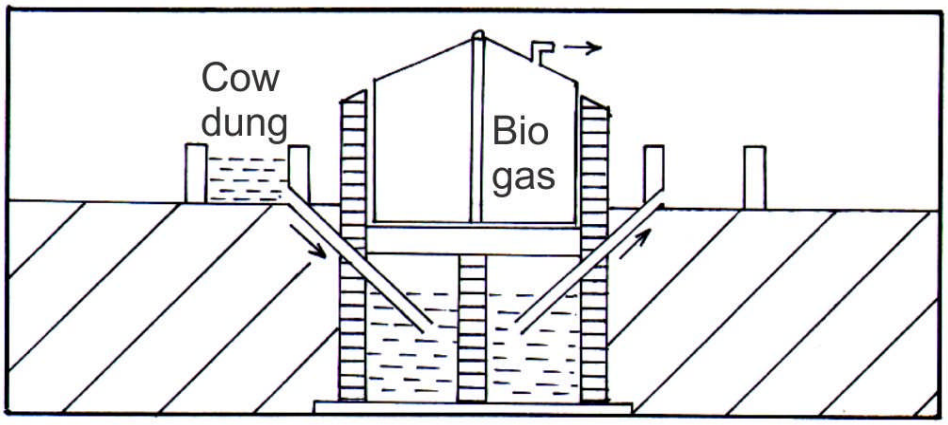


Fig. 2.23 Biogas Plant

Importance of non-conventional sources of energy:

1. The non-conventional sources of energy are abundant in nature. According to energy experts the non-conventional energy potential of India is estimated at about 95,000 MW.
2. These are renewable resources. The non-conventional sources of energy can be renewed with minimum effort and money.
3. Non-conventional sources of energy are pollution-free and eco-friendly

2.10. PROBLEMS ASSOCIATED WITH MANAGEMENT OF WATER, FOREST AND ENERGY RESOURCES:

➢ **Water Resources:**

One of the basic requirement of the living being is availability of water. Adequate supply of fresh water is important for maintaining the life on the Earth. Water is a natural resource has influence on almost every aspect of development. Agriculture, industries and households, all sector needs adequate supply of fresh water. Water resources are sources of water that are useful or potentially useful to humans. Water is indispensable natural resource that human terms water as a LIFE. The whole earth looks blue from the space and describe as the blue planet. This is because Earth is rich in water. The hydrosphere forms 71% of the earth surface. But 97% of this water is a salt water and sodium chloride is the most abundant dissolved substances. Magnesium, calcium and other elements in the rest of the salts have very less proportion. This salt water is not useful for drinking, agriculture and industrial purposes. 97 % of the water on the Earth is salt water and only three percent is fresh water; slightly over two thirds of this is frozen in glaciers and polar ice caps. The remaining unfrozen freshwater is found mainly as groundwater, with only a small fraction present above ground or in the air. (https://en.wikipedia.org/wiki/Water_resources-) Fresh water is a

renewable resource. Water is used in different sectors such as agriculture, industry and domestic use. It is estimated that 70% of worldwide water is used for irrigation, with 15-35% of irrigation withdrawals being unsustainable. It takes around 2,000 - 3,000 litres of water to produce enough food to satisfy one person's daily dietary needs. This is a considerable amount, when compared to that required for drinking, which is between two and five litres. It is estimated that 22% of worldwide water is used in industry. It is estimated that 8% of worldwide water use is for domestic purposes. These include drinking water, bathing, cooking, toilet flushing, cleaning, laundry and gardening.

❖ **Degradation of water resources:**

- **Pollution:**Water pollution is a major global problem which requires ongoing evaluation and revision of water resource policy at all levels (international down to individual aquifers and wells). It has been suggested that water pollution is the leading worldwide cause of deaths and diseases, and that it accounts for the deaths of more than 14,000 people daily. An estimated that about 580 people in India die of water pollution related illness every day. About 90 percent of the water in the cities of China is polluted.

❖ **Sources of Water Pollution and Effect of Water Pollutants:**

- **Domestic Wastes and Sewage:** Domestic waste is one of the main source of water pollution. Organic waste gives rise to scum and sludge that makes the water unfit for recreational and industrial use. Modern day detergents degrade very slowly. They, therefore, accumulate and render the water unfit for human and animal use. The phosphates present in detergents further stimulate algal growth that add to the organic loading of water.

- **Surface Run-Off:** The pollutants present on the surface of land and fertilizers added to the soils are washed down into water reservoirs and water courses during rains. This flow of fertilizer rich water into streams and lakes gives rise to eutrophication.

- **Thermal pollution:** Thermal pollution is the degradation of water quality by any process that changes ambient water temperature. A common cause of thermal pollution is the use of water as a coolant by power plants and industrial manufacturers. When water used as a coolant is returned to the natural environment at a higher temperature, the change in temperature decreases oxygen supply and affects ecosystem composition. Fish and other organisms adapted to particular temperature range can be killed by an abrupt change in water temperature (either a rapid increase or decrease) known as "thermal shock."

- **Industrial Effluents:** The industrial wastes are allowed to pass into water bodies. The important toxic chemicals presents in them create pollution. Mercury is released during combustion of coal, smelting of metallic ores, paper and paint industries. Mercury is persistent. In water it gets changed into water soluble compounds and enters the food chain accompanied by biological or ecological amplification. Human beings feeding on poisoned animals and fishes develop a crippling deformity called minamata disease. The sources of lead pollution are smelters, battery, industry, paint, chemical and pesticide industries, automobiles' exhausts, etc. It causes anaemia, headache, and bluish lines round the gums. Copper, zinc, nickel, titanium, etc. cause toxaemia and change in enzyme functioning. Several types of liquid effluents containing toxic chemicals, acids and bases, are added to the rivers and other water bodies. They kill fish and other aquatic life besides being toxic to human being.

❖ **Overuse and Misuse of Water:**

The biggest misuse of water is the excessive pumping of groundwater. It is most scary in India and China, which rely on large-scale, industrialized agriculture to feed their huge populations. They withdraw more groundwater than Mother Nature provides reliably each year. The aquifers in both China and India, as well as in the United States, are declining. The world is **pumping more water from the ground than is sustainable**; more than is being refilled by nature. Eventually, if things do not change, these groundwater sources will be pumped dry.We need to change the way we are using water and the amount of water we are pulling from the ground, in addition to addressing larger ecological and climate issues that have an impact on our water supply as well, if our future generations are going to have the water they need for life itself.

❖ **Conservation of Water Resource:**

Water is essential for life on our planet. It is required for many things including growth of food, maintaining ourselves clean, power generation, in cases to control fire and most importantly to stay alive. Water is a part of our daily life and we are heavily dependent on it. The average family of four uses 450 liters (120 gallons) of water a day, which is 164,000 liters (44,000 gallons) a year. The conservation of water is very important and necessary to have a healthy and long-lasting life. Conserving the water is not difficult, it saves money, and it is beneficial to our future. We do not know if there will be enough water for a more crowded world in the future. We must learn about the importance of water, and conserve the water to prevent future problems.

Fig. 2.25

Water conservation refers to the reduction in usage of water. It can also include the recycling of water for purposes like irrigation, cleaning, and even treatment for later use. That is the reason why we need to conserve our water we need to take action now, because it may be too late. Now a days we use much more water than we ever did. Every human being uses hundreds of gallons of water per day. This makes a state's population use millions of gallons of water a day. All this consumption of water comes to a high cost, sometimes paying hundreds of dollars per month. Reducing the water you use will save you money. Even though, water makes up about seventy percent of the earth's surface, only a small percentage of that water is attainable for usage. Reducing the amount of water used will help you economically as well as benefiting you and your family in the future.

❖ **Some steps to conserve water resources:**

- **Rainwater harvesting** is the accumulation and deposition of rainwater for reuse on-site, rather than allowing it to run off. Rainwater can be collected from rivers or roofs, and in many places the water collected is redirected to a deep pit (well, shaft, or borehole), a reservoir with percolation, or collected from dew or fog with nets or other tools. Its uses include water for gardens, livestock, irrigation, domestic use with proper treatment, and indoor heating for houses etc. The harvested water can also be used as drinking water, longer-term storage and for other purposes such as groundwater recharge.

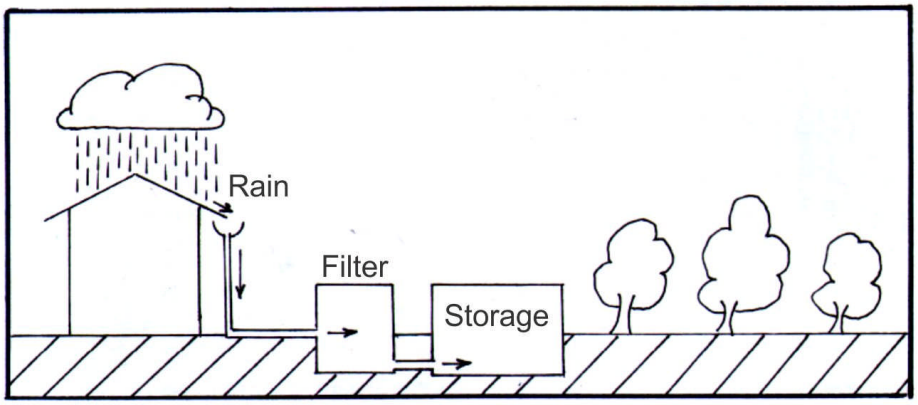


Fig. 2.26 Rainwater Harvesting

- **Watershed management** is the study of the relevant characteristics of a watershed aimed at the sustainable distribution of its resources and the process of creating and implementing plans, programs, and projects to sustain and enhance watershed functions that affect the plant, animal, and human communities within a watershed boundary. Features of a watershed that agencies seek to manage include water supply, water quality, drainage, storm water runoff, water rights, and the overall planning and utilization of watersheds. Landowners, land use agencies, storm water management experts, environmental specialists, water use surveyors and communities all play an integral part in watershed management.

- **Control pollution:** Fresh water is a limited resource. Some steps should be taken to control the water pollution. In agricultural sectors sediment (loose soil) washed off fields is the largest source of agricultural pollution. Farmers may utilize erosion controls to reduce runoff flows and retain soil on their fields. Common techniques include contour plowing. Some industrial facilities generate ordinary domestic sewage that can be treated by municipal facilities. Industries that generate wastewater with high concentrations of conventional pollutants (e.g. oil and grease), toxic pollutants (e.g. heavy metals, volatile organic compounds) or other non-conventional pollutants such as ammonia, need specialized treatment systems. Some of these facilities can install a pre-treatment system to remove the toxic components, and then send the partially treated wastewater to the municipal system. In urban areas of developed countries, domestic sewage is typically treated by centralized sewage treatment plants. Well-designed and operated systems can remove 90 percent or more of the pollutant load in sewage. Some plants have additional systems to remove nutrients and pathogens.

- **Water efficiency:** Water efficiency means thinking about the way you use water, in other words, your water management. The key is to try to reduce your water use if possible and not to waste water. Water efficiency is reducing water wastage by measuring the amount of water required for a particular purpose and the amount of water used or delivered. Water efficiency differs from water conservation. In that it focuses on reducing waste, not restricting use. Solutions for water efficiency focus not only on reducing the amount of potable water used, but also on reducing the use of non-potable water where appropriate (i.e. flushing toilet, watering landscape, etc.). It also emphasizes the influence consumers can have in water efficiency by making small behavioral changes to reduce water wastage and by choosing more water efficient products.Examples of water efficient steps includes fixing leaking taps, taking showers rather than baths, installing displacements devices inside toilet cisterns, and using dishwashers and washing machines with full loads. These are things that fall under the definition of water efficiency, as their purpose is to obtain the desired result or level of service with the least necessary water.

➢ **Forest Resource:**

A **forest** is a large area of land covered with trees or other woody vegetation. United Nations Food and Agriculture Organization definition. Forests covered four billion hectares (15 million square miles) or approximately 30 percent of the world's land area in 2006.Forests are the dominant terrestrial ecosystem of Earth, and are distributed across the globe. Forests account for 75% of the gross primary productivity of the Earth's biosphere, and contain 80% of the Earth's plant biomass. The amount of precipitation and the elevation of the forest also affect forest composition. Human society and forests influence each other in both positive and negative ways. Forests provide ecosystem services to humans and serve as tourist attractions. Forests can also impose costs, affect people's health, and interfere with tourist enjoyment. Human activities, including harvesting forest resources, can negatively affect forest ecosystems. Many forests have a deeper spiritual importance for those who live there and for those who never visit forest but always cherish the thought of their existence.

❖ **Importance of Forest as a Resource:**

- **Economic Importance**: Forest is the main source of food for the primitive societies. Forest is the main source of fuel for domestic use in many underdeveloped and developing countries. It also provides different products like: quinine, gum, resin, camphor

etc. It is the source of different types of medicines like ayurvedic, unani medicines etc. It supplies raw materials to many industries like paper, building materials, furniture and other industries.

- **Environmental Importance:** They play an important role in maintaining the quality of the environment. Forest also controls flood by reducing the siltation. It prevents the soil erosion and help in the process of soil conservation by holding the soil particles firmly. It helps in conserving water and regulating the water cycle. It is the habitat for many wild animals. They play a vital role in maintaining **ecological balance.**

❖ **Distribution of Forest:**

The world's forests cover some 3, 400 million hectares - an area the size of North and South America combined. During the 1980s more than 15 million hectares of tropical forests were lost each year: the overwhelming majority of the deforestation was intended to provide land for agriculture. The largest losses occurred in tropical moist deciduous forests, the areas best suited for settlement and farming. The extent of these forests declined by 61 million hectares - more than 10 percent of their area -while 46 million hectares, or 60 percent, of tropical rainforests were lost. Few of these areas have been replanted.

The forest is not evenly distributed in the world. Forest distribution and types are greatly influenced by different climatic factors like rainfall and temperature. The other factors like soil, slope, altitude etc. are also important.

Tree cover is increasing in many temperate regions, mainly due to the establishment of forest plantations. Europe increased its forest and wooded land by 2 percent over the 1980s and there were small increases in New Zealand and Australia. In the same decade, however, a drop of some 3.5 million hectares occurred in the United States. The area of the former USSR reported an increase between 1978 and 1988. However, there is an urgent need to bring many of the Siberian forests under sustainable management to avoid their degradation. As well as managing some forests for production, diversity should be preserved in others by designating protected areas.

❖ **Types of Forest:**

1. Tropical Forest

a. **Tropical Rain Forest**

- The tropical rainforests contain the greatest diversity of species of all biomes on earth. They are found around the equator,

between the Tropic of cancer ($23\frac{1}{2}^0$ N.) & the Tropic of Capricorn ($23\frac{1}{2}^0$ S.)

- The evergreen forests are usually found in areas receiving rainfall more than 200cm and having more temperature.
- They occupy 7% of the earth surface.
- The wood is very hard and difficult to cut.
- It is found in central America, the Amazon basin, the Congo basin, S.E. Asia and northern margin of Australia.
- These forest are dense and have broad leaves that release excess water trough transpiration.
- Important species are teak, ebony, rosewood, ironwood, mahagony etc.

b. **Tropical Seasonal Forest**

- This forest is found in region of monsoon rain, mainly in India and part of SE Asia.
- They occupy 9% of the earth's surface area.
- These forests are more open and allow a denser undergrowth of bamboo, shrubs and grasses.
- These forests are broad-leafs and shed leaves during dry season.
- Important species are teak, sal, sandalwood, neem etc.

2. Temperate Forest

- They are mainly found in Eastern United States and Canada, Western Europe and parts of Russia, China and Japan.
- There are four distinct seasons in temperate deciduous forests and precipitation falls throughout the year. Temperate deciduous forests receive 30-60 inches of rain per year.
- Maple, oak and birch trees are some examples of the deciduous trees that dominate these forests.
- Trees provide hard wood and are deciduous.

3. Coniferous Forest

- Coniferous forests are made up mainly of cone-bearing or coniferous trees, such as spruce, hemlock, pine and fir.
- The leaves of these trees are either small and needle-like or scale-like and most stay green all year around (evergreen).

- Coniferous trees thrive where summers are short and cool and winters long and harsh, with heavy snowfall that can last as long as 6 months.

4. Taiga or Boreal Forest

- Taiga also known as boreal forest or snow forest, is characterized by coniferous consisting mostly of pines, spruce and larches.
- In North America it covers most of inland Canada and Alaska as well as parts of the extreme northern continental United States.
- Taiga is the world's largest land biome, and makes up 29% of the world's forest cover, the largest areas are located in Russia and Canada.
- The taiga experiences relatively low precipitation throughout the year (generally 200–750 mm annually, 1,000 mm in some areas), primarily as rain during the summer months, but also as fog and snow.

❖ **Problems associated with forest**

- **Deforestation**

Humans have generally decreased the amount of forest worldwide. Anthropogenic factors that can affect forests include logging, urban sprawl, human-caused forest fires, acid rain, invasive species, and the slash and burn practices or shifting cultivation. The loss and re-growth of forest leads to a distinction between two broad types of forest, primary or old-growth forest and secondary forest. There are also many natural factors that can cause changes in forests over time including forest fires, insects, diseases, weather, competition between species, etc. In 1997, the World Resources Institute recorded that only 20% of the world's original forests remained in large intact tracts of undisturbed forest. More than 75% of these intact forests lie in three countries—the boreal forests of Russia and Canada and the rainforest of Brazil.

❖ **Main Causes of Deforestation**:

For the most part, human activity is to blame for deforestation, though natural disasters do play a role. So let's take a look at how and why humans deforest areas.

1. Logging, or cutting down trees in a forest to harvest timber for wood, products or fuel, is a primary driver of deforestation. Logging affects the environment in several ways. Since trucks and large equipment need to get into the forest in order to access trees and transport timber, loggers must clear large areas for

roadways. **Selective logging** -- where only the most valuable trees are felled -- doesn't help matters, as one falling tree can bring down dozens of surrounding trees and thin the forest's protective canopy. The **forest canopy** is important to the forest's ecosystem because it houses and protects plant, animal and insect populations. It also protects the forest floor, which slows down soil erosion.

2. **Agriculture** also drives deforestation. Farmers clear the land for crops or for cattle and often will clear acres of land using slash and burn techniques -- cutting down trees and then burning them. Migratory farmers clear a forest area and use it until the soil becomes too degraded for crops. Then they move on and clear a new patch of forest. The abandoned land, if left untouched, will eventually reforest, but it will take many, many years to return to its original state.

3. **Mining** also results in deforestation. Digging a coal, diamond or gold mine requires the removal of all forest cover, not just for the mines but also for trucks and equipment.

4. **Fires** both natural or man-made, destroy acres of forest very quickly. Areas affected by logging are more susceptible to fires due to the number of dried, dead trees. Milder winters and extended warm seasons due to global warming also fuel fires. In the United States, there are typically between 60,000 and 80,000 forest fires that occur each year, burning 3 million to 10 million acres (12,000 to 40,000 square kilometers) of land depending on the year.

5. Agriculture and Grazing: Deforestation occurs mainly due to the conversation of land for agriculture and grazing purpose.

6. **Hydroelectric dams** are quite controversial because while they help to power communities, they also contribute to deforestation.

7. **Urbanization:** Further on order to gain access to these forests, the construction of roads is undertaken; here again trees are chopped to create roads. Overpopulation too directly affects forest covers, as with the expansion of cities more land is needed to establish housing and settlements. Therefore, forest land is reclaimed.

8. **Desertification of land:** Some of the other factors that lead to deforestation are also part natural and part anthropogenic like Desertification of land. It occurs due to land abuse making it unfit for growth of trees. Many industries in petrochemicals release their waste into rivers which results in soil erosion and make it unfit to grow plants and trees.

❖ **Effects of Deforestation**

1. Climate Imbalance: Deforestation affects the climate in more than one ways. Trees release water vapor in the air, which is compromised on with the lack of trees. Trees also provide the required shade that keeps the soil moist. This leads to the imbalance in the atmospheric temperature further making conditions for the ecology difficult. Flora and fauna across the world are accustomed to their habitat. This haphazard clearance of forest has forced several of these animals to shift from their native environment. Due to this several species are finding it difficult to survive or adapt to new habitats.

2. Increase in Global Warming: Trees play a major role in controlling global warming. The trees utilize the greenhouse gases, restoring the balance in the atmosphere. With constant deforestation, the ratio of greenhouse gases in the atmosphere has increased, adding to our global warming woes.

3. Soil Erosion: Also, due to the shade of trees the soil remains moist. With the clearance of tree cover, the soil is directly exposed to the sun, making it dry.

4. Floods: When it rains, trees absorb and store large amount of water with the help of their roots. When they are cut down, the flow of water is disrupted and leads to floods in some areas and droughts in other.

❖ **Management of Forest Resource**:

The management of forests is often referred to as **forestry**. Forest management has changed considerably over the last few centuries, with rapid changes from the 1980s onwards culminating in a practice now referred to as sustainable forest management. Forest ecologists concentrate on forest patterns and processes, usually with the aim of elucidating cause-and-effect relationships.

India has a long history of traditional conservation and forest management practices. Under British rule, forest management systems were set in place mainly to exploit forests. Nonetheless, there were some attempts to conserve forests and meet the needs of local communities. The Indian National Forest Policy of 1894 provided the impetus to conserve India’s forests wealth with the prime objectives of maintaining environmental stability and meeting the basic needs of the fringe forests user-groups. Consequently, forests were classified into four broad categories, namely forests for preservation of environmental stability, forests for providing timber supplies, forests for minor forest produce, and pasture lands. While the first two categories were declared as reserve forests, the rest

were designated as protected forests and managed in the interests of the local communities.

Soon after independence, rapid development and progress saw large forest tracts fragmented by roads, canals, and townships. There was an increase in the exploitation of forest wealth. In 1950 the Government of India began the annual festival of tree planting called the **Vanamahotsava.** Gujarat was the first state to implement it. However, it was only in the 1970s that greater impetus was given to the conservation of India's forests and wildlife. India was one of the first countries in the world to have introduced a social forestry programme to introduce trees in non-forested areas along road sides, canals, and railway lines.

Since 1991, India has reversed the deforestation trend. Specialists of the United Nations report India's forest as well as woodland cover has increased. A 2010 study by the Food and Agriculture Organization ranks India amongst the 10 countries with the largest forest area coverage in the world. From 1990 to 2000, FAO finds India was the fifth largest gainer in forest coverage in the world; while from 2000 to 2010, FAO considers India as the third largest gainer in forest coverage. Some 500,000 square kilometres, about 17% of India's land area, were regarded as Forest Area in the early 1990s. In FY 1987, however, actual forest cover was 640,000 square kilometers, which is 19.45% of the total geographical area.

❖ **Some steps towards the conservation of forest resource**:

Following are some important steps of forest conservation:

1. **Regulated and Planned Cutting of Trees***:* One of the main reasons of deforestation is commercial felling of trees. According to an estimate, about 1,600 million cubic metres of wood have been used for various purposes in the world. Cutting of tress should be regulated by adopting methods like: (i) Clear cutting and (ii) Selective cutting. The clear-cutting method is useful for those areas where the same types of trees are available over a large area. In that case, trees of same age group can be cut down in a selected area and then marked for re-plantation. In selective cutting only mature trees are selected for cutting. This process is to be followed in rotation. The time gap between these cuttings is helpful in re-growth of trees. In regulated cutting only one-tenth of the forest area is selected for use and rotational system is always followed for their protection. The forest can be managed in such a way that a timber crop may be harvested indefinitely year after year without being depleted. This technique is called the ‘sustained yield’ method adopted by many countries.

2. **Reforestation and Afforestation:** Afforestation is the planting of trees in an area where there was no forest. Reforestation is the reestablishment of forest cover, either naturally or artificially. So, reforestation and afforestation are both forestation. Many governments and non-governmental organizations directly engage in programs of afforestation to increase the forest cover.

3. **Protection of Forests:**The existing forests should be protected. Apart from commercial cutting, unorganised grazing is also one of the reasons. There are several forest diseases resulting from parasitic fungi, rusts, mistletoes, viruses and nematodes which cause the destruction of trees. The forests should be protected either by use of chemical spray, antibiotics or by development of disease resistant strains of trees.

4. **Proper Utilisation of Forest and Forests Products:** Generally, trees are cut for logs and the rest, including stump, limbs, branches and foliage, etc., is left out as worthless debris. Further waste occurs at the saw mills. There is thus need to utilise this waste material. Today, several uses have been developed and products like waterproof glues, etc., can be obtained. Similarly, forests can be used or developed as tourist centers. By using them as tourist centers the country can earn substantial foreign exchange. This practice has been adopted by many countries, both developed and developing. The concepts of ‘national park’ and ‘game sanctuary’ have now become popular and every country has developed its unique forest area as a ‘national park’. In India alone, there are as many as 92 national parks and game sanctuaries. This is a good method of forest conservation.

5. Control forest fires: Forest must be protected from forest fires. In 2016, forest fires have been noted numerous places across the Indian state of Uttarakhand. These fires, set mainly in pine forests in the slopes of the sub-Himalayan region, produced clouds of smoke. Earliest possible steps should be taken to control the forest fires.

6. Role of Government in Forest Conservation: Although the government of every country is very particular about conservation of its forest resources and has several rules and laws for the protection of forests but, they are not implemented in an effective manner. Government should take the steps to control the commercial logging. They can implement the high amount of taxes over commercial logging**.**

7. Increase the use of substitute products: Increase the use of substitute products instead of forest products. For example, in

the place of wooden furniture we can use plastic or iron furniture. Use of paper can be minimized by using the technology.

- **Energy Resources:**

Our life is dependent on energy resources. Energy is the capacity to do work and is required for life processes.

An energy resource is something that can produce heat, power life, move objects, or produce electricity. Most of the energy we use today comes from fossil fuels.But fossils fuels have a disadvantage in that they are non-renewable on a human time scale, and responsible for other potentially harmful effects on the environment. Therefore, the gap creates between increasing demand and less supply. This gap is called **ENERGY CRISIS**.

The energy crisis is the concern that the world's demands on the limited natural resources that are used to power industrial society are diminishing as the demand rises. These natural resources are in limited supply. While they do occur naturally, it can take hundreds of thousands of years to replenish the stores. Governments and concerned individuals are working to make the use of renewable resources a priority, and to lessen the irresponsible use of natural supplies through increased conservation.

The energy crisis is a broad and complex topic. The energy crisis is something that is ongoing and getting worse, despite many efforts. The reason for this is that there is not a broad understanding of the complex causes and solutions for the energy crisis that will allow for an effort to happen that will resolve it.It would be easy to point a finger at one practice or industry and lay the blame for the entire energy crisis at their door, but that would be a very naive and unrealistic interpretation of the cause of the crisis.

- **Overconsumption:** The energy crisis is a result of many different strains on our natural resources, not just one. There is a strain on fossil fuels such as oil, gas and coal due to over consumption.

- **Overpopulation:** Another cause of the crisis has been the steady increase in the world's population and its demands for fuel and products. Transport sectors have developed a lot and increased their fuel consumption.

- **Poor Infrastructure:** Aging infrastructure of power generating equipment is yet another reason for energy shortage. Most of the energy producing firms keep on using outdated equipments that restrict the production of energy. It is the responsibility of utilities to keep on upgrading the infrastructure and set a high standard of performance.

- **Unexplored Renewable Energy Options:** Renewable energy still remains unused in most of the countries. Most of the energy comes from non-renewable sources like coal. It still remains the top choice to produce energy. Unless we give renewable energy a serious thought, the problem of energy crisis cannot be solved.

- **Gap between demand and supply:** In few countries, there is a significant delay in commissioning of new power plants that can fill the gap between demand and supply of energy. The result is that old plants come under huge stress to meet the daily demand for power. When supply doesn't match demand, it results in load shedding and breakdown.

- **Wastage of Energy:** In most parts of the world, people do not realize the importance of conserving energy. It is only limited to books, internet, newspaper ads, lip service and seminars. Unless we give it a serious thought, things are not going to change anytime sooner. Simple things like switching off fans and lights when not in use, using maximum daylight, walking instead of driving for short distances, using CFL instead of traditional bulbs, proper insulation for leakage of energy can go a long way in saving energy.

- **Poor Distribution System:** Frequent tripping and breakdown are result of a poor distribution system.

- **Major Accidents and Natural Calamities:** Major accidents like pipeline burst and natural calamities like eruption of volcanoes, floods, earthquakes can also cause interruptions to energy supplies. The huge gap between supply and demand of energy can raise the price of essential items which can give rise to inflation.

- **Wars and Attacks:** Wars between countries can also hamper supply of energy specially if it happens in Middle East countries like Saudi Arabia, Iraq, Iran, Kuwait, UAE or Qatar. That's what happened during 1990 Gulf war when price of oil reached its peak causing global shortages and created major problem for energy consumers.

- **Others Factors:** Tax hikes, strikes, military coup, political events, severe hot summers or cold winters can cause sudden increase in demand of energy and can choke supply.

❖ **Some steps towards the conservation of Energy Resources:**

- **Move Towards Renewable Resources:** The best possible solution is to reduce the world's dependence on non-renewable resources and to improve overall conservation efforts. Much of the

industrial age was created using fossil fuels, but there is also known technology that uses other types of renewable energies – such as steam, solar and wind. The Switching over to renewable resources is the important solution of energy crisis.

- **Awareness of Buying Energy Efficient products:** Replace traditional bulbs with CFL's and LED's. They use less watts of electricity and last longer. If millions of people across the globe use LED's and CFL's for residential and commercial purposes, the demand for energy can go down and an energy crisis can be averted.

- **Energy Simulation:** Energy simulation software can be used by big corporate and corporations to redesign building unit and reduce running business energy cost. Engineers, architects and designers could use this design to come with most energy efficient building and reduce carbon footprint.

- **Perform Energy Audit:** Energy audit is a process that helps you to identify the areas where your home or office is losing energy and what steps you can take to improve energy efficiency. Energy audit when done by a professional can help you to reduce your carbon footprint, save energy and money and avoid energy crisis.

- **Awareness on Climate Change:** Both developed and developing countries should adopt a common stand on climate change. They should focus on reducing greenhouse gas emissions through an effective cross border mechanism. With current population growth and over consumption of resources, the consequences of global warming and climate change cannot be ruled out. Both developed and developing countries must focus on emissions cuts. To cut their emission levels to half from current levels by 2050.

There are many global initiatives that are working towards resolving the energy crisis. This has taken the form of increased regulation and restriction on carbon emissions, the promotion of greener manufacturing and construction projects, the funding of research into hybrid technologies and more sustainable technologies and more.

2.11 RESOURCE UTILIZATION AND SUSTAINABLE DEVELOPMENT:

The name sustainability is derived from the Latin sustinere (tenere, to hold; sub, up). Sustain can mean "maintain", "support", or "endure". Since the 1980s

sustainability has been used more in the sense of human sustainability on planet Earth.

Sustainable development is a process for meeting human development goals while sustaining the ability of natural systems to continue to provide the natural resources and ecosystem services upon which the economy and society depend. As the concept developed, it has shifted to focus more on economic development, social development and environmental protection.

Sustainable development is the organizing principle for sustaining finite resources necessary to provide for the needs of future generations of life on the planet. It is a process that envisions a desirable future state for human societies in which living conditions and resource-use continue to meet human needs without undermining the "integrity, stability and beauty" of natural biotic systems.

There are many different definitions of the term sustainable development but in 1987 the World Commission on Environment and Development's report called the Brundtland Report is by far the best and is now one of the most widely recognized definitions:

"**Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs".**

The world's resources are finite, and growth that is unmanaged will lead to increased poverty and decline of the environment. We owe it to future generations to explore lifestyles and paths of development that effectively balance progress with awareness of its environmental impact. In order to preserve the future, we must appreciate the interconnectedness between humans and nature at all levels. Sustainable development practices can help us do this, and through education and building awareness, preserving the future is within everyone's reach.

Some of the more common examples of sustainable development practices are:

- **Use of Renewable Energy**: Energy from these resources is limitless, meaning we have the ability to eliminate dependence on non-renewable power sources by harnessing power from renewable resources.

- **Crop rotation**. Many farmers and gardeners are using this method as a chemical free way to reduce diseases in the soil and increase growth potential of their crops.

- **Water fixtures**. Water conservation is critical to sustainable development, and more and more products are available that use less water in the home, such as showers, toilets, dishwashers and laundry system.

On September 25th 2015, countries adopted a set of goals to **end poverty**, **protect the planet**, and **ensure prosperity for all** as part of a new sustainable development agenda. Each goal has specific targets to be achieved over the next 15 years.For the goals to be reached, everyone needs to do their part: governments, the private sector, civil society and people.

2.12 SUMMARY

We use a variety of materials derived from the environment. Nature has given us abundant resources in form of water, air, soil, wild animals, metals, fossils, fuels etc. and man by his technical skill and knowledge using resource from the dawn of civilization. Resource is the ability to perform the work of satisfying the needs or wants of human being. Resource can be classified on the basis of their nature, durability, ownership and distribution pattern. All the resources are derived from the environment. Many natural resources are essential for human survival, while others are used for satisfying human desire. Conservation is the protection, improvement, and wise use of natural resource to provide the greatest social and economic value for the present and the future. “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. On September 25th 2015, countries adopted a set of goals to **end poverty**, **protect the planet**, and **ensure prosperity for all** as part of a new sustainable development agenda. Each goal has specific targets to be achieved over the next 15 years. For the goals to be reached, everyone needs to do their part: governments, the private sector, civil society and people.

2.13 CHECK YOUR PROGRESS/EXERCISE

1. True or false:

a. Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs

b. Only developing countries should adopt a common stand on climate change

c. Forest is the main source of food for the primitive societies

d. Most of the time developing countries not able to explore the new resources due to low amount of financial support.

e. A resource is something that satisfies the needs of the nature.

2. Fill in the blanks:

a. On_____, countries adopted a set of goals to end poverty**,** protect the planet, and ensure prosperity for all.

b. _____are formed over very long geological periods

c. One limitation to maximize resources is _____

d. _____play an important role in resource development.

e. _____energy sources do not require heavy expenditure.

3. Match the columns:

A	B
a. Renewable resources	1. Chemical free way to reduce diseases
b. Non-renewable resources	2. Pine, spruce and larches
c. Crop rotation	3. Solar power
d. Taiga forest	4. Degradation of water due to temperature changes
e. Rainwater harvesting	5. All plant material and animal excreta
f. Thermal pollution	6. Hydrogen
g. Geothermal energy	7. Coal
h. Biomass	8. Logging
i. Stock resource	9. Heat of earth’s interior
j. Deforestation	10. Accumulation and deposition of rainwater

2.14 ANSWERS TO THE SELF-LEARNING QUESTIONS

1. True or False:

a. True
b. False
c. True
d. True
e. False

2. Fill in the blanks:

a. September 25th 2015
b. Non-renewable resources
c. Technology
d. Governmental policies
e. Non-conventional

3. Match the columns:

a. 3
b. 7
c. 1
d. 2
e. 10
f. 4
g. 9
h. 5
i. 6
j. 8

2,14 TECHNICAL WORDS AND THEIR MEANING

- **Resources:** a stock or supply of money, materials, staff, and other assets that can be drawn on by a person or organization in order to function effectively.
- **Conservation:** Conservation is the efficient using of resources in an efficient or ethical manner.
- **Exploitation:** The action of making use of and benefiting from resources, over use of the resources.

2.15 TASK

Spread awareness about minimum resource use and conservation of the resources.

2.16 REFERENCES FOR FURTHER STUDY

- Natural Resource Management, Pandey, B ed.
- The Exploitation of Natural Resources and the Consequences, Sarsby, R. eds.
- A New Century for Natural Resources Management, Knight. et. al. eds.

Unit -3

POPULATION AND EMERGING ISSUES OF DEVELOPMENT

After going through this chapter, you will be able to understand the following features:

3.1 OBJECTIVES

By the end of this unit you will be able to –

- Understand the importance of human resources in environment
- Understand the need to have an optimum population in the world
- Understand the benefits and challenges of population
- Know the newer trends in population studies.

3.2 INTRODUCTION

The study of environment is incomplete without understanding the role man plays in nature. As the population numbers are increasing in the world, the resources are becoming scarce and therefore the onus of controlling population has emerges as a major step for mankind. Countries like China have effectively introduced the one child model and reduced their population, while most developing countries like India are struggling with the population.

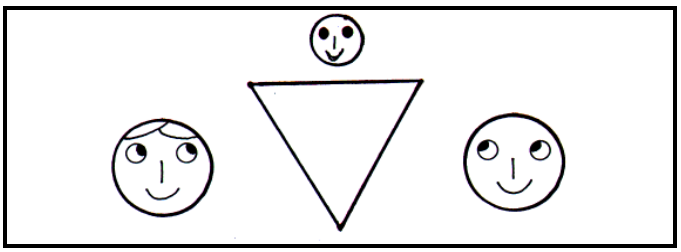
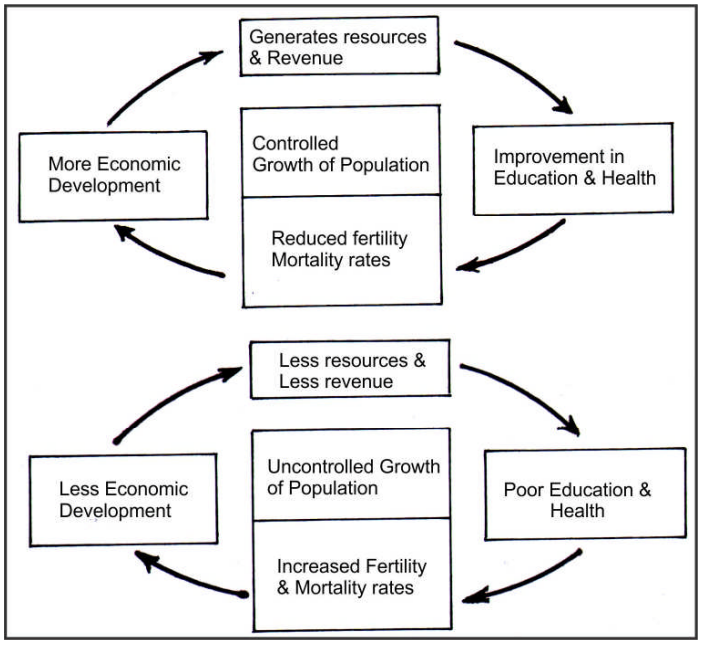


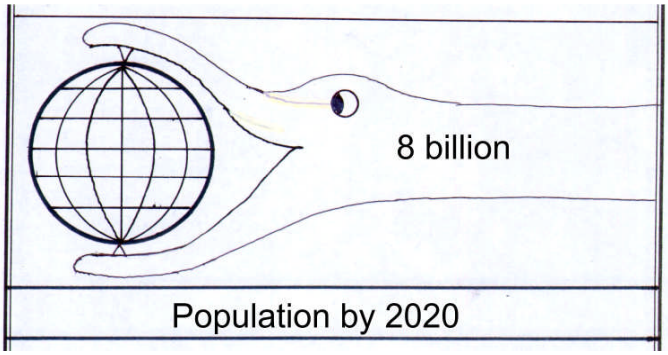
Fig. 3.1 One Child Policy

Population growth and development are linked in complex ways. Economic development generates resources and revenue which is used to improve education and health. These improvements, along with related social changes can moderate and reduce both fertility and mortality rates. On the contrary, high rates of population growth put excess pressure on the existing resources hindering the economic and social development and in turn education and health.



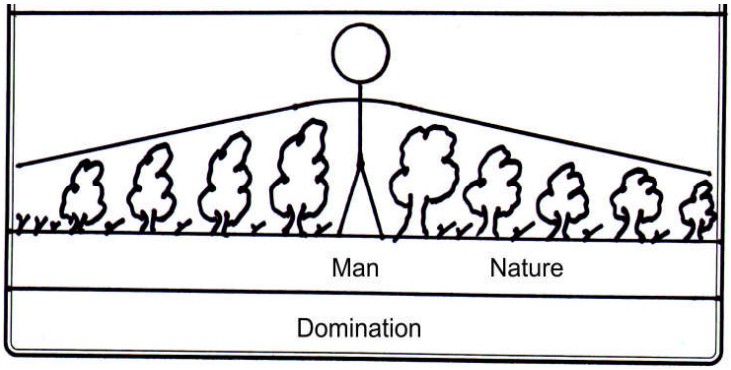
3.3 SUBJECT DISCUSSION

Population is the most integral part of environment and needs to be studied in detail as it has the capacity to alter all other components of environment. The population in the world and also in India is growing rapidly almost touching a 7 billion mark and with a global projection of 8 billion by 2020.

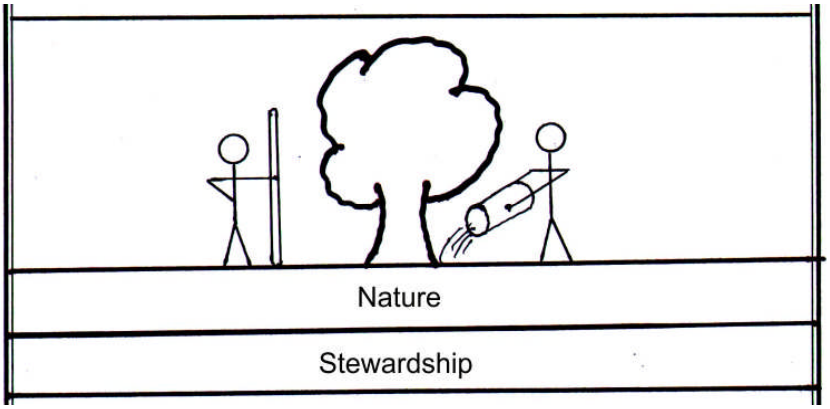


The human perspective in nature is of three broad kinds-

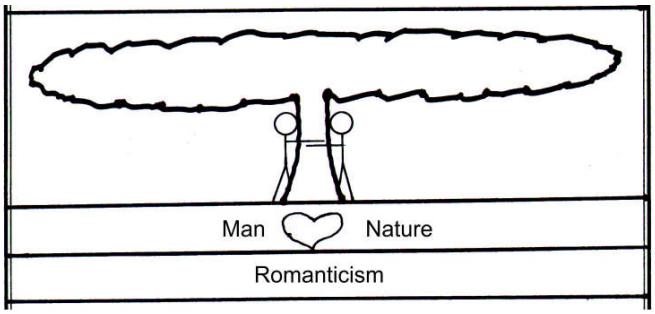
- ***Domination***- where human domination of nature is prevalent



- ***Stewardship-***development of an exploitative view, more harmonious relationship between human and environment and is desirous relation.



- ***Romanticism or deep ecology***-has love for nature and intrinsic value for all forms of life is the idealistic form of man nature relation.



Population can be a blessing as well as a bane for a nation.

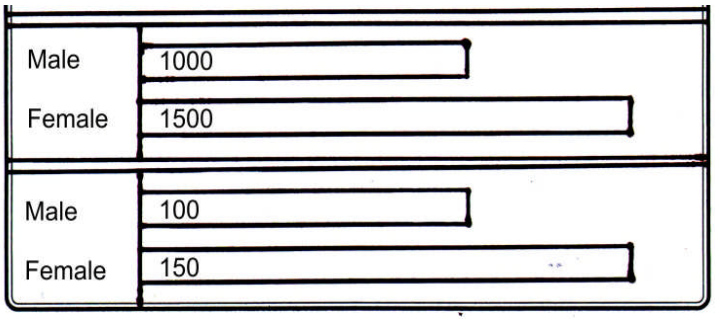
Why is Population Beneficial	Why is Population a Hindrance
• Greater consumer base • Large workforce • Greater diversity • Wider and broader political machinery • Greater potential to use resources	• Excessive pressure on existing resources-medical, educational, infrastructure • Poor Developmental Index-housing, sanitation, drinking water • Social problems- • Dissatisfaction with the governments due to limited funds

3.4 POPULATION EXPLOSION

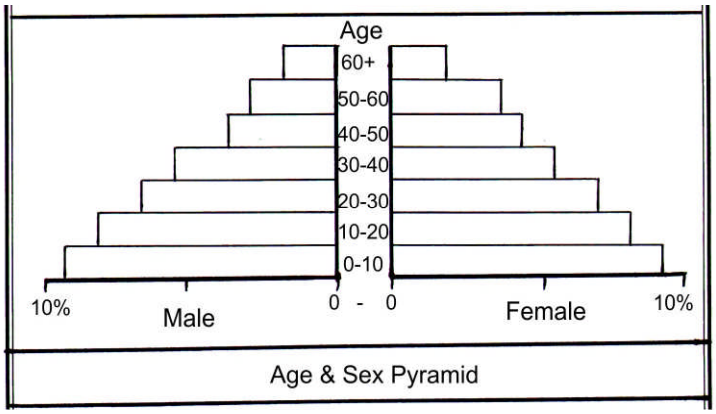
a. Demographic terms to know-

- **Demography** is the population of a place and the features it represents. It includes the Growth of population, Sex Ratio, Density of population, Literacy rate, Distribution of population, Poverty, Age-Sex Ratio and many other parameters.
- **Census** is the decadal count of population of the country which is tabulated in a country to understand the related trends of the country. In India the first census was conducted in the early 19^{th} century by the British
- **Sex Ratio**-It is the number of females per 1000 males in the country

Sex Ratio 1500



- **Literacy**- The ability of a person to read and write with understanding. Literacy rate is the number of people who are literate.
- **Density of Population** – is the number of persons living per square kilometer in an area.
- **Age Sex Pyramid**- is a statistical representation of the percentage of males and females in a mirror graph based on the specified age groups, e.g., 0-10 years etc.



b. Population Explosion

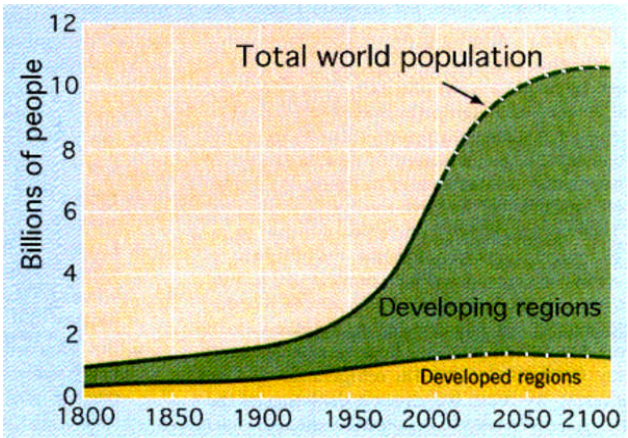
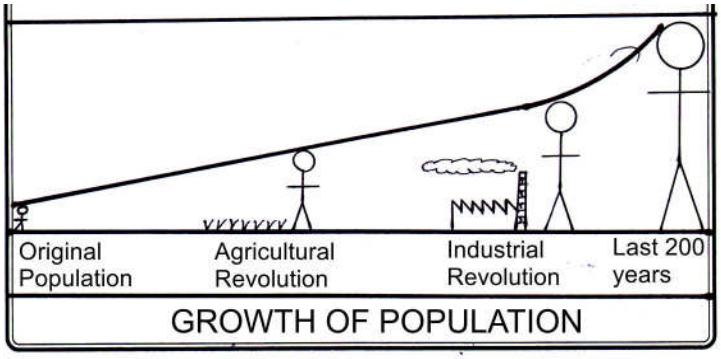


Fig. 3.9 Population Projection

The distribution of population in the world has shown wide fluctuations which has been evident in the manner of growth of population. It is estimated that at the time of Christ the human population was only 200 to 300 million(Hussain). The last 10,000 years the population has galloped in two distinct phases, the agricultural revolution and industrial revolution. The last two centuries, the doubling of population happened for the whole world. The sharp increase in population is reflected in the J curve or the almost steep rise of population in the last few decades. Currently the population in the world stands at 6.4 billion and estimates suggest it would be 8 billion by 2020.



The causes for the growth of population and also for population explosion are:-

- **Poverty-** Has been the most important cause of population growth. Poor people have more children to help them support their families with working hands. Lack of advancement in medicine and other social benefits have made them suffer in the developmental system of the country.

- **Illiteracy-** Education is a key enabler to help handle population increases. Lack of awareness, poor adaptability to the development goals make them susceptible to being excluded from the development indices.

- **Infant Mortality-** Poor medical facilities result in high infant mortality and the people tend to have more children as the survival rates of the infants are low.

- **Social Customs-** Social customs like early marriage, poor position of women in society,preference for the male child, selected female infanticide in some states are reasons for the explosion of population in the world.

- **Migration and Immigration-** Just like there is natural increase of population by birth, there is a greater amount of increase in

population that happens through migration of people from one country, state, region to another.

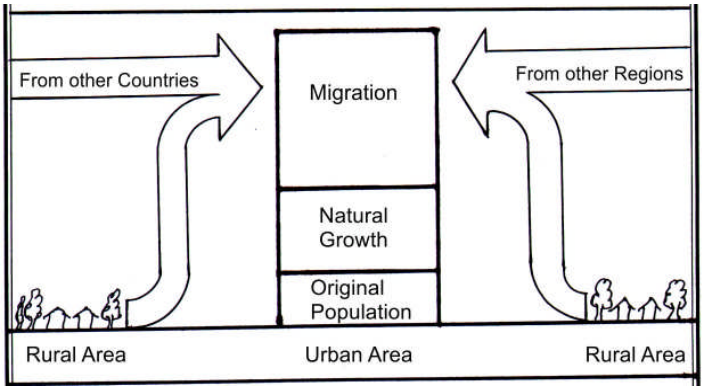


Fig. 3.11 Growth of Population due to Migration

- **Medical Facilities-** Improved medical facilities have resulted in falling death rate which have increased the longevity of the people, life expectancy and reduced infant deaths too. This has lead to an increase in population.

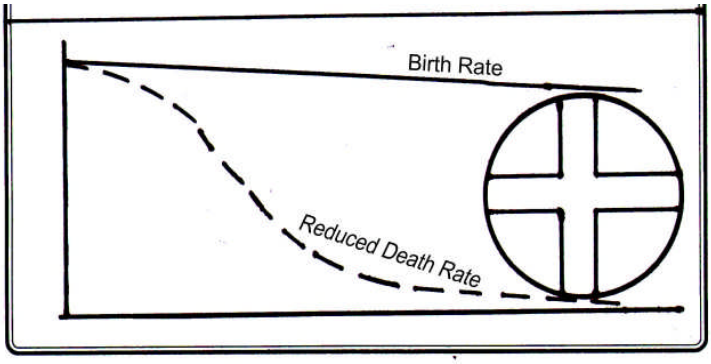


Fig. 3.12 Improved Medical Facilities

3.5. DEMOGRAPHIC TRANSITION MODEL

All countries in the world are in different stages of development. These stages are determined by the selected criteria that have been made by social scientists to stage the economic development of the country. One of the most popular model is the Demographic Transition Model.This model was propounded by W.S. Thompson (1929) and Frank W. Notestein(1945).It is based on the fertility and mortality trends in Europe, America and Australia. It analysed the birth rate and the death rate of all countries and arrived at a conclusion as to which stage the economy is. It shows the transition of an economy from an agrarian to urban modern society.

- This is a model based on the gradual progression of society from an underdeveloped to a developed as per the demographics of the nation.

- The model has three broad phases:-

a. **Phase I-**This is the stage of high underdevelopment and agrarian community with subsistence. It is characterized by high birth rate and high fluctuating death rate (pre demographic transition stage). The stage is characterized by poor medical facilities, subsistence living, lack of industrial activity, poor educational standards and overall underdevelopment.

b. **Phase II-**This stage is characterized by high birth rate and high but declining death rate, also the phase of population explosion (most under developed to developing countries would fall in this category). This is a stage of improved health care facilities which bring down the death rate and the IMR to cause population growth when the two curves diverge. Improved education, awareness and governmental efforts gradually enable the growth rates to fall. Some advanced models further subdivide this phase into three, Stage of falling birth and death rate, stage of sharper fall of death rate and a modest reduction of birthrate and maximum population growth, and the stage of falling and stable death rate and a sharp falling birth rate.

c. **Phase III-**This is the last stage of the model which is characterized by low but fluctuating birth rate and low death rate which can be found in all developed countries.

The Demographic Transition Model

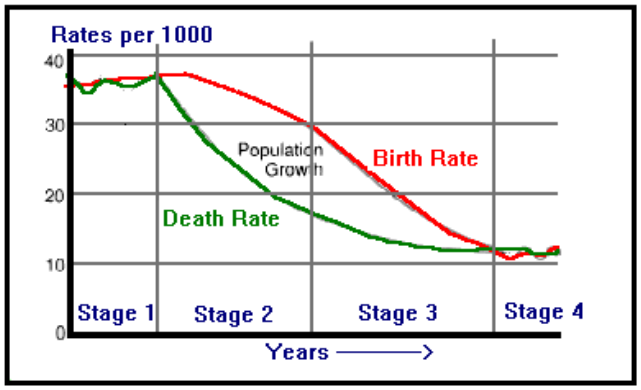
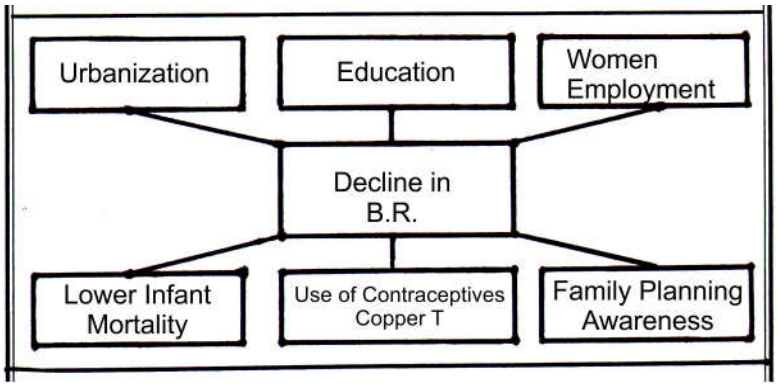


Fig. 3.13 Demographic Transition Model

3.6 PATTERN OF POPULATION GROWTH

- In 1901 the world population was only 1.6 billion.
- By 1960, it was 3 billion, and by 1987, 5 billion and in 1999, 6 billion.
- During the last decade there has been substantial decline in birth rate.The reasons for decline, include;



Reasons for decline in Birth Rate

a. Urbanization

b. rising educational attainment

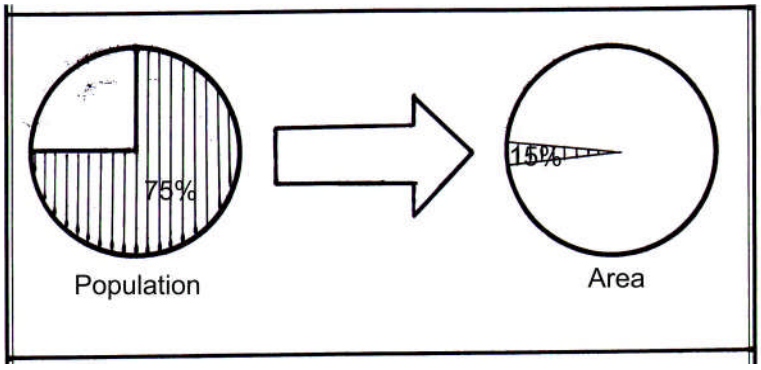
c. increasing employment among women

d. lower infant mortality

e. increasing awareness and

f. improved access to contraception have made it possible for the majority of the couple to achieve the desired family size.

- In some countries slowing of the population growth has been due to an increase in mortality (e.g. HIV related mortality in sub-saharan Africa).
- As a result of all these the decline in the global population growth during the nineties is steeper than the earlier predictions.
- It is expected to decrease to about 64 million by 2020 -25 and to 33 million by 2045 -50; 95 % of the growth of population occurs in developing countries.
- The population distribution is highly uneven. About 75 % of the people in the world live in less than 15% of the area while the rest 25% is spread all over.



- Global density of the world is about 35 persons per square kilometer while Asia as a landmass has 71 persons per

square kilometer. These variations are dependent on the physical factors, economic factors and the overall development of a places.

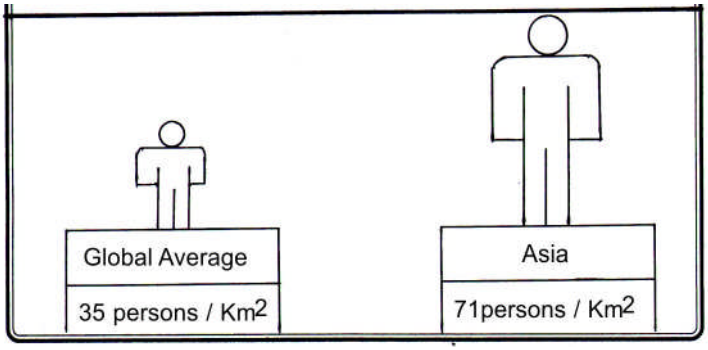


Fig. 3.16 Population Density - Global average & Asia

3.7 PROBLEMS OF EXCESS POPULATION

Rapid population growth is followed by increase in air, water pollution as more and more people use and contaminate the environment. There are increased demands for food and hence agriculture is carried out extensively. These may impact the quality of land by over use and over irrigation. All resources may be strained with overuse. Insufficient housing, overcrowding, transport related road clogging may also result. Excess urbansiation and migration from the rural areas may cause cities to overflow with people. Unsanitary conditions, poor sanitation and inadequate drainage may create unhealthy urban living. Rural areas may see disguised unemployment and productivity of the lands will fall. Malnutrition and starvation may be seen in areas where the food resources have not been distributed properly.Socially, unemployment, crime and unrest will result.

Summarizing the challenges of rising population:-

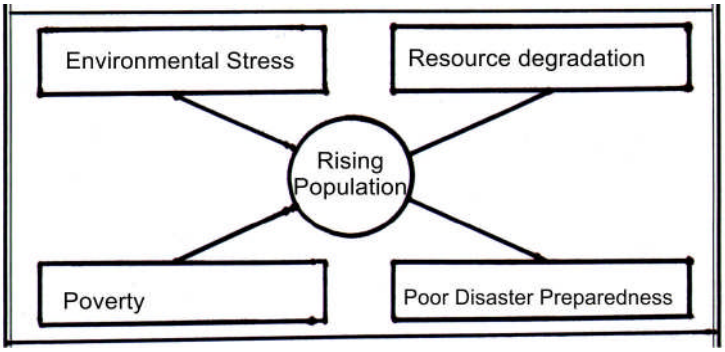


Fig. 3.17 Challenges of rising Population

- Environmental stress
- Resource degradation, depletion and resource crunch
- Poverty

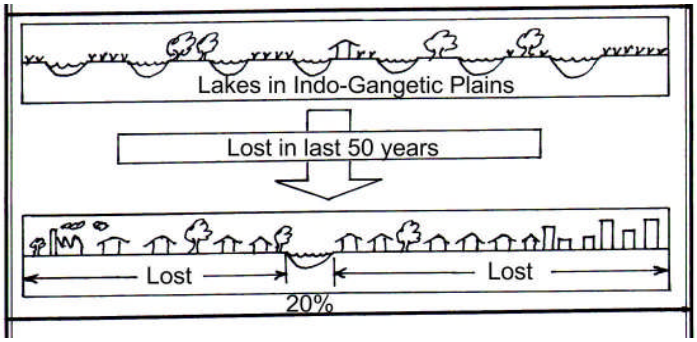
- Poor Disaster preparedness

The Planning Commission in its Report on “Population Growth Trends and Challenges” outlined the following ecological adverse impacts of excess population on India:-

a. Severe pressure on the forests due to both the rate of resource use and the nature of use. The per capita forest biomass in the country is only about 6 tons as against the global average of 82 tons.

b. Adverse effect on species diversity

c. Conversion of habitat to some other land use such as agriculture, urban development, forestry operation. Some 70-80 % of fresh water marshes and lakes in the Gangetic flood plains has been lost in the last 50 years.



d. Tropical deforestation and destruction of mangroves for commercial needs and fuel wood. The country’s mangrove areas have reduced from 700,000 ha to 453,000 ha in the last 50 years.

e. Intense grazing by domestic livestock

f. Poaching and illegal harvesting of wildlife.

g. Increase in agricultural area, high use of chemical fertilizers pesticides and weedicides; water stagnation, soil erosion, soil salinity and low productivity.

h. High level of biomass burning causing large-scale indoor pollution.

i. Encroachment on habitat for rail and road construction thereby fragmenting the habitat. increase in commercial activities such as mining and unsustainable resource extraction.

j. Degradation of coastal and other aquatic ecosystems from domestic sewage, pesticides, fertilizers and industrial effluents.

k. Over fishing in water bodies and introduction of weeds and exotic species

l. Diversion of water for domestic, industrial and agricultural uses leading to increased river pollution and decrease in self-cleaning properties of rivers

m. Increasing water requirement leading to tapping deeper aquifers which have high content of arsenic or fluoride resulting health problems.

n. Disturbance from increased recreational activity and tourism causing pollution of natural ecosystems with wastes left behind by people.

3.8. POPULATION CONTROL MEASURES IN INDIA

The population policy in India is a fallout of the plan periods and has achieved modest results. As the country stands as the second populous country and has over a billion population, the policies have to be implemented really effectively for any desired benefits.

Important Milestones in of the Population Policy of India	• **1946- Bhore Committee Report**
• **1952-family planning programme launched**	• 1976-National Policy Statement
• **1977-Family Welfare Programme policy statement**	• 1991-Karunakaran committee(NDC)
• **1993- Karunakaran report accepted as the NPP**	• 1994-Dr.Swaminathan Expert report-on population policy
• **1998-99-opinions sought on the policy**	• 2000- accepted as the new NPP

National Population Policy-2000

The NPP is implemented by the National Commission on Population and has been attempting to stabilize the population of the country with the help of the following measures:-

- **I**nfrastructure for basic reproductive and child health
- School education upto 14 yrs
- Reduction of the IMR to below 30 persons /100 live births
- Reduction of the maternal mortality to below 100/100000 live births

- Achieve universal immunization of children against all preventive diseases
- Achieve 80% institutional deliveries and by trained persons
- Universal access to information ,counseling, contraception
- Achieve 100% registration of births and deaths and marriage
- Contain AIDS, communicable diseases
- Promote small family norms
- Make emphasis on people centric program National Population Policy-2000

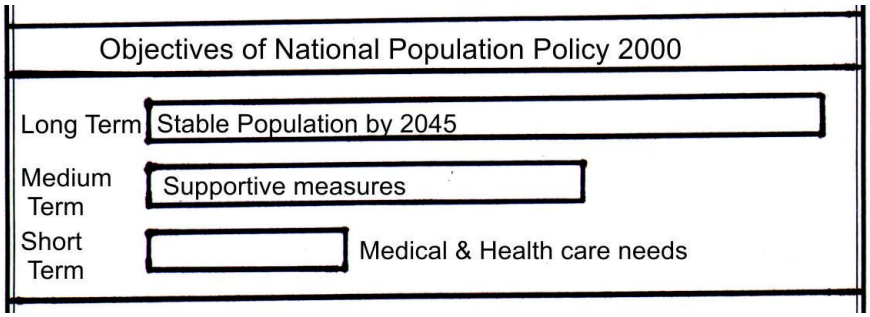
Objectives of the Policy

a. Long Term Objectives- i) stable population by 2045

ii) sustainable economic growth with social and environmental development

b. Medium Term Objectives- Inter sectoral operational strategies to enable achievement of the policy objectives

c. Short Term Objectives-Meet the medical and health care needs



Evaluation of the Policy

NPP has been operational and implemented for more than two decades. Yet the success rate is poor. Reasons for low success are:

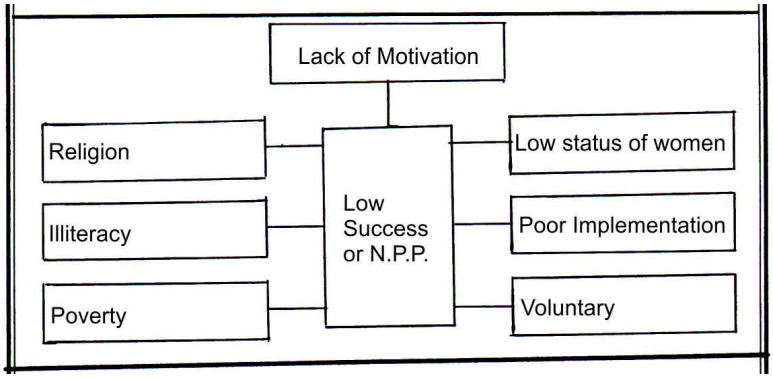


Fig. 3.20 Reasons for Low Success of N.P.P.

- Poverty
- Illiteracy
- Religion
- Lack of motivation
- Low status of women
- Poor implementation
- Voluntary and hence slow

The NPP however, reaffirms the government's determination to reduce the population numbers. Health facilities may have improved yet there are several areas in the country where there are limited or no facilities. Education has been boosted with right to education, mid day meal schemes, freeship for the girl child etc. to enable inclusiveness. Awareness and penetration of neonatal and infant care has improved.

3.9. HUMAN POPULATION AND ENVIRONMENT

Concept of the Carrying Capacity and the Tragedy of Commons: Garret Hardin in his classic essay "tragedy of commons" in 1968, stressed that every ecosystem has a threshold or a limit of supporting the population. This is determined by the amount of respuces and the dependable population in the area. Whether population increases by natural increase or migration, beyond a certain limit there is experience of stress. This ideal numbers which any environmental space can hold without any damage to the environment is called the carrying capacity of the ecosystem or the environment. He explained this in his famous essay Tragedy of Commons.

The study of human population is important for the following reasons,

a. Man is an integral part of the environment

b. Has a dual role as a producer and consumer of resources

c. The changing roles of man in nature from dependency to supremacy

d. Maintain a harmony in the environment

There are three types of activities that are carried on by man to alter and create resources. They are, Primary activities like farming, fishing. Secondary activities like industries and Tertiary activities are the service based.

3.10 ENVIRONMENT AND HUMAN HEALTH

The relation between health and environment is indeed interesting. The presence of greater number of people in an area causes health problems that need to be studied. Overcrowding leads to shortages, which in turn, may cause unequal distribution of medical and other necessary resources. The rate of population growth affects long-range planning of community health and medical facilities. Also any changes in age composition, migration changes in population density and urban-rural movement may result in changing the entire health program of an area. In advanced nations population trends like aging of the population is the most fundamental aim on their national health policy. Environmental health, as defined by WHO, comprises those aspects of human health, including quality of life, that are determined by physical, chemical, biological, social, and psychosocial factors in the environment. It also refers to the theory and practice of assessing, correcting, controlling, and preventing those factors in the environment that adversely affect the health of present and future generations.(Bharucha)

Our environment affects health in a variety of ways.

- Climate and weather affect human health.
- Public health depends on sufficient amounts of good quality food, safe drinking water, and adequate shelter
- Natural disasters such as storms, hurricanes, and floods still kill many people every year. Unprecedented rainfall trigger epidemics of malaria and water borne diseases.
- Food Shortages and resulting Poverty
- Spread of diseases and combating them

Definition of Health Impact Assessment (HIA) by World Health Organisation: Health impact assessment is a combination of procedures, methods and tools by which a policy, program or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population Concerns in Diseases due to unregulated health in highly populated areas

i. **Infectious diseases-** Those that spread through direct contact. Tuberculosis has a virulent strain which is highly contagious.

ii. **Vector Borne-** Those that spread by carrier vectors like rodents, mosquito, like malaria, leptospirosis.

iii. **Water Borne-** Those spreading through consumption of contaminated water like cholera

iv. **Mutated Varieties-** All virus spread diseases which have mutated such as the flu, avian flu

v. **Inoculations and Vaccination issues-**As the whole world have irradiated diseases like yellow fever and small pox; inoculations have to be made to ensure that they are in check. A good example is that of polio which was a drop administered inoculation has move to become injected one to make it more effective. Congested and overpopulated areas can be a problem in the ability of the administration to reach out to all section of the society. Some of these may reoccur if not administered on time. Awareness and education of the people has to be made to ensure that the timely administering of the drugs occur.

3.11 HUMAN DEVELOPMENT INDEX (HDI)

Is a measure of development in the world. It has been introduced by the UNDP to emphasize the level of development of the countries. It was introduced by Prof Amartya Sen, Lord Meghnad Desai And Dr. Mahabubul Haq. The objective of the ranking index is to enable the society to lead a quality life.

- The parameters of the HDI as measured are:-
  1. Life span
  2. Literacy
  3. Income per Capita for quality of life

The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. It is calculated as a geometric mean of normalized indices for each of the three dimensions. The health dimension is assessed by life expectancy at birth, the education dimension is measured by mean of years of schooling for adults aged 25 years and more and expected years of schooling for children of school entering age. The standard of living dimension is measured by gross national income per capita. The HDI uses the logarithm of income, to reflect the diminishing importance of income with increasing GNI.

Much later in 1995, the Gender Development Index (GDI) was introduced as an index to measure of gender equality. GDI together with the Gender Empowerment Measure (GEM) were introduced in 1995 in the Human Development Report of the UNDP.

The **Gender** Inequality **Index** (GII) is an **index** for measurement of **gender** disparity that was introduced in the 2010

Human Development Report 20th anniversary edition by the United Nations Development Programme (UNDP).

Name of the Country	HDI Rank 2015, released in 2016	Index
Norway	1	0.94
Australia	2	0.93
Switzerland	3	0.93
India	131	0.62

- India falls in the medium developed countries in the world.
- Most livable Countries in the world today remain the Scandinavian countries and the Western European Countries such as Norway, Iceland, Sweden, Austria, Netherlands, Belgium, USA, Canada, Japan, Switzerland, Denmark, Ireland, UK, etc
- Least Livable Countries-Sierra Leone, Niger, Burkina Faso, Mali, Burundi, Mozambique etc.

HDI in Indian states

- The HDI is the highest for Kerala (0.625) followed by Punjab (0.569) and the lowest for Orissa(0.569) while Bihar (0.447) and Chhattisgarh (0.449) .Maharashtra has (0.549) .

3.12 WORLD HAPPINESS INDEX

In 2012 ,the World introduced the World Happiness Index .The report is generated from a survey of the state of global happiness. The World Happiness Report 2017, which ranks 155 countries by their happiness levels, was released in March, 2017 and ranked India 122 out of 155 nations.In June 2016, the OECD worked to "to redefine the growth narrative to put people's well-being at the center of governments' efforts".In February 2017, the United Arab Emirates held a full-day World Happiness meeting, as part of the World Government Summit.Thereafter, on World Happiness Day, March 20th, the launch the World Happiness Report 2017 was made. Norway has jumped from 4th place in 2016 to 1st place this year, followed by Denmark, Iceland and Switzerland. 80% of the variance of happiness across the world occurs within developed countries. In richer countries the differences are not by income inequality, but by differences in mental health, physical health and personal relationships: the biggest single source of misery is mental illness. Income differences matter more in poorer countries, but even there mental illness is prevalent.

3.13 SUMMARY

Demographic studies are an important determinant of the study of environment. Previously man was highly dependent on nature but as he progressed technologically, he learned to combat the uncontrollable natural forces. This helped him to develop and confront the many natural forces. Gradually societies progressed from agrarian to urban and the environmental degradation began. Just as excess population can be a hinderance, under population too can result in underdevelopment. Hence the scope of the study become more and more defined as man also learns to improve the quality of living through human development and sustainable development.

3.14.CHECK YOUR PROGRESS/EXERCISE

1. True or False

a. India ranks 105 in the World Happiness Index.
b. The global population is currently at 8 billion.
c. India falls in the Phase 1 of the DTM
d. India follows no defined policy on population control
e. Census is collected every 5 years.

2. Fill in the Blanks

a. India ranks _____in the World Happiness Index
b. _____is a parameter for HDI
c. _____state in India has the highest HDI**.**
d. MDGs stand for_____
e. NPP stands for _____.

3. Multiple Choice Questions

a. Concept of Carrying Capacity was given by
   i. T. Malthus
   ii. Garret Hardin
   iii. Odum
   iv. A Zimmerman

b. DTM has _____phases.
   i. One
   ii. Two
   iii. Three
   iv. four

c. Human population rose sharply during the _____.
   i. Paleolithic
   ii. Neolithic
   iii. Industrial Revolution
   iv. None of the above

d. Global population is highly concentrated in which continent _____

i. Asia
ii.Africa
iii.Europe
iv. Australia

e. _____ has the largest population in the world.

i.India
ii.China
iii. Brazil
iv. Australia

3.15 ANSWERS TO THE SELF-LEARNING QUESTIONS

1. True or False

1.a. False
1.b. False
1.c. False
1.d. False
1.e. False

2. Fill in the Blanks

2.a. 122
2.b. Longivity
2.c. Kerala
2.d. Millinium Development Goals
2e. National Population Policy

3. Multiple Choice Questions

3.a. (ii)
3.b. (iii)
3.c. (iii)
3.d. (i)
3.e. (i)

3.16 TECHNICAL WORDS AND THEIR MEANINGS

- **Census-** The decadal compoting of demographic data in a country**.**
- The **Gender Inequality Index** (GII) is an **index** for measurement of **gender** disparity that was introduced in the 2010 Human Development Report 20th anniversary edition by the United Nations Development Programme (UNDP).

3.17 TASK

- Make a questionnaire for the students in your class and find out the following:-
  - Literacy level in their families
  - Awareness about girl child education
  - RTE

3.18 REFERENCES FOR FURTHER STUDY

- Basics in Environmental Studies, Dr. Pushpendra
- Environmental Management, Swapan Deb.
- Human Geography, Majid Hussain.
- Environment and Sustainable Development, Sundar, I.
- World Development Report- Annual
- Census of India, 2011.

Unit -4

URBANIZATION AND ENVIRONMENT

After going through this chapter, you will be able to understand the following features:

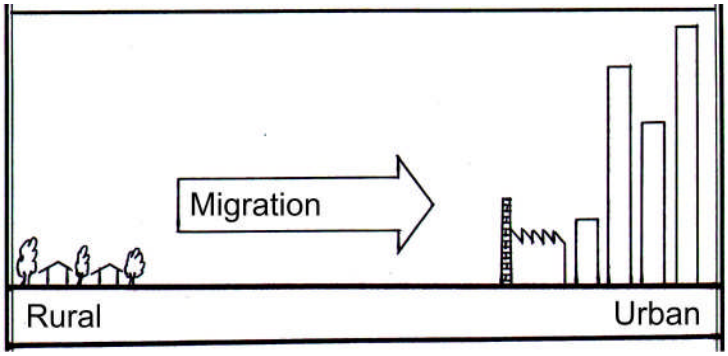
4.1 OBJECTIVES

By the end of this unit you will be able to –

- Understand the patterns of global urban growth
- Understand the problems of excess urbanization
- Understand the concept of smart cities
- Understand the patterns of urban population

4.2 INTRODUCTION

Urbanisation is the process of becoming urban. All regions have moved from a rural to an urban population growth causing cities to change their morphology and the characteristics.



As cities become more and more urban, there are problems that have arisen like pollution, overcrowding etc. These have called for better planning and management of the urban morphology. Planners and governing agencies have created solutions like smart cities, sustainable cities to ensure that cities continue to grow. Projections show that urbanization combined with the overall growth of the world's population could add another 2.5 billion people to urban populations by 2050, with close to 90 percent of the increase concentrated in Asia and Africa, according to the United Nations.

4.3 SUBJECT DISCUSSION

According to the World Bank data, in 2007, the global urban population exceeded the global rural population, and the world population has remained predominantly urban thereafter. With more than 54 per cent of the world’s population is urban today planning for urbanization is a much needed action. India just like many other developing countries too is increasing becoming urban. Urban areas promote employment, better quality life, improved medical and educational opportunities, create infrastructure and push economies into becoming better. The pitfalls to urbanization are the slums developments. Stress on the existing resources,

pollution, infrastructure bottlenecks and overcrowding. In order to combat this the Indian government has come up with the concept of smart cities to align with the Rio 20+ objectives of improved urban development. Selected cities in the country will be modeled into ideal smart cities and the process has begun.

4.4 CONCEPT OF URBANIZATION

a. Defining Terms

The Census of India defines urban areas as, (as per 1961 Census later adopted in every Census)

(a) All places with a Municipality, Corporation or Cantonment or Notified Town Area

(b) All other places which satisfied the following criteria:

(i) a minimum population of 5,000.

(ii) at least 75% of the male working population was non-agricultural sector.

(iii) a density of population of at least 400 sq. Km. (i.e. 1000 per sq. Mile)

- An **urban area** can be defined by one or more of the following: administrative criteria or political boundaries (e.g., area within the jurisdiction of a municipality or town committee), a threshold population size (where the minimum for an urban settlement is typically in the region of 2,000 people.
- **Urban growth** is the (relative or absolute) increase in the number of people who live in towns and cities.
- **Urbanization** is the proportion of a country that is urban
- **Urban agglomeration** is the proportion of a built-up or densely populated area
- **Urban Sprawl** is the uncontrolled and disproportionate expansion of an urban area into the surrounding countryside, forming low-density, poorly planned patterns of development.
- **Megacity** is an urban agglomeration with a population of 10 million or more.

b. Trends of Indian Urbanisation

According to the Ministry of Urban Development, the following trends are evident in Urbanisation in India.

- Among all the States and Union territories, the National Capital Territory of Delhi and the Union territory of Chandigarh are most urbanized with 97.5 percent and 97.25 percent urban population
- Goa is now the most urbanized State with 62.2 percent urban population, a significant increase since 2001 when urban population of Goa was 49.8%.
- Kerala, has an urban population of 47.7 per cent, while a decade ago it was just 25.9 percent.
- The North-Eastern States has Mizoram as the most urbanised with 51.5 per cent urban population, though in terms of absolute contribution to total urban population in the country, Mizoram's contribution is just 0.1 percent.
- The proportion of urban population continues to be the lowest in Himachal Pradesh with 10.0 per cent followed by Bihar with 11.3 percent, Assam (14.1 percent) and Orissa (16.7 percent).
- Maharashtra has in absolute numbers the highest with 50.8 million persons which comprises 13.5 percent of the total urban population of the country.
- The provisional results of census 2011 reveals that there is an increase of 2774 towns comprising 242 Statutory and 2532 census towns over the decade.
- Growth rate of population in urban areas was 31.8%.Further the number of million plus cities/urban agglomeration UA has increased from 35 in Census 2001 to 53 in Census 2011.

c. Causes of Urbanisation:

Various reasons have led to the growth of cities. They are as follows:

i. Industrialization:

Industrialization is a major cause of urbanization. It has resulted in the employment for many people and areas have become urban as they support secondary activities.

ii. Social factors and urban benefits:

In most developing countries people are attracted to urban areas, better standard of living, better educational facilities, need for status also induce people to migrate to cities.

Employment opportunities:

In India, cities provide more job opportunities to people. Hence most cities tend to be overcrowded and centers of urban growth.

iv. Modernization:

Urban areas are characterized by sophisticated technology better infrastructure, communication, medical facilities, etc. People feel that they can lead a comfortable life in cities and migrate to cities.

v. Migration:

Migration of people from rural to urban areas, from the suburbs to the city centre and from smaller towns to bigger cities.

vi. Natural Increase of Population:

As the population of the cities grow there is an increase in the number of urban population of the city.

4.5. PROBLEMS OF MIGRATION AND URBAN GROWTH

i) What is migration?

Migration is the movement of people from one place to another. The reasons for migration can be economic, social, political or environmental. There are usually push factors and pull factors at work for the process to be complete. Migration impacts on both the place or origin, and on the place where migrants settle. Historically man has been migrating for better opportunities, agricultural lands, employment, avoid disasters, politically motivated as refugees, religious reasons, and educational, social and cultural reasons.

Push Factors	**Pull Factors**
Hostile environment	Improved employment opportunity
Disasters	Religious Reasons
Political Refugee	Social Reasons(Marriage)
Lack of opportunities Education, Employment	Education

ii) People migrating may be of different types:-

On the basis of the source place:-

- **Internal Migration-** is when the migration of the people is within the country of origin. Internal migration could be rural to rural, urban to urban, rural to urban, and urban to rural. Amongst the different types, rural to urban migration is the most common in India.

- **International Migration-** Is when migration of the people is from one country to another. It may be for employment, better quality of life, marriage, education etc.

On the basis of numbers:-

- **Individual Migration-** Is when an individual migrates to a new land for his personal goals, needs and desires.
- **Group Migration-** Is when people migrate in groups from one place to another. Families, communities, groups of unrelated people may migrate for the want of better opportunitiy. In India, the highest numbers over (10 million) migrated during the partition of the country in 1947, from West and East Pakistan into India and vice versa. These were mostly community and family migrations.

On the basis of Choice:-

- **Voluntary –** When the migration of a person or a group of people is by choice, it is voluntary and based on the needs of the of the individual or the group.

- **Forced-** When migration is compulsory in order to survive or when wars or political tensions force people out of their places of living, they are forced migration also called the refugees. During the Kashmir insurgency the Kashmiri Pandits fled the valley to avoid being troubled. Similarly, developmental projects may create forced migration for the tribal people living in an area. Building of dams, roads, rail lines, airports, force people to leave a place and migrate.

Interestingly, when people migrate the following happens in both the area where the migrant is moved from and where he is headed.

Effect of Migration in Area of Origin	**Effect of Migration in Area of Destination**
Will have lesser people	Will have more people
Will have lesser workforce	Will have more workforce
Will have less consumption of goods and services	Will have more consumption of goods and services
Income and earnings falls	Income and earnings rise

Quality of life improves	Quality of life declines
Sparse population means better available resources	Dense population means strain on the existing resources.

iii) Effect of Urbanisation

Urban growth is the unprecedented growth of people, houses and livelihood of an area. There are distinct reasons for the growth of urban centers also called growth poles in a region. A factory, a temple etc. may be triggers to allow growth of settlements around them.

Positive effect of Urbansiation	Negative Effect of Urbanistion
• Migration of rural people to urban areas. • Employment opportunities in urban centres. • Transport and communication facilities. • Educational facilities. • Increase in the standard of living.	• Problem of over population • Cost of living • Increase in Crime rates • Pollution

Urbanisation comes with some defined problems:-

c. Degradation of air and water

d. Loss of soil cover impact on biodiversity,

a. Changing Land Use- Any urban area needs to develop on some geographic space. This means that the city or a town needs some space to grow or develop its houses, institutions, roads, railways etc. Thus the land use in an urban area changes from largely rural and agrarian to urban to include the urban facilities. The morphology undergoes a change and may even impact the ecological balance of a place. For example the increase in the built up area may conflict and reduce the ground waste infiltration and prevent natural water conservation. Trees decline too and may cause the air to be polluted and carbon balance may be impacted.

b.Crowding and Stress on Urban Resources or Overpopulation-

Congestion and unhygienic living is dominant due to over urbanization. The density of people is very high in the urban areas causing land prices to rise. Housing becomes expensive and average house size is small. There are prevalent chawls (slums)

and cluster settlements and vertical living e.g. high rises become a norm. Mumbai as a city is known for its slum and one third of its population live in them. Slums have been called by different locally, a Bastee in India, a Favela in Brazil etc.

c. Degradation of Air, Water and Land or Pollution-

i) Pollution from contaminated waste from sewage, waste water, industrial waste water and domestic wastewater may be a major problem with urban development. Most Indian cities like Delhi (Yamuna), Mumbai (Mithi) have seen water bound pollution from urban rivers which have been converted into carriers of urban waste waters.

ii) Vehicular exhausts, industries emitting harmful gases, dumpyards releasing gases, domestic heating may all be contribution to the poor urban health of the air around it.

iii) Wasteland from dumping of the garbage, creating dumpyards, disposing harmful waste on urban lands can cause the land to be degraded .

iv) Noise Pollution from vehicles, industries, crackers, honking, and festival noise can all harm the urban environment.

d. Loss of soil cover and Impact on biodiversity-

The spread of urban population in an area needs built up area. Vegetation is cut causing the biodiversity to be affected. In Mumbai, the Sanjay Gandhi National Park has receeded to accommodate the megacity. Similarly, man animal conflicts can also occur, like sighting of the animal in urban areas, animals venturing into roads, railways, bird hits in airports etc. The rise in the number of people result in deforestation of the region and hence the ecology is impacted.

Other problems include

Water Supply and Sanitation- The presence of a higher population causes pressure on the existing water supplies and ability of the municipality to handle the disposal of sanitation. Since the pressure on water and other resources is very high shortages may arise. Untreated waters may contaminate and make water difficult to use.

Transportation- too many vehicles clog the transport networks and cause traffic jams, overcrowding of the mass transport systems like buses and trains. Delays in commuting, accidents, honking may cause stress for the commuters.

Clearly the **solution** to the problems of urbanization is better management from the problems and tackling the problems with planning and vision.

(a) To create Employment at Rural Level: The chief responsible factor for urbanization is limited employment in villages. So, we should try to create more and more employment in rural area to stop migration.

(b) The make the rural area better adapted to tackle the disasters like droughts which trigger massive migration to the cities.

c) Create sustainable cities which can plan the urban areas in advance with the capacity of people it can hold. This will enable the city planning to be scientific and create urban space for all the residents of the cities.

Urban Sprawl- Excessive urbanisation in developing countries can cause a different type of land use. Sprawl generally infers to some type of development with impacts such as loss of agricultural land, open space, and ecologically sensitive habitats. Also, sometimes sprawl is equated with growth of town or city (radial spread). In simpler words, as population increases in an area or a city, the boundary of the city expands to accommodate the growth; this expansion is considered as sprawl. Usually sprawls take place on the urban fringe, at the edge of an urban area or along the highways.

4.6 URBAN HEAT ISLAND

In some instances, urban development may cause harm to the environment. Due to pollution, the pollutant released may modify the physical and chemical properties of the atmosphere, and the covering of the soil surface. Generally a combined effect of all these impacts causes what is known as Urban Heat Island. It is defined as the rise in temperature of any man-made area, resulting in a well-defined, distinct "warm island" among the cooler surrounding region. The warm conditions are a result of the urban modifications that may have been made on the city, town or a built up area.

The causes of Urban Heat Island (UHI) are:-

i) Removal of land cover and replaced by built up area resulting in reflection of heat into the atmosphere rather than absorbing the heat.

ii) Urban construction materials have different thermal (heat capacity and thermal conductivity) and radiative (reflectivity and

emissivity) properties compared to surrounding rural areas, which results in more of the sun's energy being absorbed and stored in urban compared to rural surfaces.

iii) Scattered and emitted radiation from atmospheric pollutants to the urban area

iv) The production of waste heat from air conditioning and refrigeration systems, as well from industrial processes and vehicular traffic

- Cities with variable landscapes and climates can have temperatures several degrees higher than their rural surroundings
- This increase may further create a warming due to increased energy consumption for cooling (i.e. refrigeration and air-conditioning),increase the energy production by power plants, which leads to higher emissions of heat-trapping greenhouse gases such as carbon dioxide, as well as other pollutants such as sulfur dioxide, carbon monoxide and particulate matter. Thus a continous heat creation causes the temperature of the city to remain higher than the adjoining regions
- Health impacts- Heatstroke, heat exhaustion, pollution related ailments, particularly in elderly and children may be seen
- Meteorological impacts of the UHI are associated with reductions in snowfall frequencies and intensities, as well as reductions in the diurnal and seasonal range of freezing temperatures.
- High temperatures may alter the floral and fauna patterns and living.

4.7 SMART CITIES

As an initiative of the Government of India, the Smart cities concept has been introduced. The Ministry of Urban Development has outlined the details entailed in the program which may see some 20 Indian cities become smart in the future.

i) What is a Smart City?

These cities are required to promote comprehensive development-institutional, physical, social and economic infrastructure. As a long term goal and cities can work towards developing such comprehensive infrastructure gradually converting into smart cities.

ii) Smart Cities Mission,(objective) are:

- To promote cities that provide core infrastructure

- Give a decent quality of life to its citizens
- A clean and sustainable environment
- And application of 'Smart' Solutions.

The Smart Cities Mission of the Government is a bold, new initiative, attempting to focus on the core infrastructure, such as,

i. Adequate water supply

ii. Assured electricity supply

iii. Sanitation, including solid waste management

iv. Efficient urban mobility and public transport

v. Affordable housing, especially for the poor

vi. Robust IT connectivity and digitalization

vii. Good governance, especially e-Governance and citizen participation

viii. Sustainable environment

ix. Safety and security of citizens, particularly women, children and the elderly

x. Health and education.

iii) **Achievement of Smart City**

a. To drive economic growth

b. Improve the quality of life of people by enabling local area development

c. Harnessing technology, especially technology that leads to Smart outcomes.

d. Area based development that will transform existing areas (retrofit and redevelop), including slums, into better planned ones, thereby improving livability of the whole City

iv) Smart City Features (Ministry of Urban Development) -

1. Promoting mixed land use in area based developments– planning for 'unplanned areas' containing a range of compatible activities and land uses..
2. Housing and inclusiveness - expand housing opportunities for all;
3. Creating livable localities –reduce congestion, air pollution and resource depletion, boost local economy, promote interactions and ensure security.
4. Preserving and developing open spaces - parks, playgrounds and promote eco-balance;

5. Promoting a variety of transport options - Transit Oriented Development (TOD), public transport
6. Making governance citizen-friendly and cost effective e.g.online services to bring about accountability and transparency
7. Giving an identity to the city - based on its main economic activity, such as local cuisine, health, education, arts and craft, culture, sports goods, furniture, hosiery, textile, dairy, etc;
8. Applying Smart Solutions to infrastructure and services in area-based development in order to make them better. For example, making areas less vulnerable to disasters, using fewer resources, and providing cheaper services.

v) What is Area Based Development Models in Smart Cities

The strategic components of area-based development in the Smart Cities Mission are :-

- City improvement (retrofitting)
- City renewal (redevelopment)
- City extension (greenfield development) plus a
- Pan-city initiative in which Smart Solutions are applied covering larger parts of the city.

- **Retrofitting** will introduce planning in an existing built-up area to achieve smart city objectives, to make an existing area more efficient and liveable. Since existing structures are largely to remain intact in this model, it is expected that more intensive infrastructure service levels and a large number of smart applications will be packed into the retrofitted smart city. This strategy may also be completed in a shorter time frame, leading to its replication in another part of the city.

- **Redevelopment** will effect a replacement of the existing built-up environment and enable co-creation of a new layout with enhanced infrastructure using mixed land use and increased density. Example, Saifee Burhani Upliftment Project in Mumbai (also called the Bhendi Bazaar Project) and the redevelopment of East Kidwai Nagar in New Delhi being undertaken by the National Building Construction Corporation.

- **Greenfield development** will introduce most of the Smart Solutions in a previously vacant area using innovative planning, plan financing and plan implementation tools (e.g. land pooling/ land reconstitution) with provision for affordable housing, especially for the poor. Greenfield developments are required around cities in order to address the needs of the expanding population. One well known example is the GIFT City in Gujarat.

- **Pan-city development** envisages application of selected Smart Solutions to the existing city-wide infrastructure. Application of Smart Solutions will involve the use of technology, information and data to make infrastructure and services better. For example, applying Smart Solutions in the transport sector.

Bhubaneshwar tops the list as the first city to be selected for smart city program. Twenty cities which include Mumbai, Pune, Bhopal, Jaipur, Ludhiana, Ahmadabad to name a few were selected to start the smart city concept.

vi) Challenges of Smart City Program

India is a developing country and hence the biggest challenge that India faces will be in the amount to be spent on the creation of smart city infrastructure. The model on retrofitting includes working on existing urban spaces which make it difficult and time consuming. All states in India may not adhere to the manner of changing from the backwardness to transform into a smart city. Finally, change of political will may cause projects to remain suspended if not wrapped up in one governing session of the political party.

4.8 SUMMARY

Development of urban areas is a necessity in the modern world. Globally over half the population live in urban settlements. The solution to any development is not to stop it but to manage it as sustainably as possible. In 1991, the United Nations Centre for Human Settlements in its sustainable Cities program, tried to highlight the need to develop the urban space in a sustainable manner by following the three pillars of sustainable development, social development, economic development and environmental sustainability, in its planning. Most of the developing nations are struggling with huge volumes of urban population which need to be managed. Hence, a sustainable city will have low ecological footprint and would meet the development needs of the inhabitants without damaging the environment.

4.9. CHECK YOUR PROGRESS/EXERCISE

1. True or False

a. All regions move from urban to rural in the urban process

b. Megacity has 5000 people in it.

c. India has more urban than rural population

d. Migration is only within a country

e. Environmental sustainability is possible in proper development of cities.

2. Fill in the Blanks

a. The definition of urban centers India follows if from _____ census

b. Slums are called _____ in Brazil

c. _____ will introduce most of the Smart Solutions in a previously vacant area

d. _____ is a push factor of migration

e. _____ is the first city to be chosen for smart city in India.

3. Multiple Choice Questions

a._____ will introduce planning in an existing built-up area to achieve smart city objectives

i. Rebuilding
ii. Retrofitting
iii. Pan Development
iv. Retoning

b. This State/Union Territory has the highest urban population _____

i) NCT Delhi
ii. MP
iii. Assam
iv. Goa

c. _____ is a positive effect of urbanisation

i. Employment
ii. Transport
iii. Degradation
iv. Pollution

d. _____ state has the highest absolute numbers of urban population

i. West Bengal
ii. Punjab
iii. Maharashtra
iv. Tamil Nadu

e. _____ causes forced migration

i. Employment
ii. Education
iii. Wars
iv. social visit

Answers to the self-learning questions

1. True or False
1.a. False
1.b. False
1.c. False
1.d. False
1.e. True

2. Fill in the Blanks
2.a. 1961
2.b. Favela
2.c. Greenfield development
2.d. Disaster
2e. Bhubhaneshwar

3. Multiple Choice Questions
3.a. (ii)
3.b. (i)
3.c. (i)
3.d. (iii)
3.e. (iii)

4.10 TECHNICAL WORDS AND THEIR MEANINGS

- **Urbanisation :** The process of becoming urban from a rural region.
- **Smart City:** New manner of planned development for existing and newer urban spaces.
- **Urban Sprawl:** Cluster development of urban area for multiple geographical reasons.

4.11 TASK

- Make a study among your classmates to ascertain the distance travelled by them to reach your college. Map and show the hinterland of your institute

4.12 REFERENCES FOR FURTHER STUDY

- Basics in Environmental Studies, Dr. Pushpendra
- Environmental Management, Swapan Deb.
- Ministry of Urban Development official Website for Smart Cities
- The Sage Handbook of Environment and Society, Ward, Hugh eds.
- Environment and Sustainable Development, Sundar, I.
- Human Geography, Majid Hussain

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Unit -5

READING OF THEMATIC MAPS
CARTOGRAPHIC TECHNIQUES

NEED OF CARTOGRAPHIC TECHNIQUES :

Introduction -
We deal with the different types of quantitative data every day e.g. Time, Distance, Weight, Temperature, Rainfall, Price, Discount, Attendance %, Marks in the examination etc.

Similarly lot of statistical or Quantitative data is used for various purposes like administration, planning etc.

Many of us have fear about mathematics and hence they are reluctant to pay attention to the numbers.

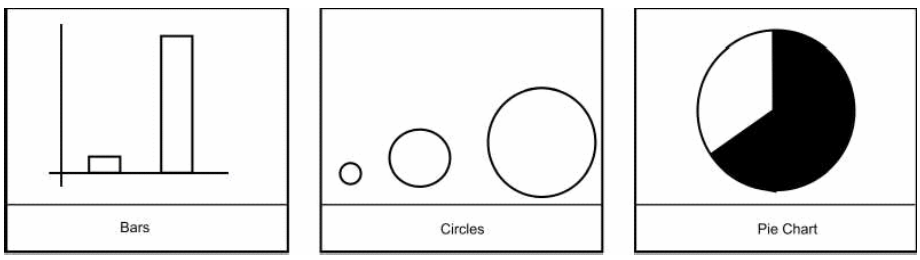
Cartographic Techniques help us to present numerical information / Quantitative information in the attractive form - i.e. in the form of a diagram. We hate to take medicine in the form of bitter powder but we take the same bitter medicine (powder) easily in the form of a capsule - because capsule looks very attractive.

CARTOGRAPHIC TECHNIQUES	
Located Bars	Isopleth map
located Circles	Choropleth Map
Pie chart	Dot Map
Flow Map	Pictogram

ADVANTAGES

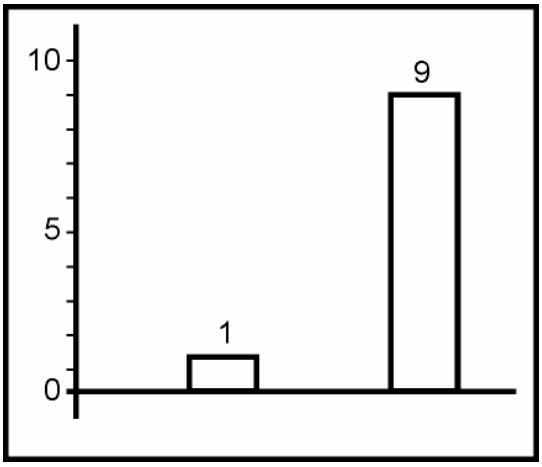
The advantages of the cartographic techniques are as follows :

Graphical Form -
Cartographic techniques like bars, circles, pie charts have specific attractive graphical forms :



Diagrams are proportional to the Quantity which they represent :

We do not write numbers proportional to the quantity which they represent. e.g. Number 1 (one) and number 9 (nine). In this case we dot not write number Nine-9 times larger than number one. Hence the difference between 1 and 9 may not be very distinct. But if we represent these numbers with the help of bars, then we find that bar for number 9 is nine times bigger than the bar of number 1.



Hence even a illiterate person can easily understand difference between number one and number nine with the help of cartographic technique (bar).

Attractive colours and shades can be used for the cartographic techniques -

We are fond of colours. We prefer colour T.V. than the black and white T.V. Girls apply bright colured lipsticks to look very attractive. Similarly colourful cartographic techniques attract our attention and serve our purpose of conveying statistical information easily to the reader.

Isolated from text -

Diagrams and maps are generally isolated from the text. These are drawn within a frame - mostly rectangular. Hence they are not mixed with the text matter. Statistical data or numbers written along with the text are not highlighted or attract our attention. On the other hand diagrams or maps drawn within frame attract our attention. Even the blank space within the framework of diagram or map help us to focus our attention on the map or the cartographic techniques e.g. Leader who is giving his speech from the stage attracts more attention than the leader standing in the crowd.

Pictoral form -

The process of learning starts with the help of pictures e.g. ‘A’ for apple. Similarly picture or line sketch of female on railway

compartment or toilet becomes more effective than the written words. There are many languages in this world and hence if you know particular language only then you can read that word and understand its meaning, but language of picture is understood by anyone in this world. Illiterate or literate, young or old.

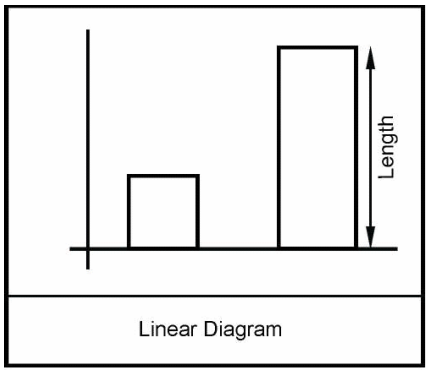
'I Love You'

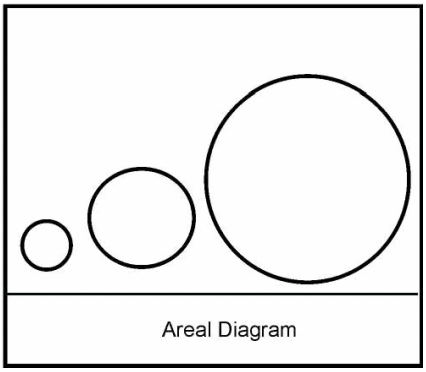
You can understand this message only if you know English

In pictogram - one of the cartographic technique - we use appropriate pictures to represent our data e.g. picture of tree to represent forest, Atomic reactor for atomic power stations, or human being for population.

Logical Reasoning -
In the different cartographic techniques some kind of logical reasoning is used in each technique. e.g. Bar is a linear diagram, where length of bar is proportional to the quantity it represents.

In circle diagram area of the circle is drawn proportional to the quantity it represents.

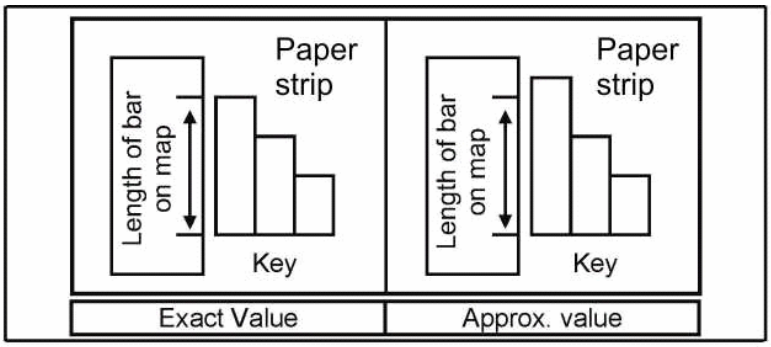




CARTOGRAHIC TECHNIQUES

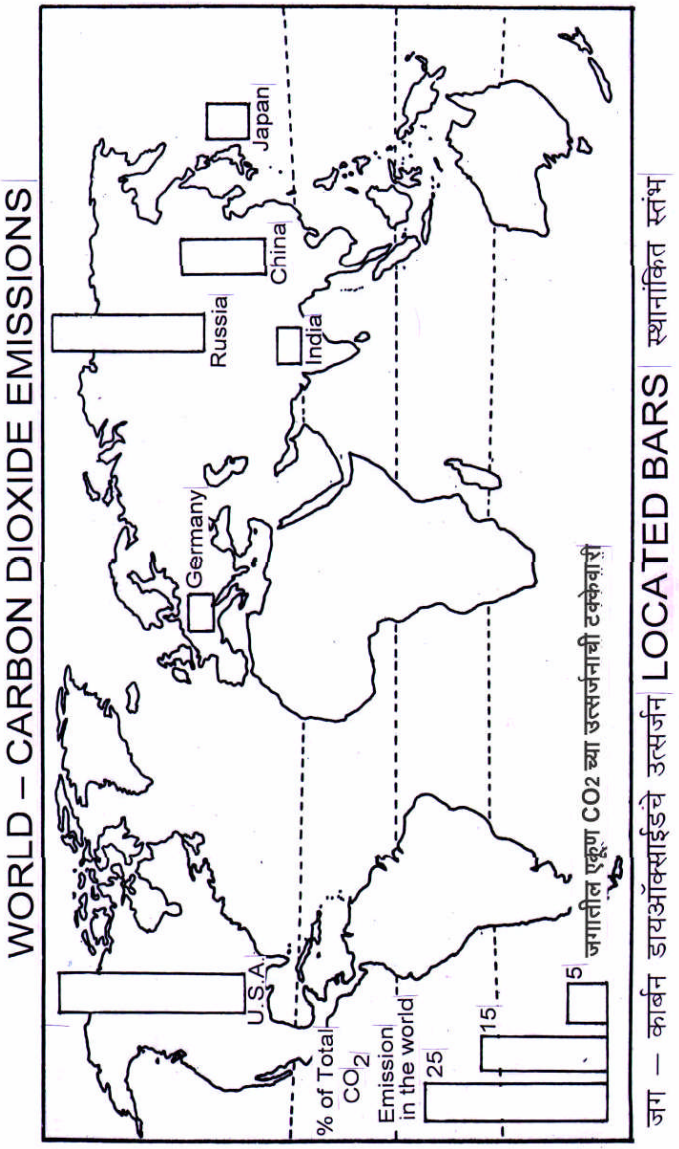
Located Bars :
Bar is a linear diagram, which means the length of bar is drawn proportional to its length.

When bar is placed on the map at proper location it is termed as located bar. It is necessary to compare bar with the key provided in the map to know its actual or approximate value. i.e. if length of the bar drawn on the map is same as the bar represented in the key then we get exact value of the bar, but the length of bar is between two values of the bars represented in the key, then we get approximate value.



Bar can be drawn in vertical or horizontal direction but width of all bars should remain same.

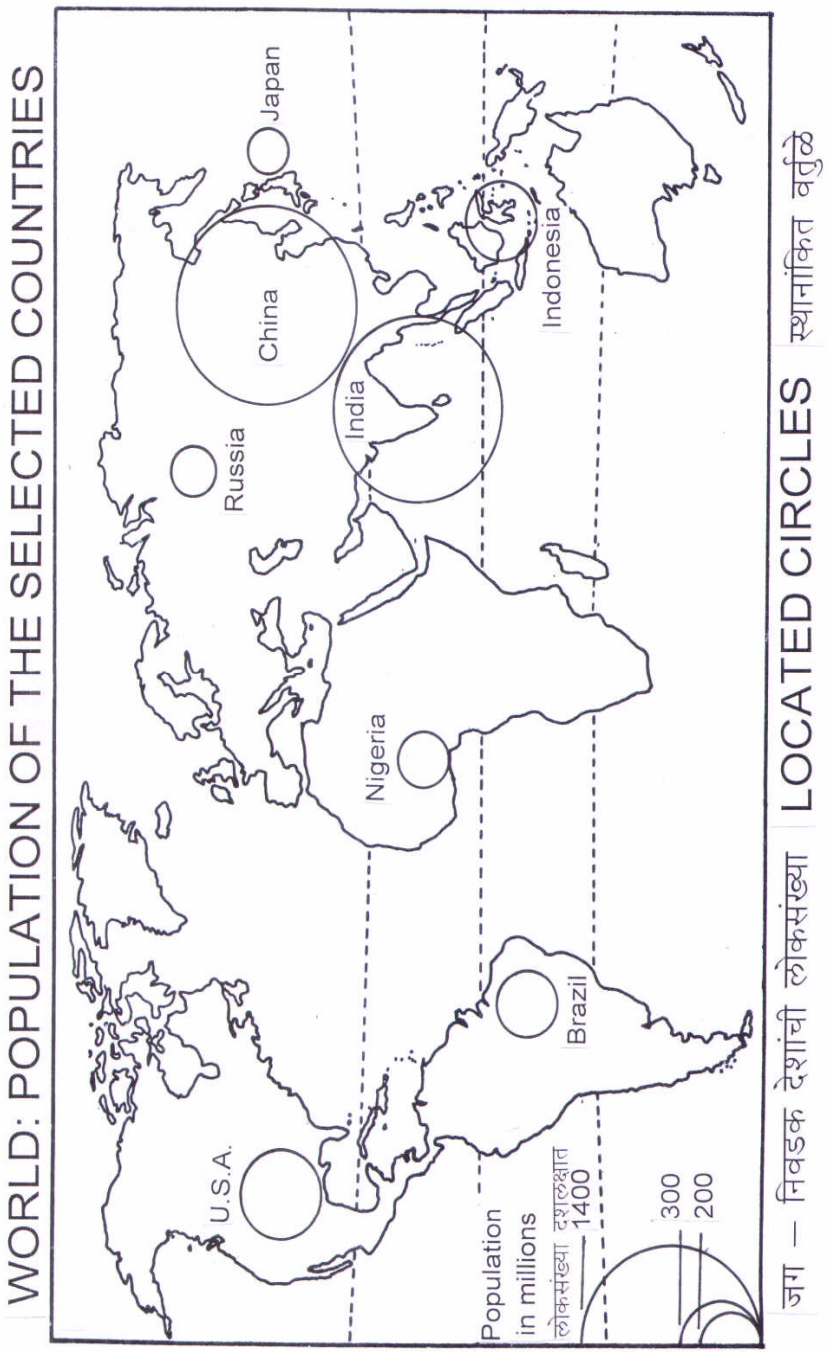
Bars are drawn to represent population, industrial production, crop production, mineral production, rainfall etc.



Located Circles :

Circle is a areal diagram, which means area of the circle is drawn proportional to the quantity it represents. Hence circles are used for the data which has greater range - (i.e. difference between the lower and higher value.) When circle is drawn on the map at proper location it is termed as located circle. We can compare size of the circle drawn on the map with the circle drawn in the key by comparing their diameters.

Circles are drawn to represent population, crop production or the production of various commodities.

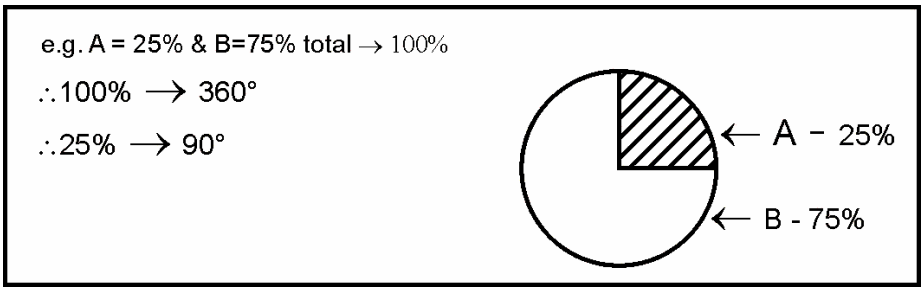


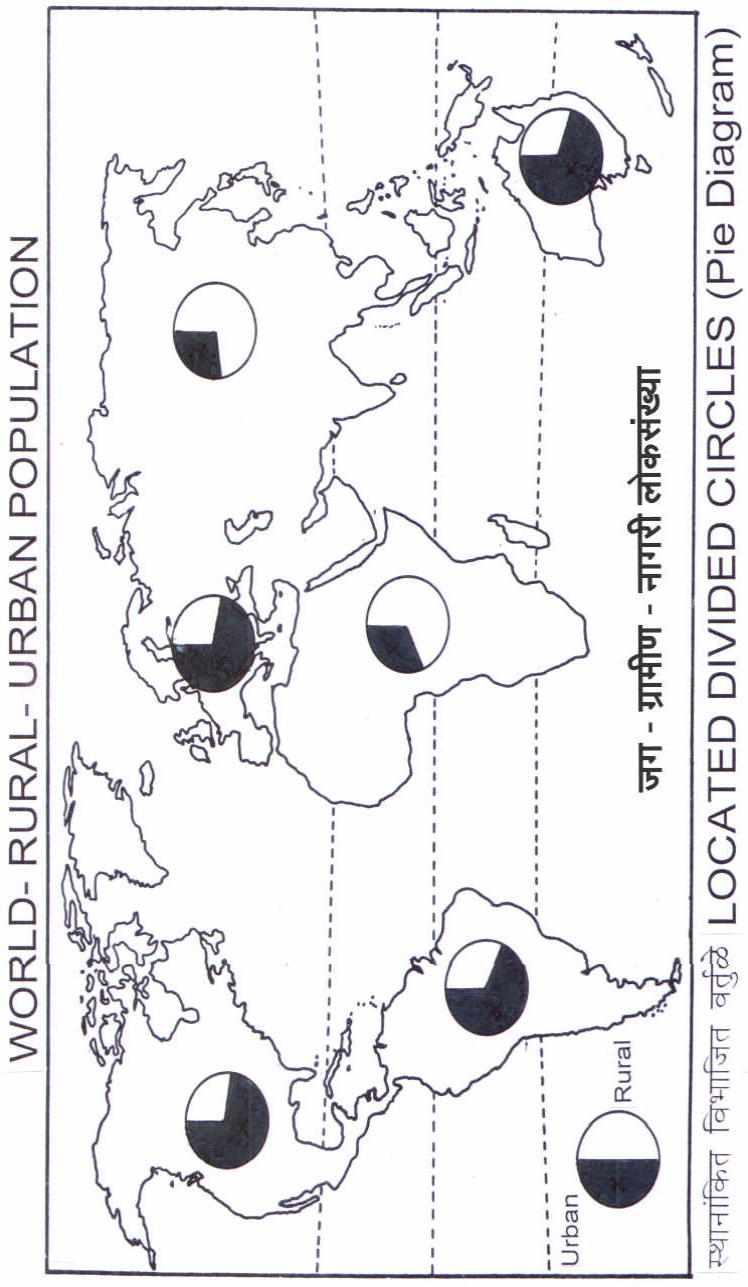
Divided Circles :

Divided circles help us to represent sub-divisions in the quantity represented e.g. Different sources of power are generated at a particular place. e.g. hydel, thermal and atomic. This variation can be represented with the help of divided circles. In this case size of the circle will represent total amount of power generated at a particular place and each sector of the circle will be drawn proportional to the production of particular type of power i.e. hydel or thermal etc. It is assumed that the total amount of power generated is equal to the total degrees of the circle i.e. 360 and so each segment or sector representing subdivision will be drawn proportionately.

Divided circles or Pie diagram : Example 2

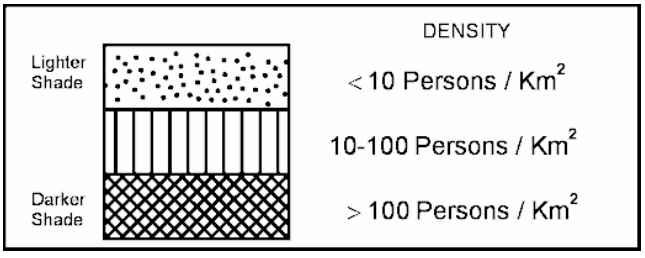
Subdivisions in the data can be represented effectively with the help of divided circles or pie diagram. Circle can be divided into 3600 and hence the total quantity is assumed to be 3600 and the subdivisions are represented as segments of the circle for which the angle of the segment is proportional to the quantity of the subdivision.





Isopleth and Choropleth -

In both these cartographic techniques line shades are used to represent data. Darker shade represents higher density & lighter shade represents lower density.

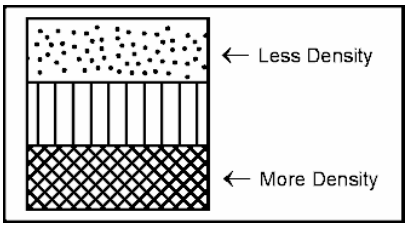


Choropleth Map :

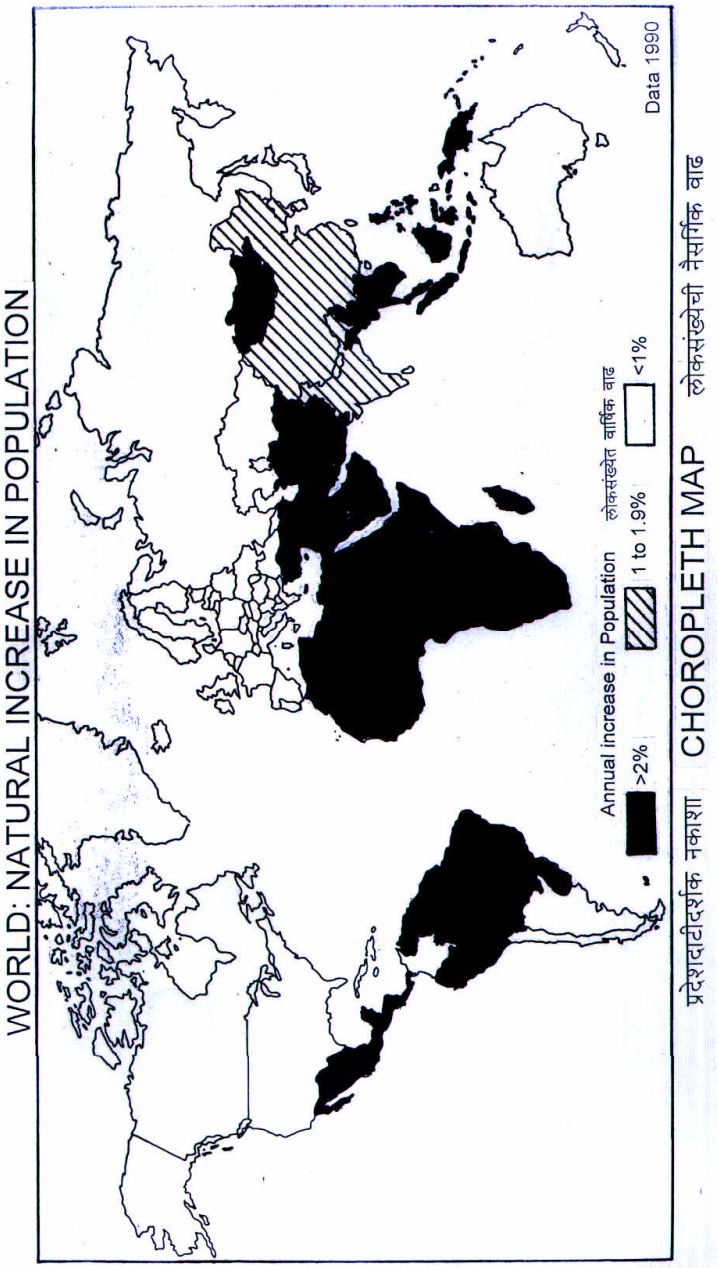
'Choro' means Region and 'Pleth' means density. Hence choropleth map is a map which represents density distribution within the various regions or administrative units.

Government collects statistical data from the people every 10 years through 'Census' operations. Hence lot of information / data is available - village wise, talukawise, districtwise, statewise, and countriwise. This information can be effectively represented by choropleth map.

In order to bring out variation within data, it is divided into 4-5 classes. Line shades are used to represent these classes. Darker shade is used for high density and lighter shade is used for low density.



Key



Isopleth Map :

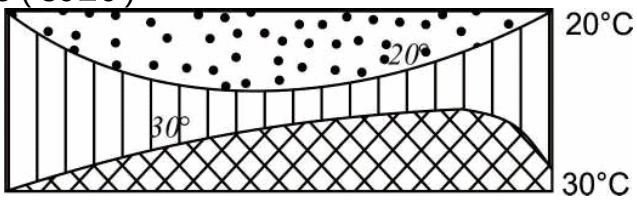
Iso means equal and pleth means density. Hence Isopleth map represents data with the help of Iso lines i.e. the lines of equal value. In order to bring out variation in the data, area between isolines is covered by line shades. Darker shade is used to represent higher density and lighter shade is used to represent lower density. Similar to the shades used in the choropleth map.

Data of natural elements like temperature, rainfall, atmospheric pressure etc. has no relation with the administrative boundaries or administrative units. Hence in Isopleth map administrative boundaries are avoided and data related to natural

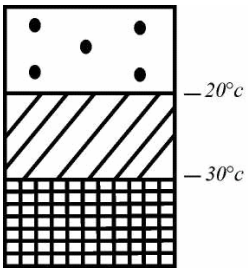
features like temperature, rainfall, atmosphere pressure etc. is represented with the help of isolines.

Temperature values at different locations.
Isolines of 20□c and 30□c

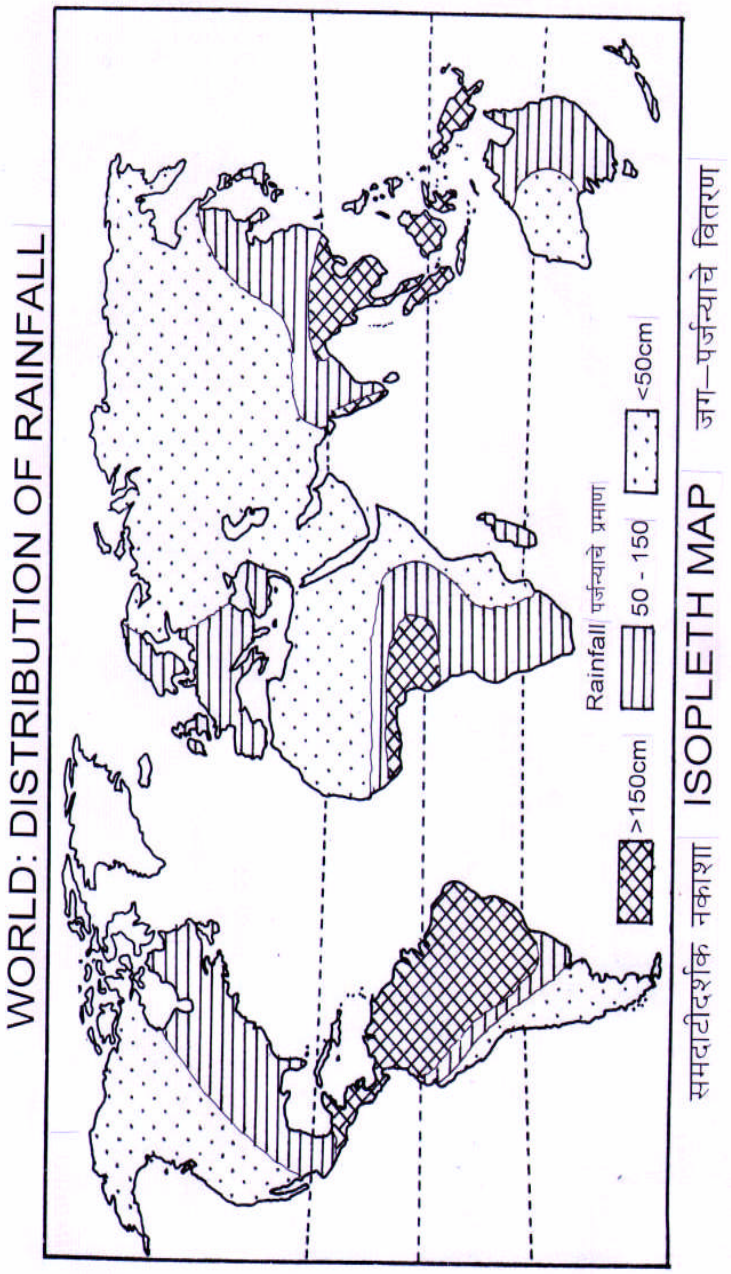
Selection of shades Darker shade for areas having higher temperature (30□c)



Temperature



Lighter shade for the areas having lower temperature (< 20^0c)



DOT MAP

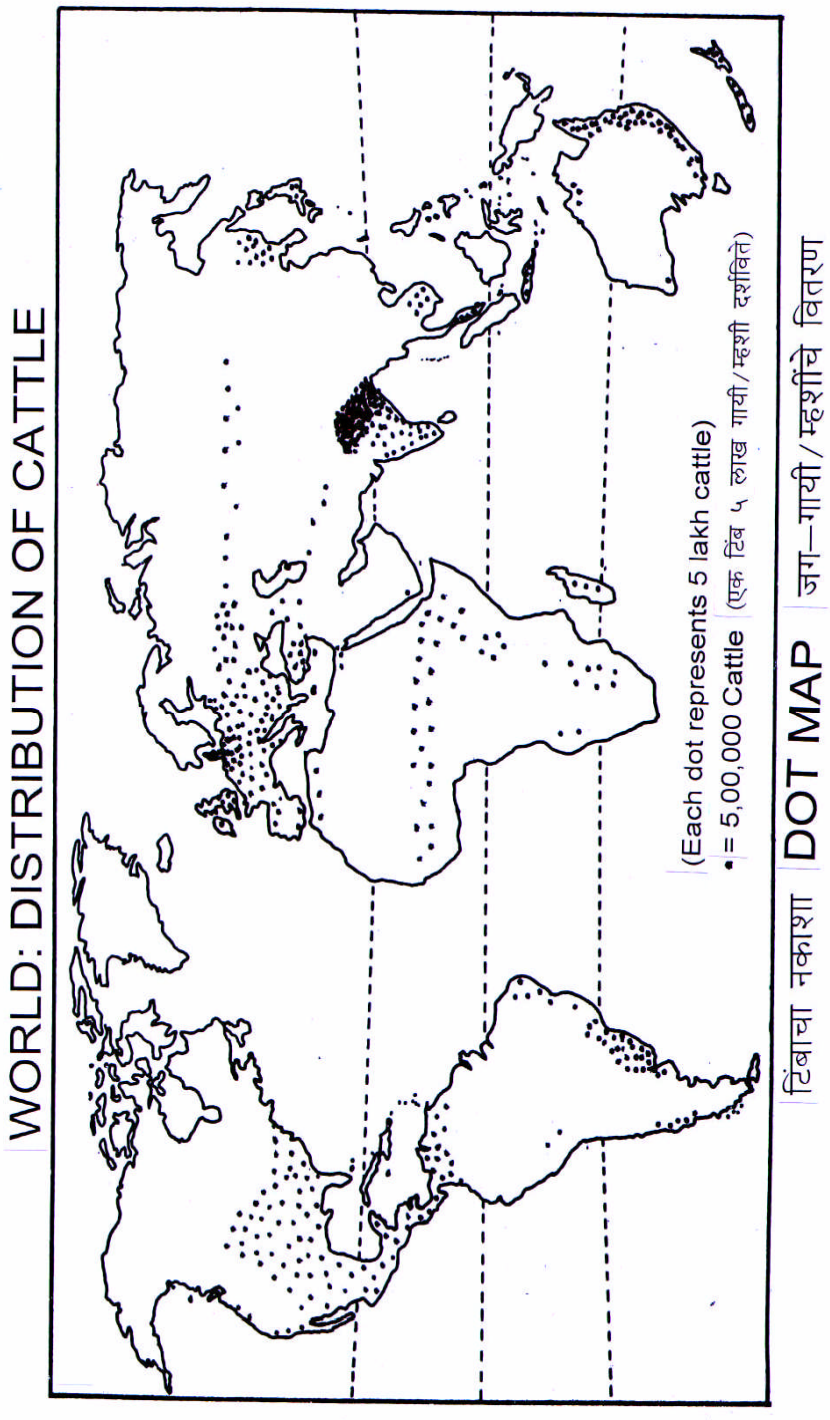
A Map in which ‘dots’ are used to represent distribution is known as Dot Map. It is one of the density maps. It is easy to draw and simple to understand.

Dot plays key role in the Dot Map and hence it is necessary to remember.

Size of dot - It should not be too large or it should not be too small. Size of dot is determined accordingly to the size of the map and value of the dot.

Value of dot - Each dot has specific value in the Dot Map and hence value of dot is carefully decided on the basis of size of the map and size of the dot.

Placement of the dots - Earth's surface is not even. Some areas are suitable for man while other areas are not. Relief & other factors are considered for the proper placement of the dots.



Flow map -

Arrow indicates direction of movement. Hence flow line indicates movement of population or material from one place to another.

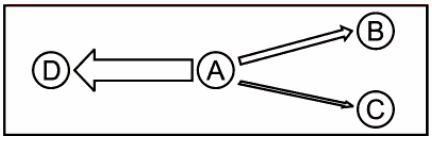
Width of the line or thickness of the flow line represents quantity carried from one place to another.

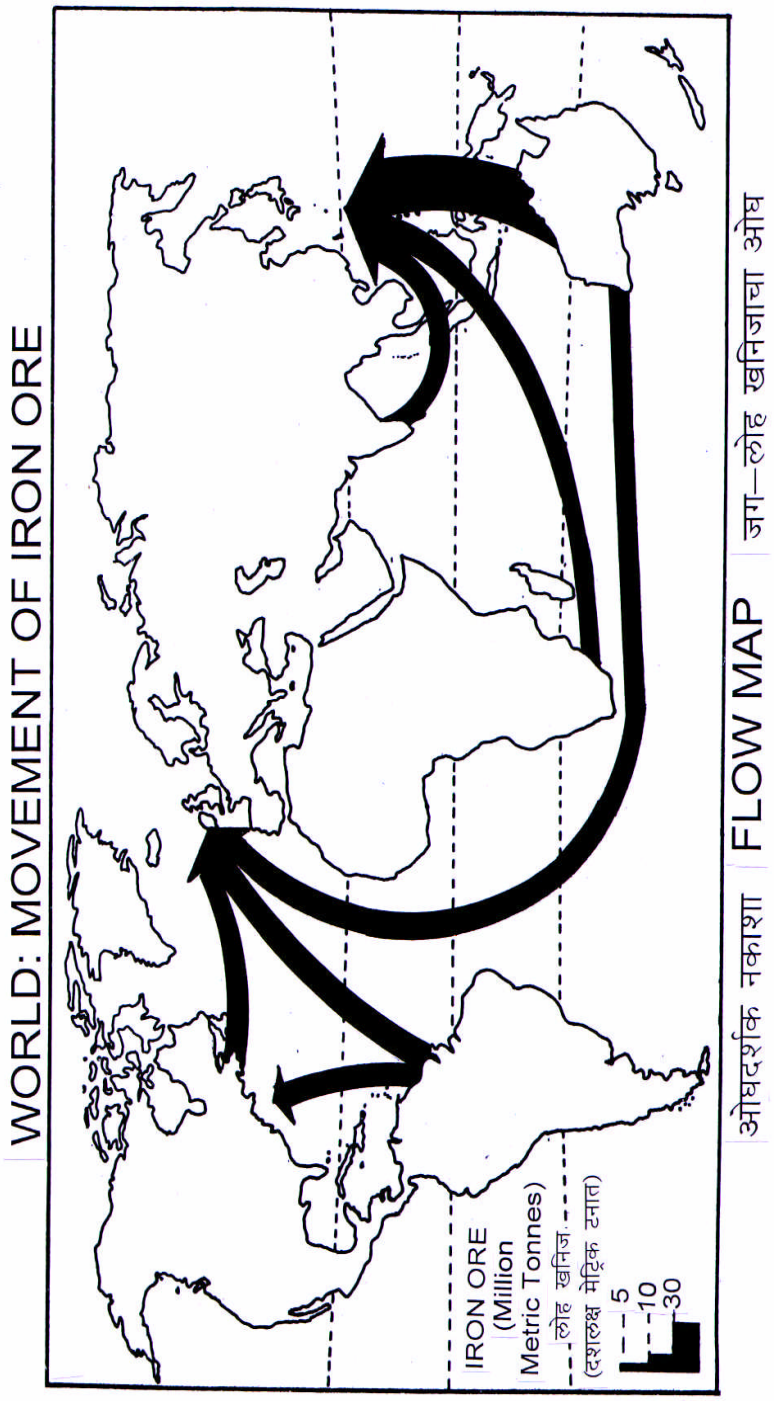
Areas of production and the areas of consumption are not same every where. Hence material is transported from one place to another. This interaction between two places can be represented by the flow map more effectively. In this map flow line is drawn between two places and width of the line is drawn proportional to the quantity of the material transferred from one place to another. Flow map is also used to represent migration of people from one place to another.

In the above diagram place is connected to the places C and D The amount of material transported from to other places is as follows.

From	To	Material transported (in Thousand tones)
A	B	20
A	C	10
A	D	50

In order to represent this data we will have to select suitable scale i.e.
5 m.m. for 50 thousand tonnes.
2 m.m. for 20 thousand tonnes.
1 m.m. for 10 thousand tonnes.





Pictogram -

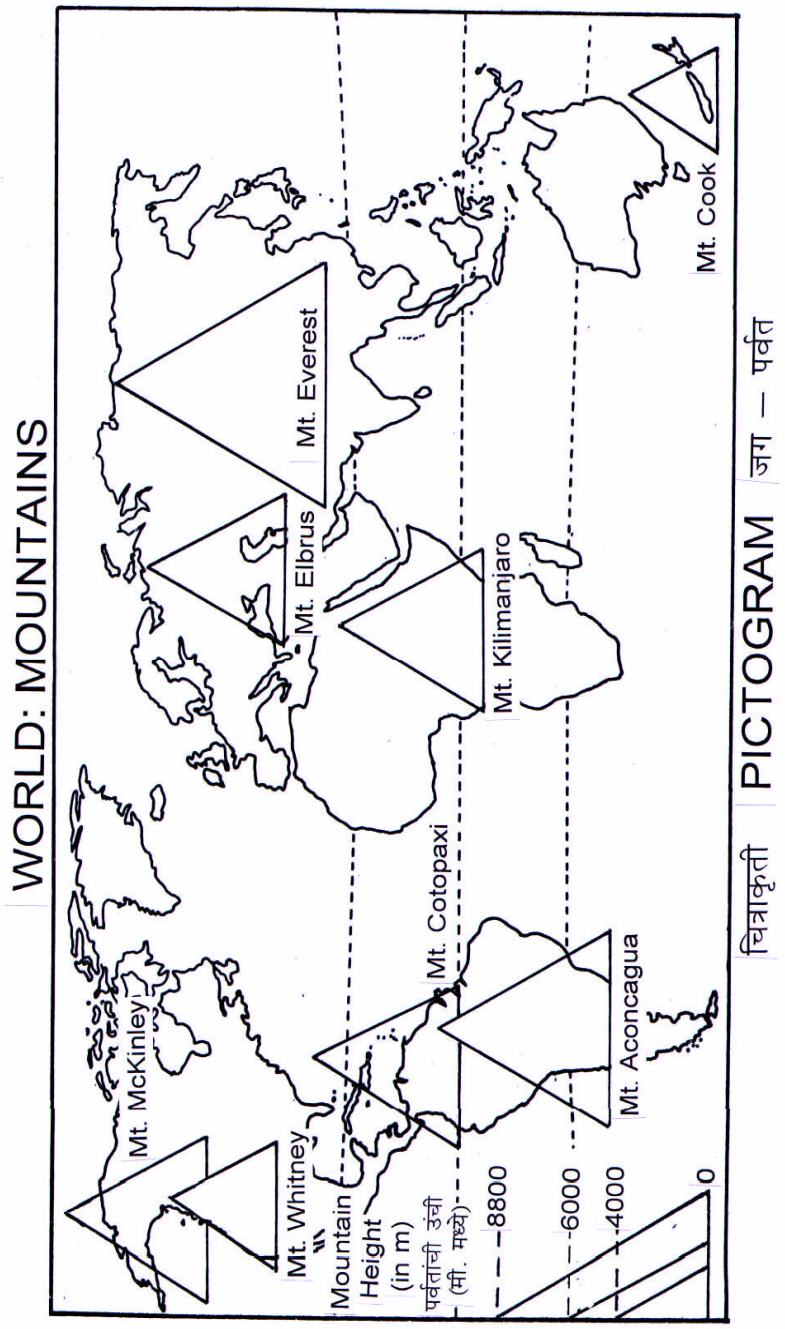
The ultimate goal of any map is to convey information effectively and attractively to the reader.

Pictures are very effective in communicating information. All people young or old like pictures and hence information or data is represented effectively with the help of pictures, in Pictogram. e.g. Forest Population

There are two methods of drawing pictograms :

a) Size of the symbols remains same in this method small size symbols / pictures are used. Each symbol / picture has specific value e.g. one picture of man represents 10,000 persons and so in order to represents population of 50,000 persons we will have to draw 5 pictures.

b) Variable size of the pictures - In this method size of the picture - i.e. height of the picture - is drawn proportionately to the quantity which it represents.



Tips for solving questions related to the Cartographic Techniques.

LOCATED BARS

How to solve questions related to the located bars?

Take a piece of paper or you can use edge of your question paper. Keep this paper near to the bar and mark height of the bar on the paper with the help of pencil marks. (Fig. 1)

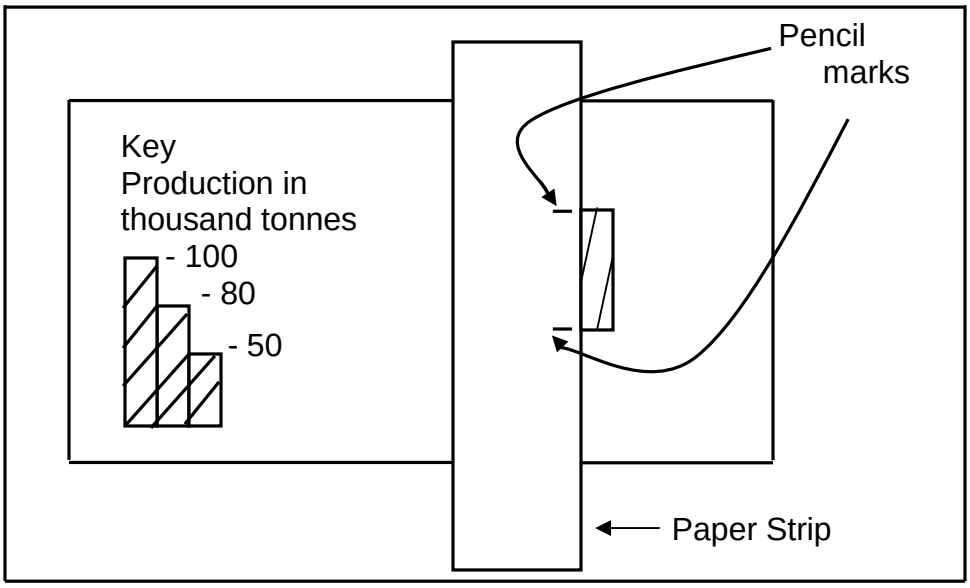


Figure 1

Now shift paper near to the key of the map. If height of the bar perfectly matches with the height of the bar in the key then you can mention exact value of the bar. (Fig.2)

Pencil marks on the strip match with the bar in the key and hence we can mention exact value as production 100 thousand tonnes.

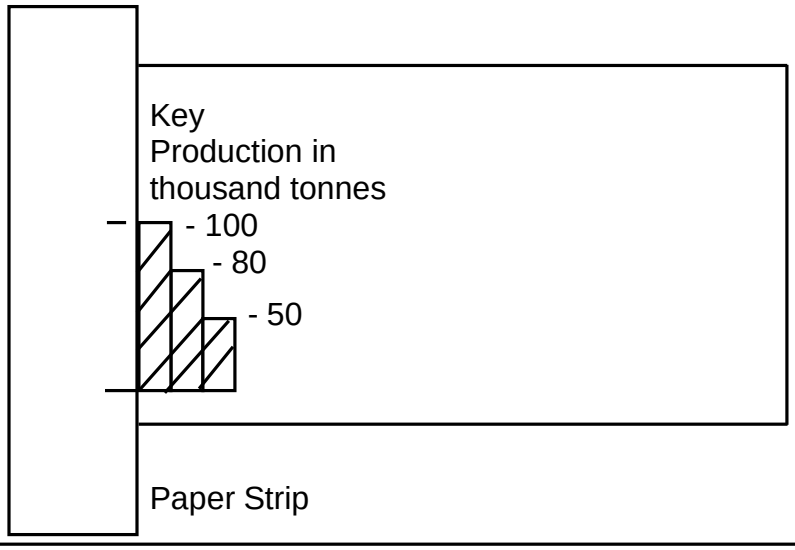


Figure 2

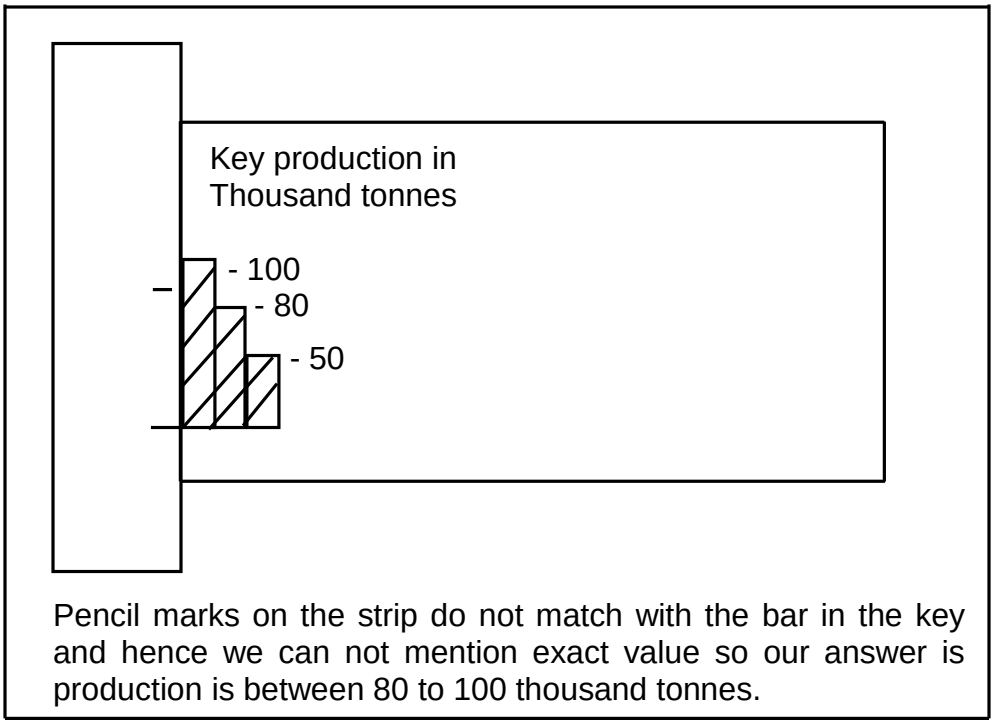


Figure 3

But if it is in between two bars in the key, then mention lower and upper values represented in the key. (Fig. 3)

Same technique can be used for the located circles map and flow diagram.

In the case of located circles mark the diameter of the circle on the strip of paper with the help of pencil marks and compare it with the key given in the map.

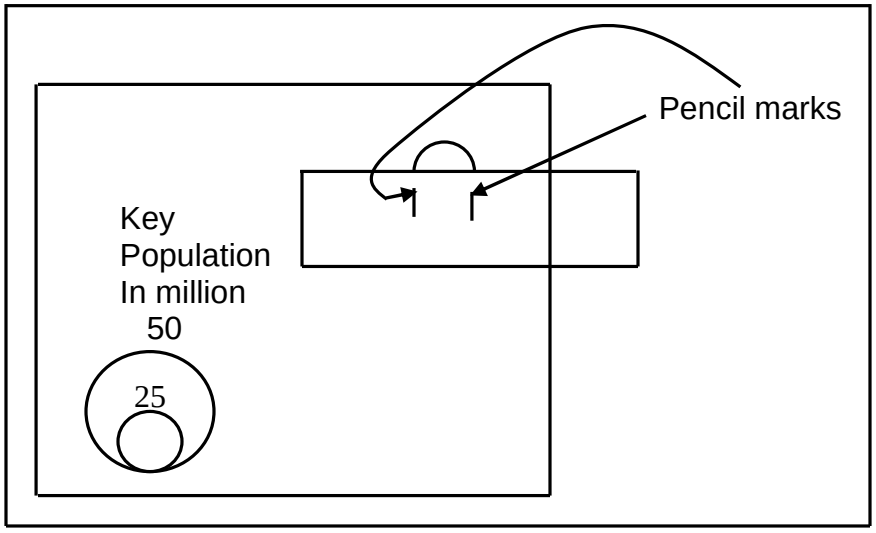
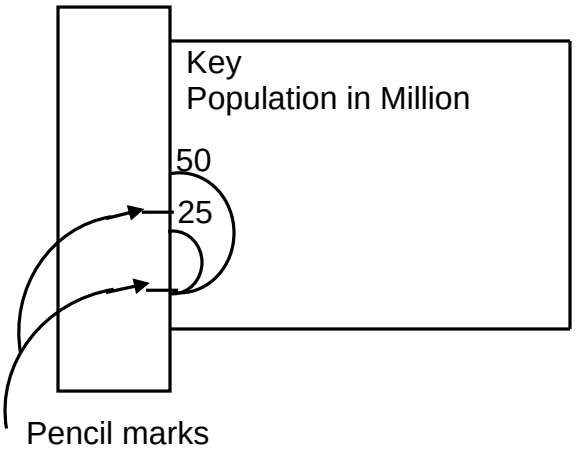


Figure. 4



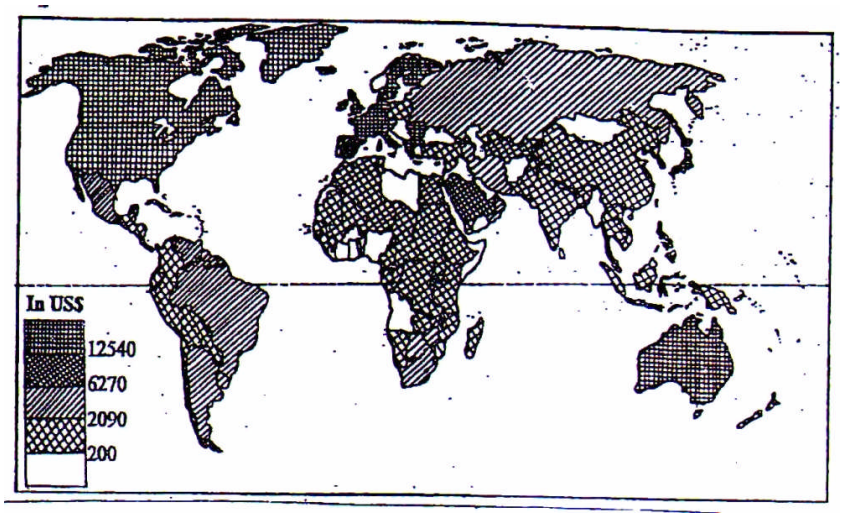
In this case diameter of the circle is between '25' and '50' so our answer is Population of the city is between 25 to 50 million.

Figure 5

In the case of flow map mark width of the flow on the strip of paper and compare it with key, given in the map.

ADDITIONAL EXERCISES - CARTOGRAPHIC TECHNIQUES

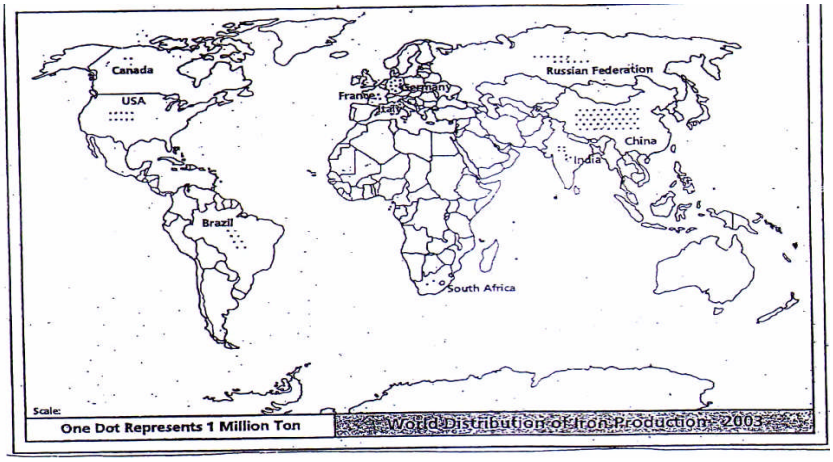
1) Study the world map given below and answer the following questions.



What is the theme of the map?
Which cartographic technique is used to represent the theme?
Which country in the South Hemisphere show highest range of GNP?
What is the range of GNP hi major part of Australia?

Identity country in the northern hemisphere, having GNP ranging between 20% and 62%.

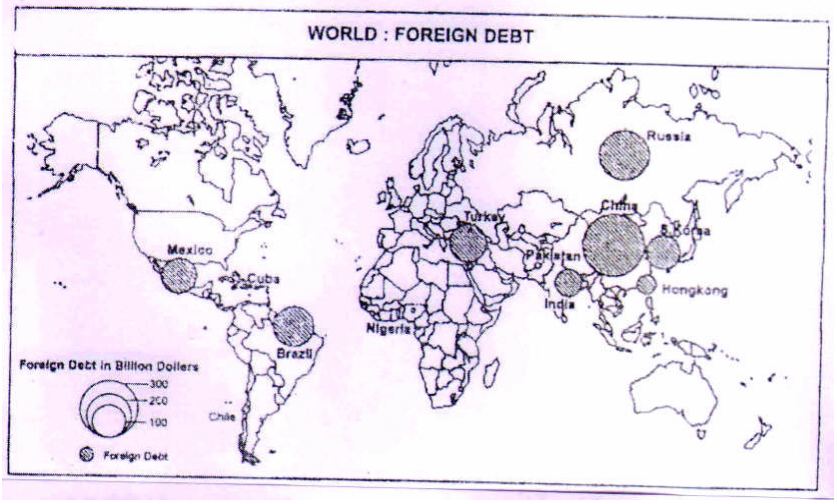
2) Study the world map given below and answer the following questions. (5)



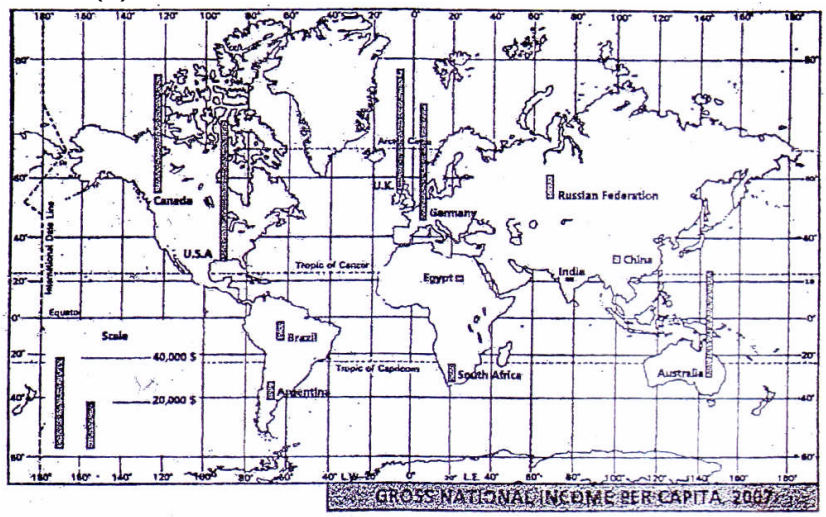
What is the theme of the map?
Which cartographic technique is used to represent the theme?
What is the total quantity of iron produced in USA?

What is the total quantity of iron produced by Europe as per this map?
What is the total production of iron by India?

3) Study the world map given below and answer the following questions. (5)
What is the theme of the map?
Name the cartographic technique used in this map.
State the amount of foreign debt of Mexico, India and Hongkong.

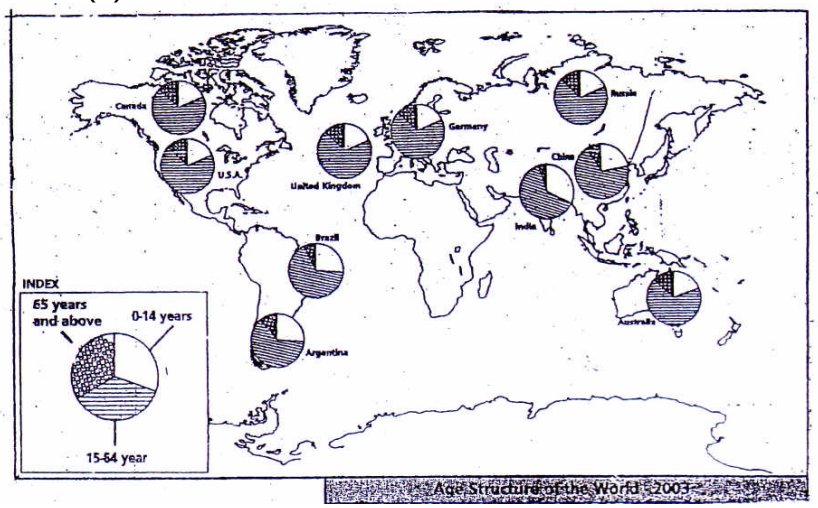


4) Study the world map printed below and answer the following questions. (5)



What is the theme of the map?
Name the cartographic technique used to represent the theme.
Name the countries having the least and maximum gross national income per capita 2007.
With the help of the scale find out gross national income per capita of South American countries?

5) Study the world map printed below and answer the following questions. (5)

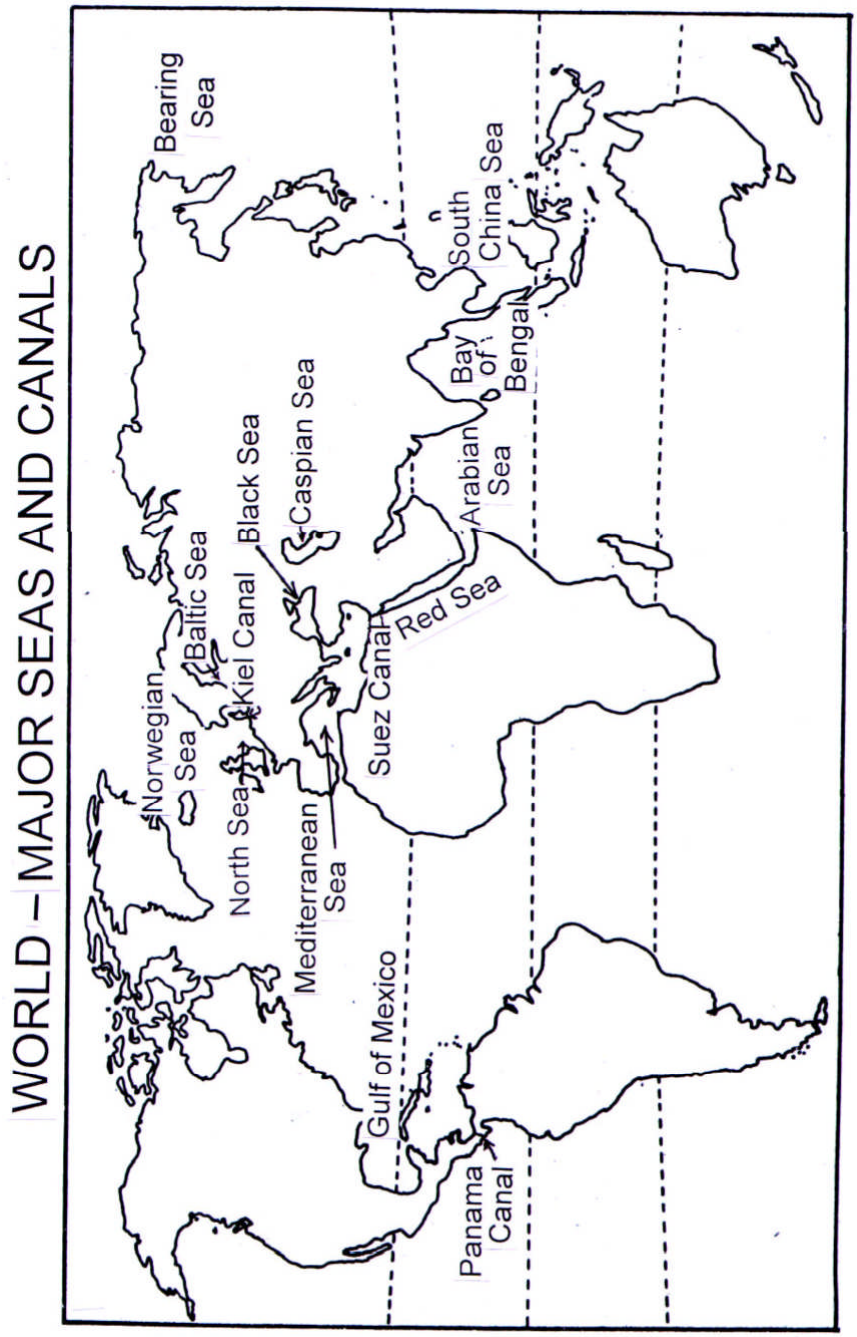


What is the theme of the map?
Which cartographic technique is used to represent the theme?
With the help of the scale, find out the percentage of population between the age group of 15-64 years in Argentina.
With the help of the scale find out the percentage of senior citizens in North-American countries.
State the composition of ‘Age Structure’ in India.

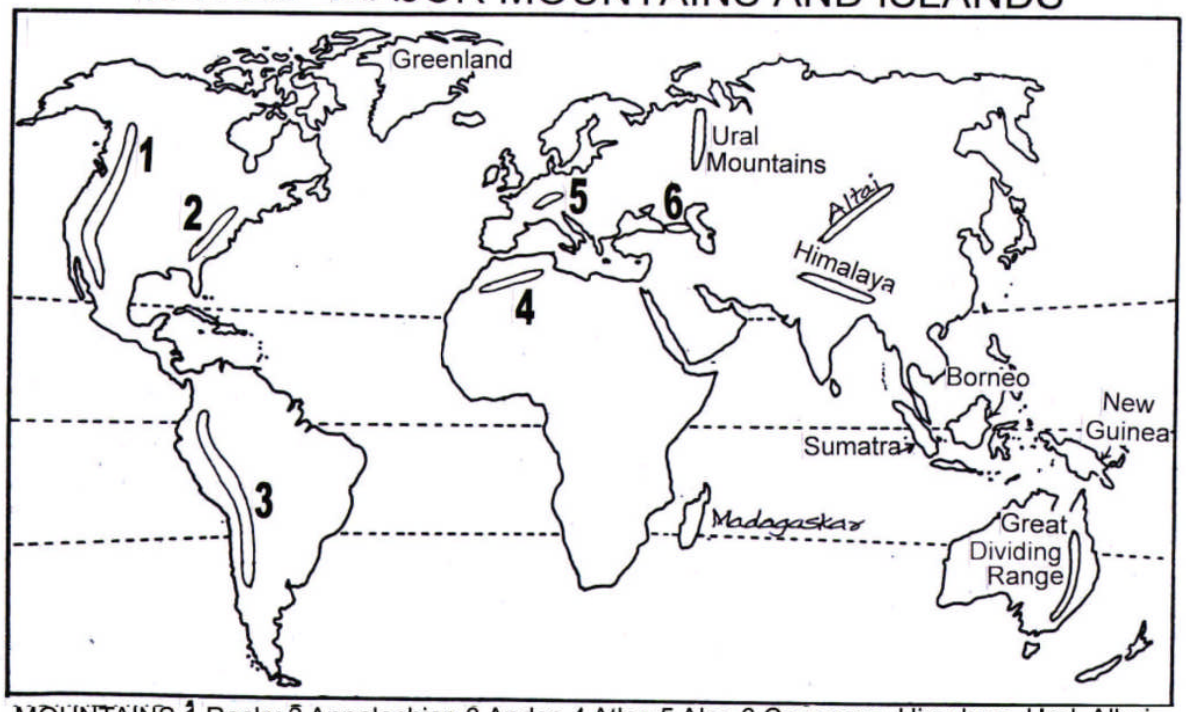
SECTION - II WORLD MAP

Colour maps given in this Section as per the instructions

SECTION - II WORLD MAP



WORLD - MAJOR MOUNTAINS AND ISLANDS



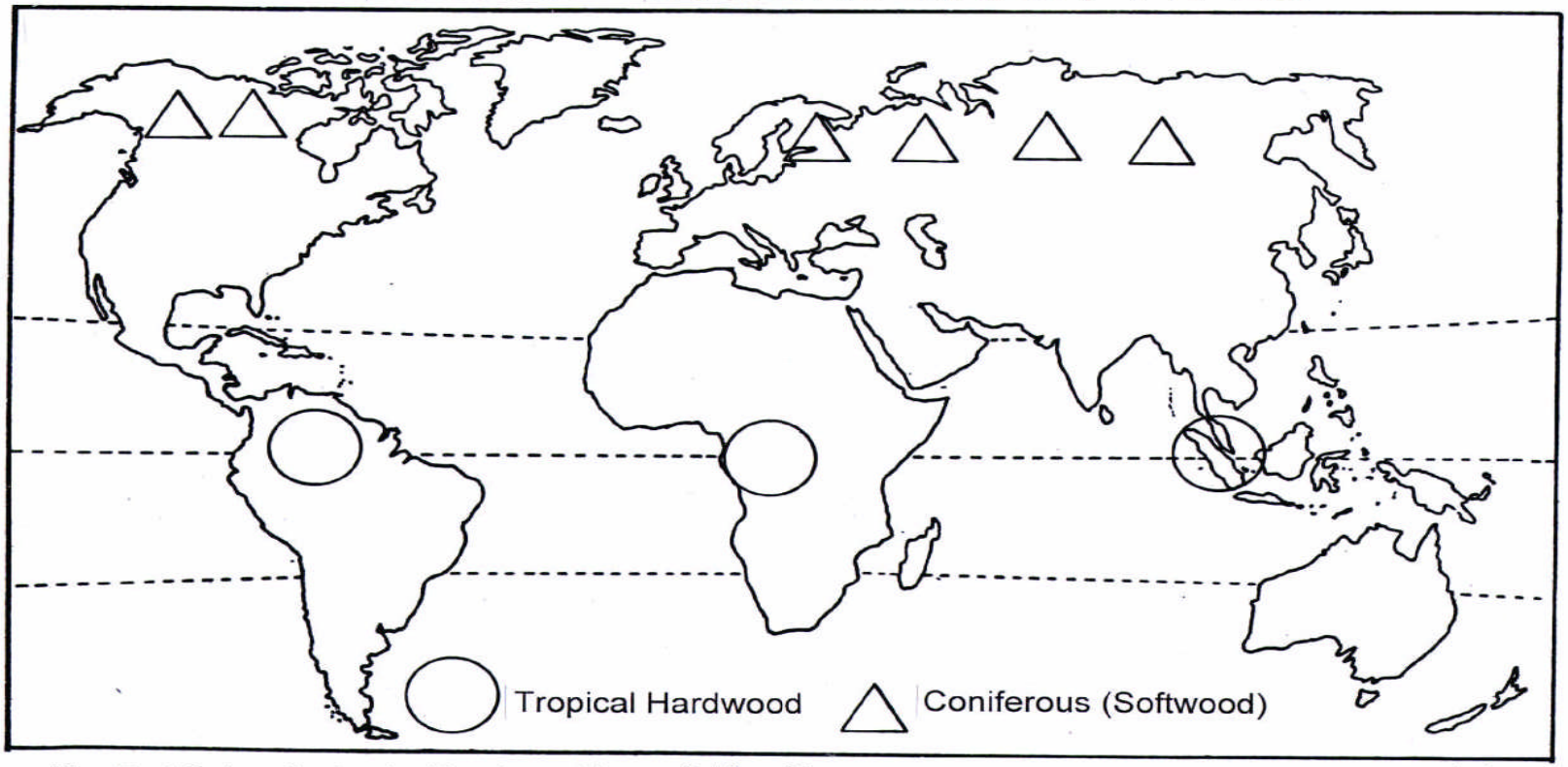
MOUNTAINS 1 Rocky 2 Appalachian 3 Andes 4 Atlas 5 Alps 6 Caucasus, Himalaya, Ural, Albai

ISLANDS - Greenland, New Guinea, Bornia, Madagaskar, Baffin, Sumatra

Use Red Colour for mountains and green for islands

पर्वतासाठी लाल रंग व बेटांसाठी हिरवा रंग वापरा

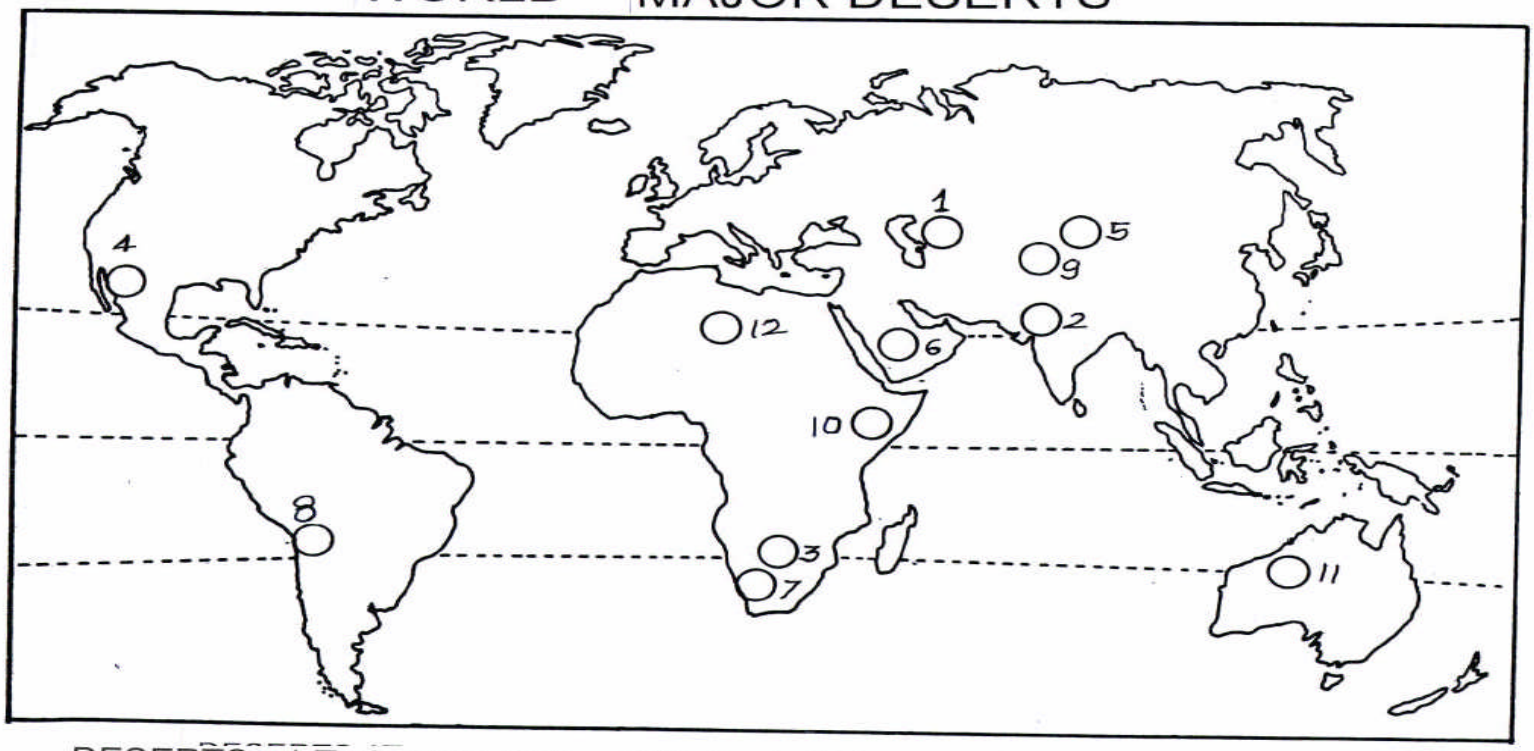
WORLD – MAJOR FOREST TYPES



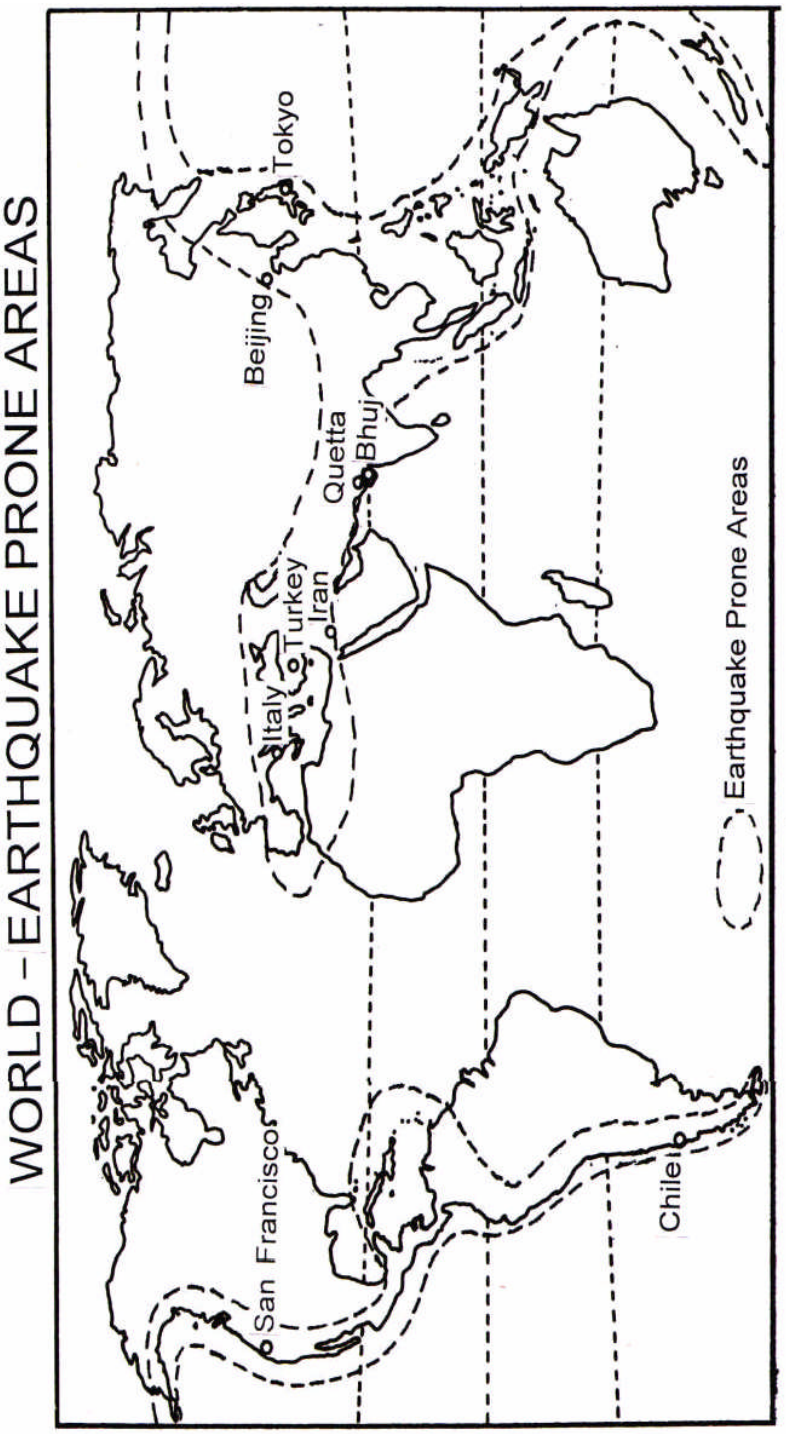
Use Red Colour for tropical hardwood (उष्ण कटिबंधीय वने)and Green Colour for conferous forests(सूचीपर्णी वने)

उष्ण कटिबंधीय वनांसाठी लाल रंग व सूचीपर्णी वनांसाठी हिरवा रंग वापरा (सूचीपर्णी वने)

WORLD – MAJOR DESERTS



DESERTS - 1 Turkestan, 2 Thar, 3 Kalhari, 4 Sonoran, 5 Gobi, 6 Arabian, 7 Namib
8 Atacama, 9 Takla Makan, 10 Somaji, 11 Great Australian, 12 Sahara
Use Red Colour to mark location of the Deserts
वाळवंटाचे स्थान दर्शविण्यासाठी लाल रंग वापरा

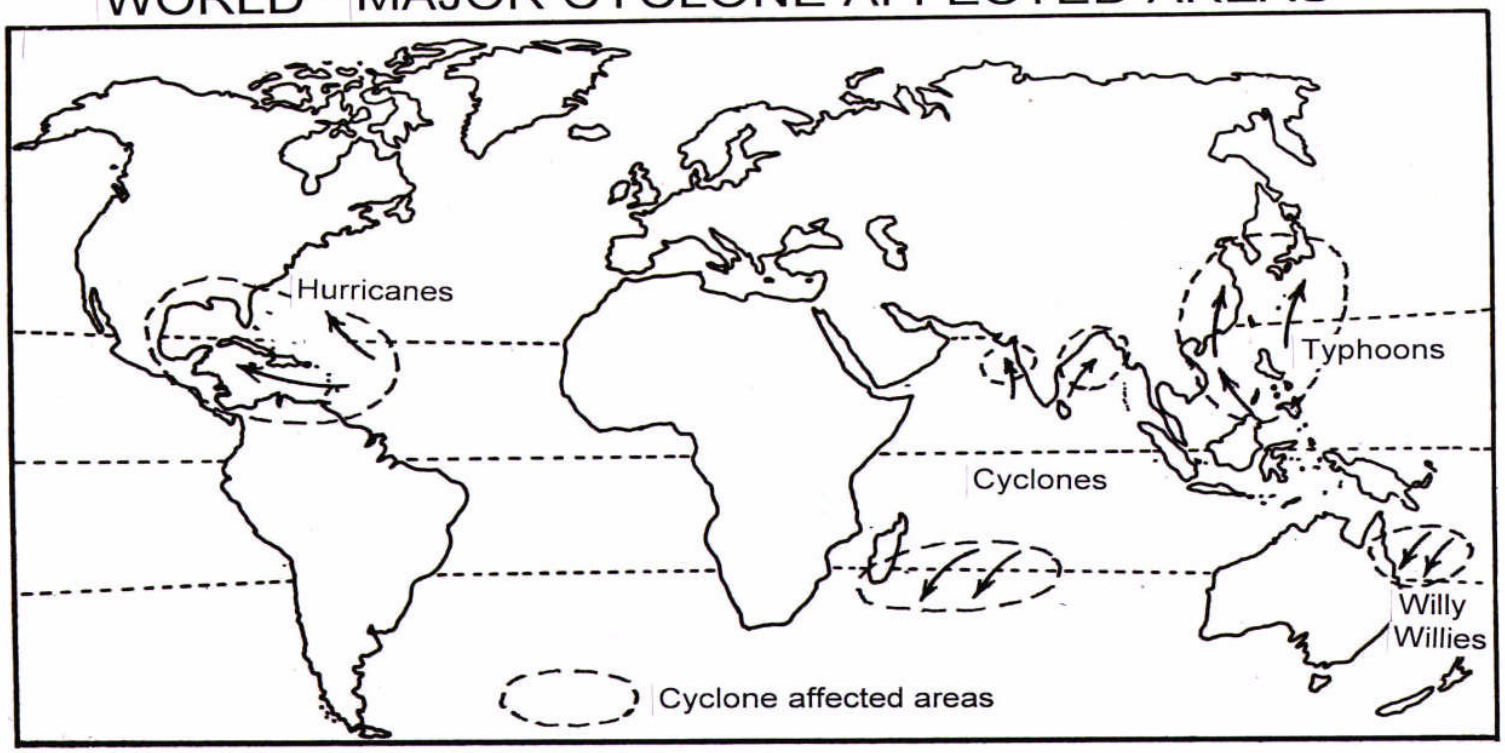


भूकंपग्रस्त भाग

(Use Red Colour to mark Earthquake Prone Areas)

(भूकंपग्रस्त भाग लाल रंगाने रंगवा)

WORLD – MAJOR CYCLONE AFFECTED AREAS

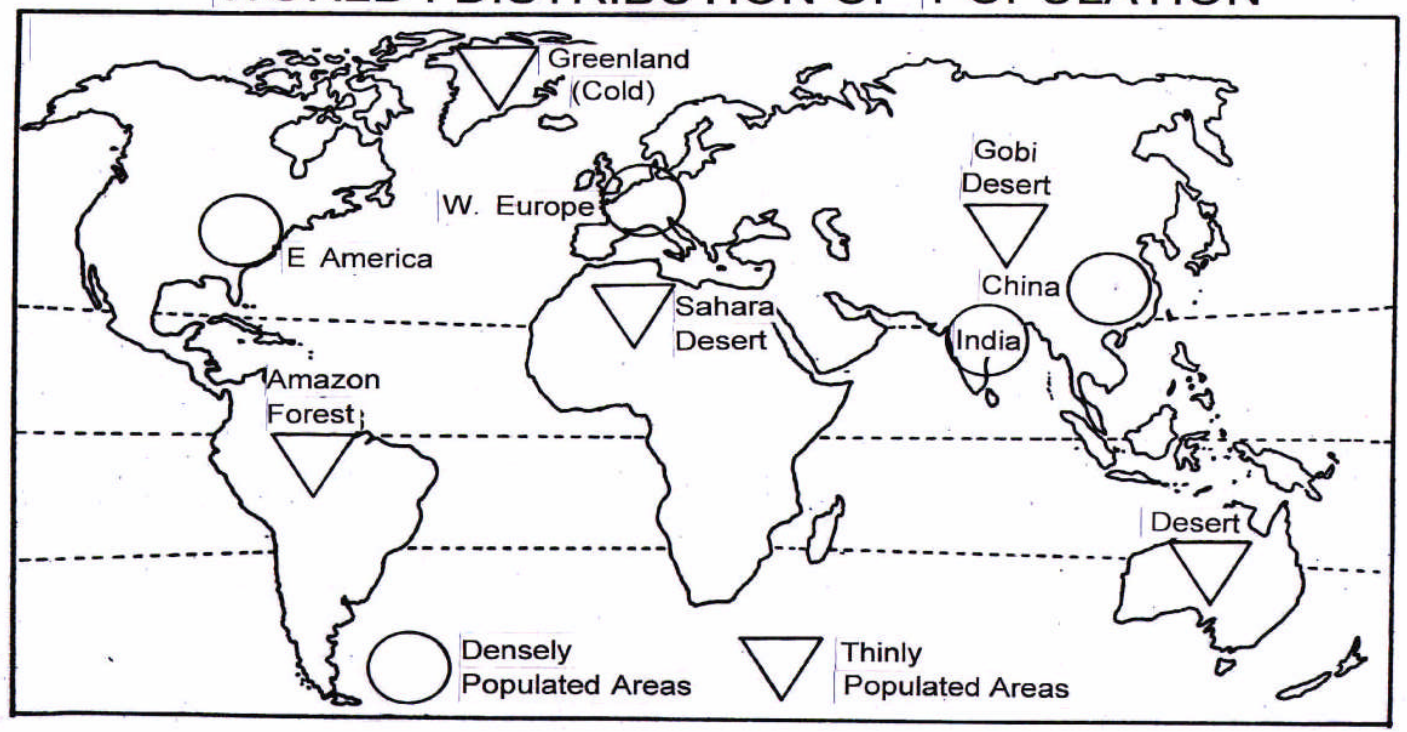


वादळग्रस्त भाग

(Use Blue Colour for Cyclone Affected Areas)

(वादळग्रस्त भागासाठी निळा रंग वापरा)

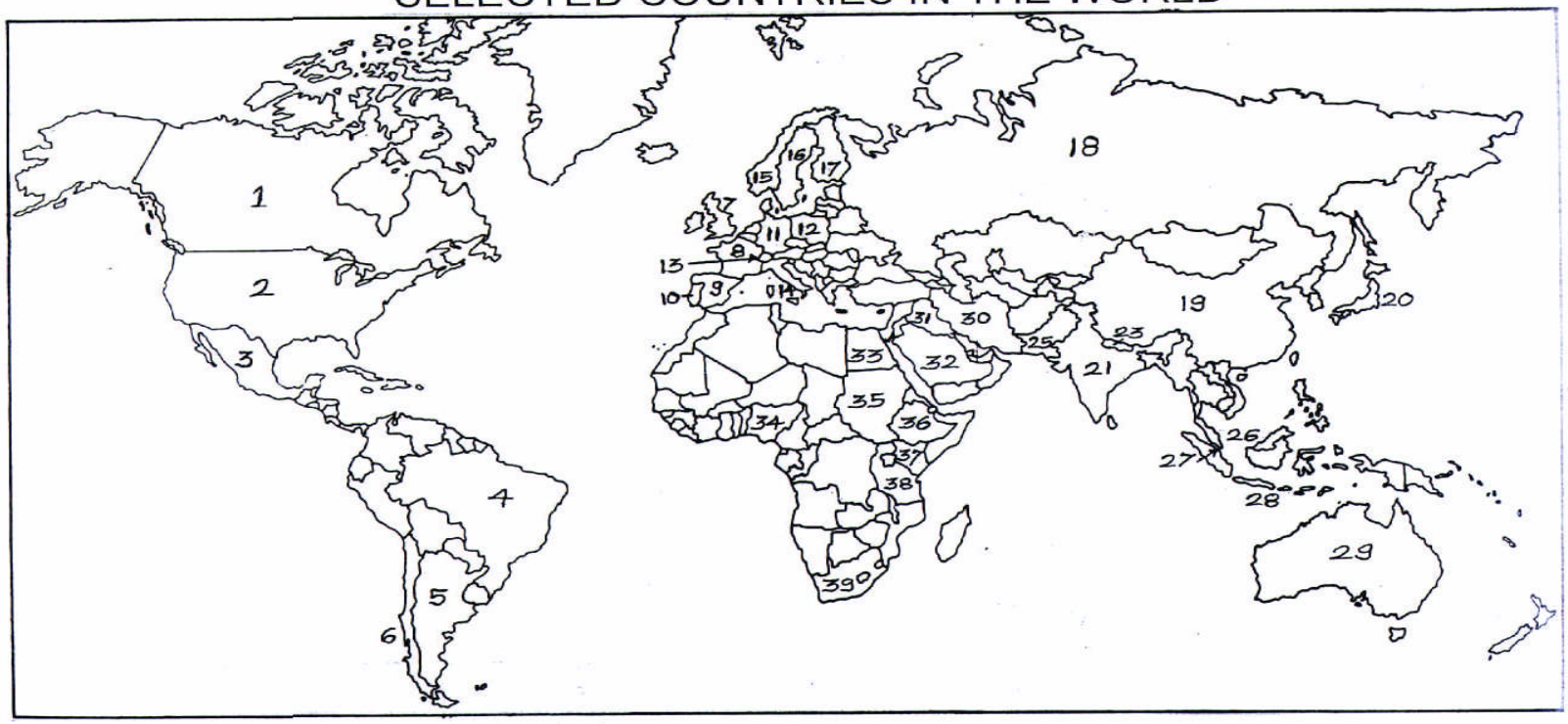
WORLD : DISTRIBUTION OF POPULATION



Use Red Colours for density populated (दाट लोकवस्ती) area and Blue Colour for thinly populated (विरळ लोकवस्ती) area

दाट लोकवस्तीसाठी लाल रंग व विरळ लोकवस्तीसाठी निळा रंग वापरा

SELECTED COUNTRIES IN THE WORLD



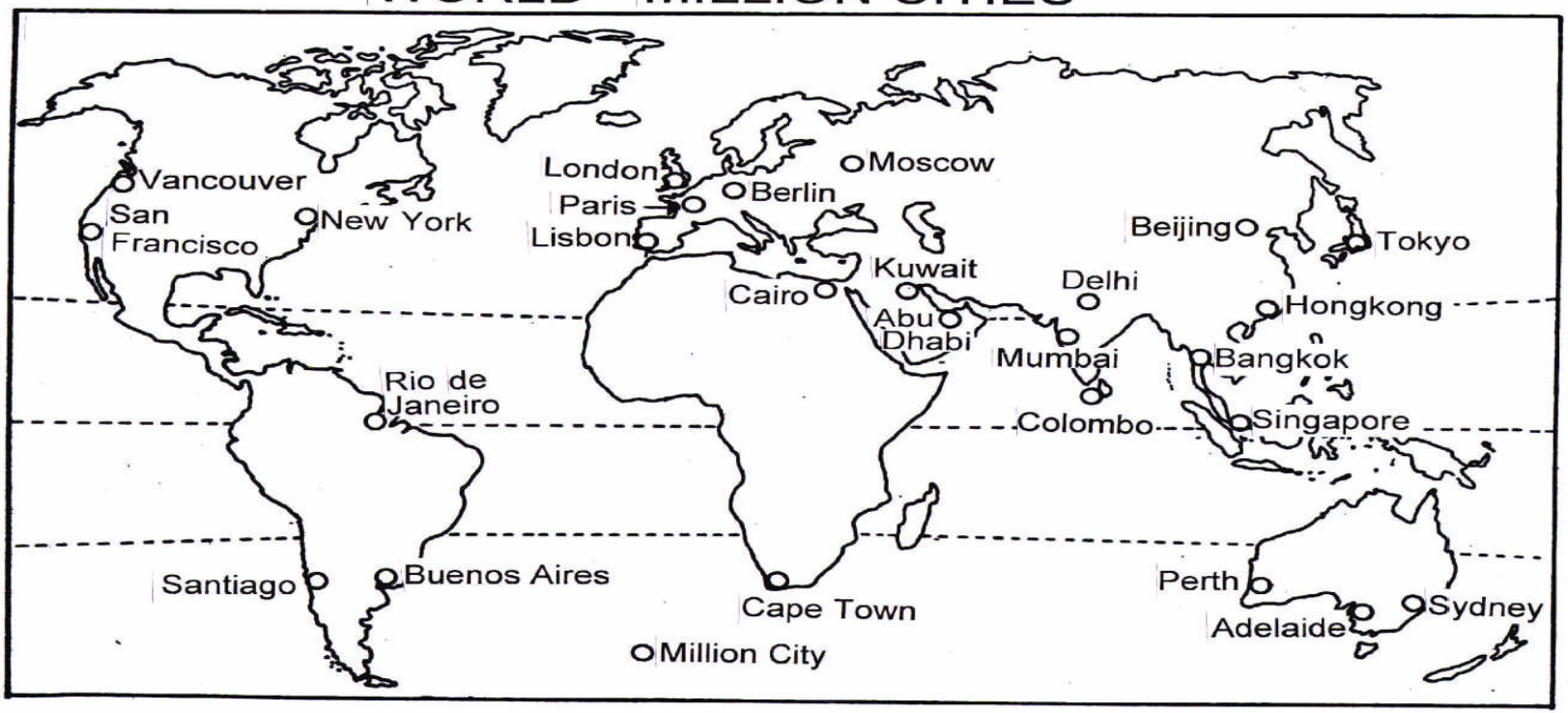
Use different colours for different Countries

विविध देशांसाठी वेगवेगळे रंग वापरा

Selected Countries in the World -

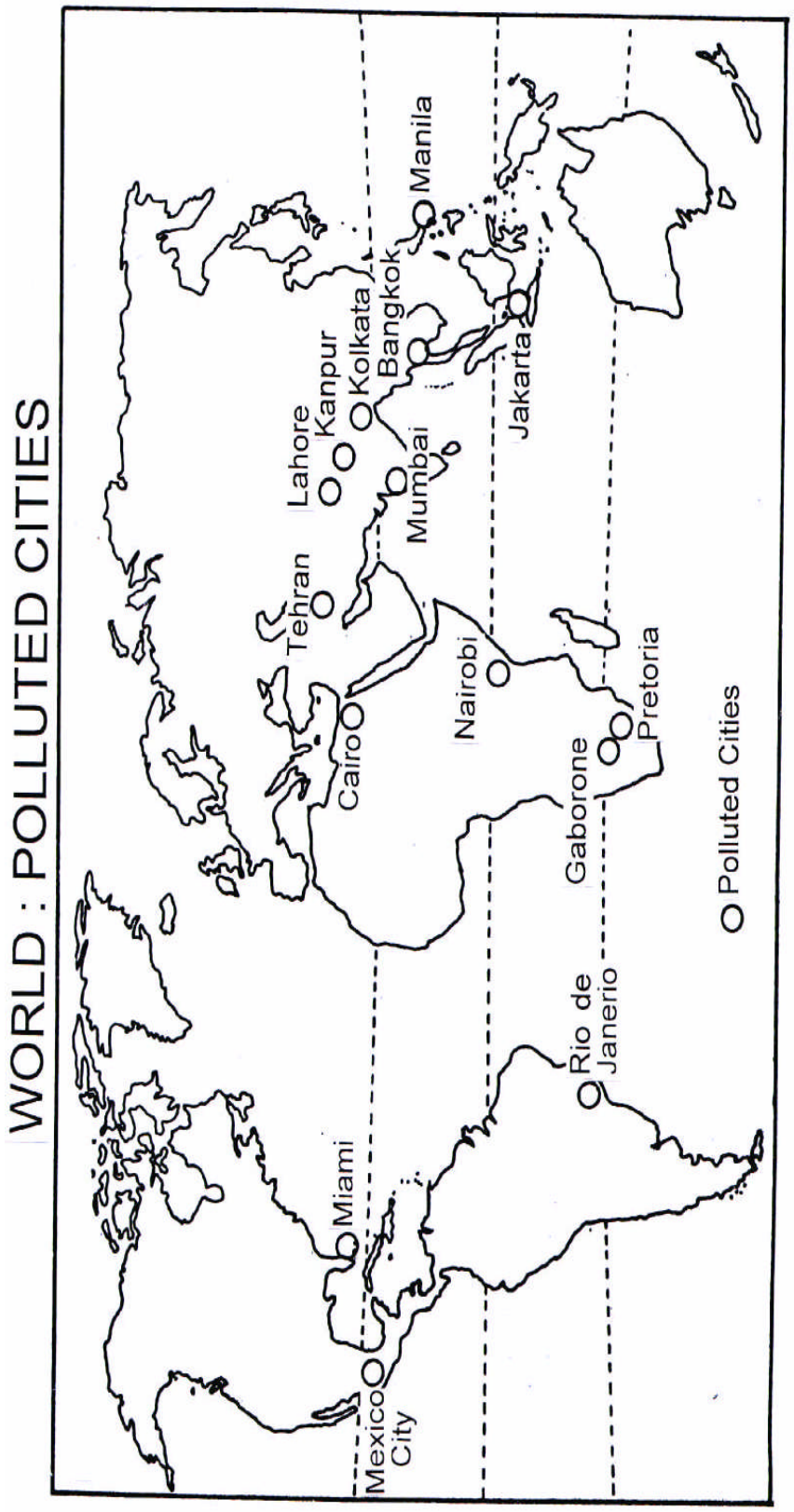
- Canada
- U.S.A.
- Mexico
- Brazil
- Argentina
- Chile
- U.K.
- France
- Spain
- Portugal
- Germany
- Poland
- Switzerland
- Italy
- Norway
- Sweden
- Finland
- Russia
- China
- Japan
- India
- Sri Lanka
- Nepal
- Bangladesh
- Pakistan
- Malaysia
- Singapore
- Indonesia
- Australia
- Iran
- Iraq
- Saudi Arabia
- Egypt
- Nigeria
- Sudan
- Ethiopia
- Kenya
- Tanzania
- South Africa

WORLD –MILLION CITIES



Use red Colour for Million Cities (दक्षलक्षी शहरे)

दशलक्षी शहरांसाठी लाल रंग वापरा



Use red Colour for poluted Cities

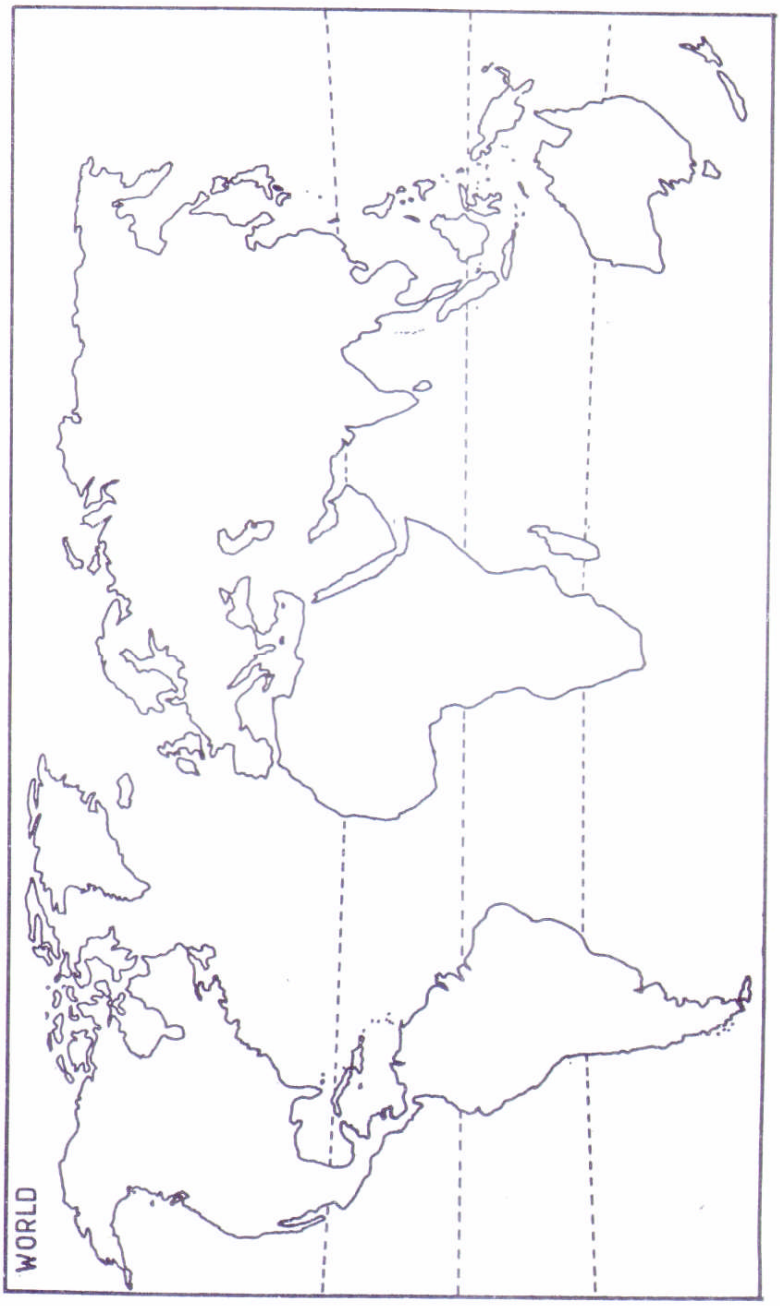
प्रदूषित शहरांसाठी लाल रंग वापरा

Exercise

Environmentally Significant Features.
Mark and Name following features in the map of the world.

PHYSICAL FEATURES

1. Major ocean to the south of India. (Indian Ocean)
2. Continent in the southern hemisphere, which is covered by snow (Antaractica)
3. Eathquake prone area in the northern part of India (Himalaya)
4. Largest continent in the world (Asia)
5. Desert in South America (Atacama)
6. Continent, which is near to the South Pole and is uninhabited (Antarctica)
7. Major island near North America. (Greenland)
8. Drought affected country in Africa (Ethiopia)
9. Largest ocean in the world (Pacific)
10. Major flood affected country to the east of India (Bangladesh)
11. Largest desert in the world (Sahara)
12. Earthquake prone area near Pacific Ocean (Circum Pacific Belt)
13. Smallest continent in the world. (Australia)
14. Major flood affected country to the west of India. (Pakistan)
15. Major mountain range in the South America (Andes)
16. Desert area in southern part of Africa (Kalhari)
17. Country having largest oil reserves Arabia)
18. (Saudi Major flood affected country to the north of Sri Lanka. (India)
19. Earthquake prone area to the north of Mediterranean Sea (Alps.)
20. Mountain range to the north of India (Himalaya)
21. Major mountain range in the Western part of N. America. (Rocky mountains)
22. Major mountain range in the eastern part of N. America (Appalachian)
23. The canal which separates two continents. (Suez Canal)
24. Major mountain range in Austrialia (Great Dividing Range)



HUMAN (CULTURAL) OR ANTHROPOGENIC FEATURES

1. New York to London air route.
2. Singapre to London air route.
3. Major canal which is situated between two major continents. (Suez Canal)
4. An international port to the South of India (Colombo)
5. An international post which is near to the Equator. (Singapore)
6. Area in North America affected by Acid Rain. (N.E. part of U.S.A.)

7. Major producer of nuclear power in Asia (Japan)
8. A canal, which connects two oceans (Panama Canal)
9. Longest railway route in the world. (Trans-siberian railway from Leningrad to Vladivostok)
10. Buenos Aires to Cape Town air route
11. Area affected by Acid Rain to the east of China (Japan)
12. Country having largest population in the world.
13. Asian country affected by Acid Rain (Japan)
14. New York to Mumbai air route.
15. Region in Europe affected by Acid Rain (N.W. Europe)
16. City in India, which was affected by worst gas disaster (Bhopal)
17. Cape town to Colombo air route.
18. The longest ship canal (Suez 16.9 Km)
19. Delhi to Tokyo air route.
20. Mumbai to Moscow air route.
21. Delhi to Canbera air route.
22. Washington D.C. to Paris air route.
23. Delhi to London air route.
24. Cairo to Hongkong air route.
25. New York to Moscow air route.
26. San Francisco to New York ship route.

ADDITIONAL EXERCISES MAP OF THE WORLD

1) Mark and Name the following on the outline Map of the World : (5)

An ‘earthquake’ prone island in Far-East Asia.

Part of India with economic water scarcity.

A country in Africa with very high Deforestation rate.

A sea experiencing oil spill.

An European country facing problem of ‘Acid rain’.

2) Mark and name the following features on the outline map of world provided to you : (5)

A country with highest deforestation rate in South America.

An area rich in biodiversity in India.

An area in North America having physical water scarcity.

A Gulf in the West Asia having problems of oil spill.

An earthquake prone island country in far East Asia.

3) Mark and Name the following in the outline Map of the World: (5)

Mumbai to London water way

Panama Canal

Industrial area in the USA

Worlds largest producer of rubber

Amazon basin

4) Mark and Name the following on the outline Map of the World: (5)

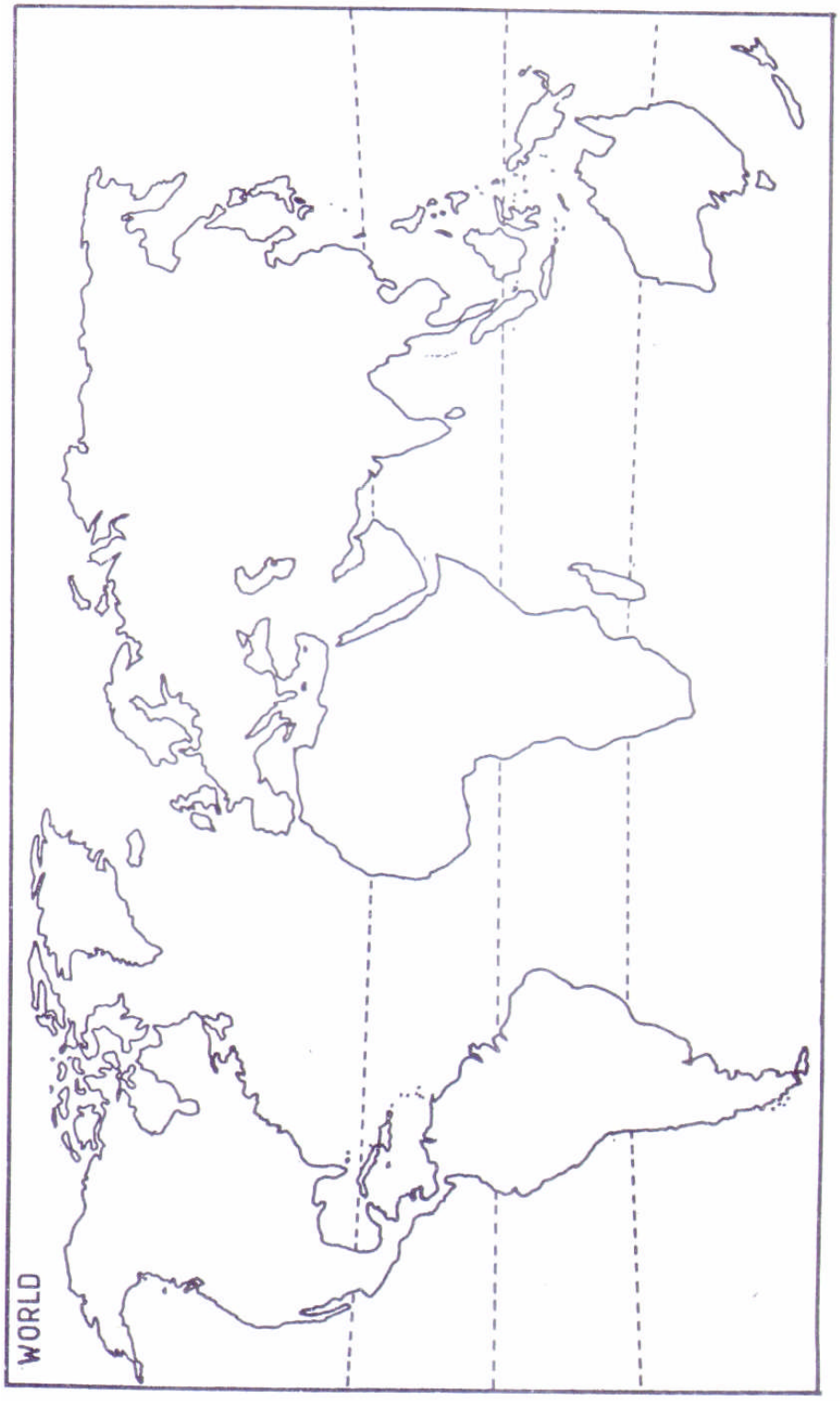
Suez Canal

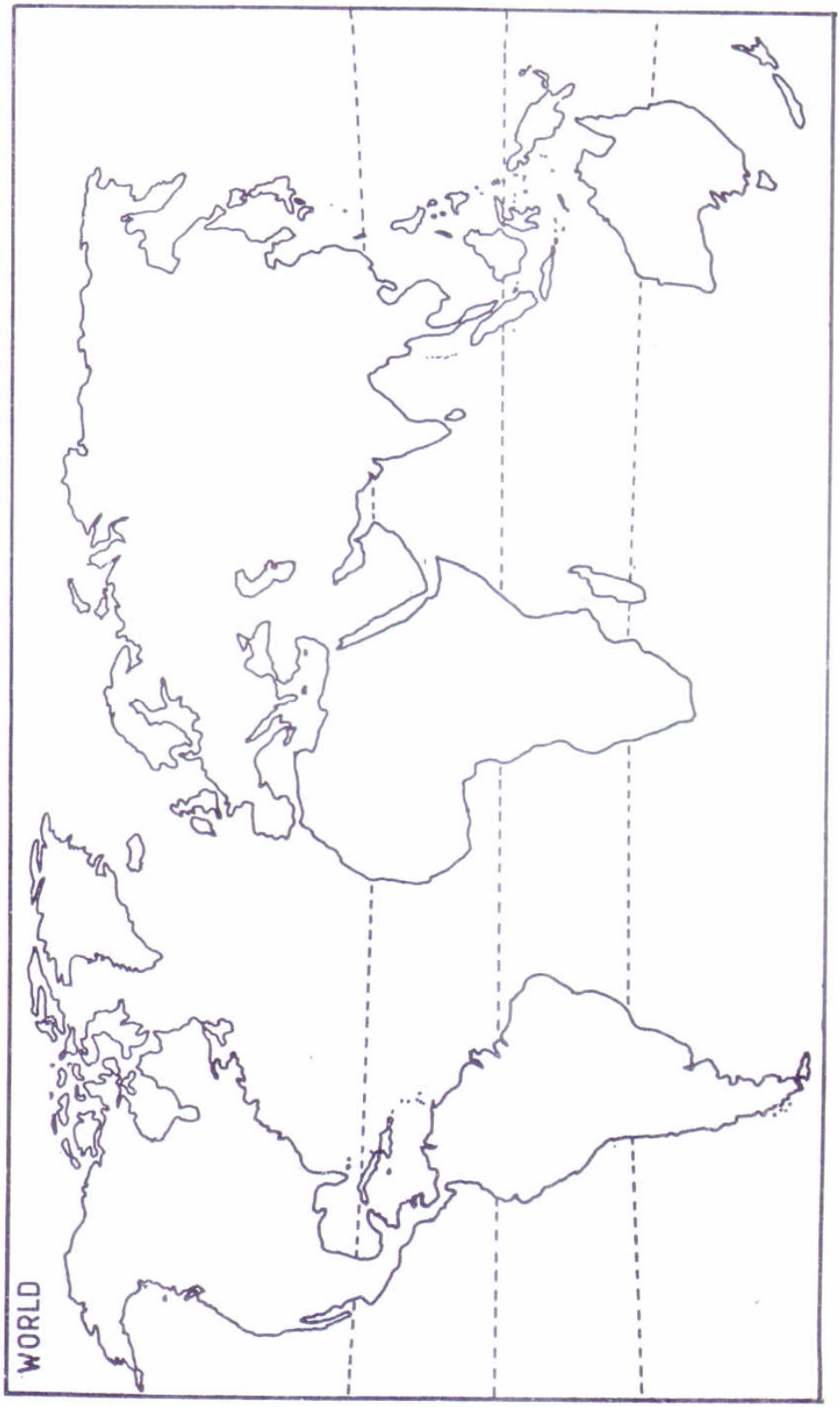
Equatorial forest in South America.

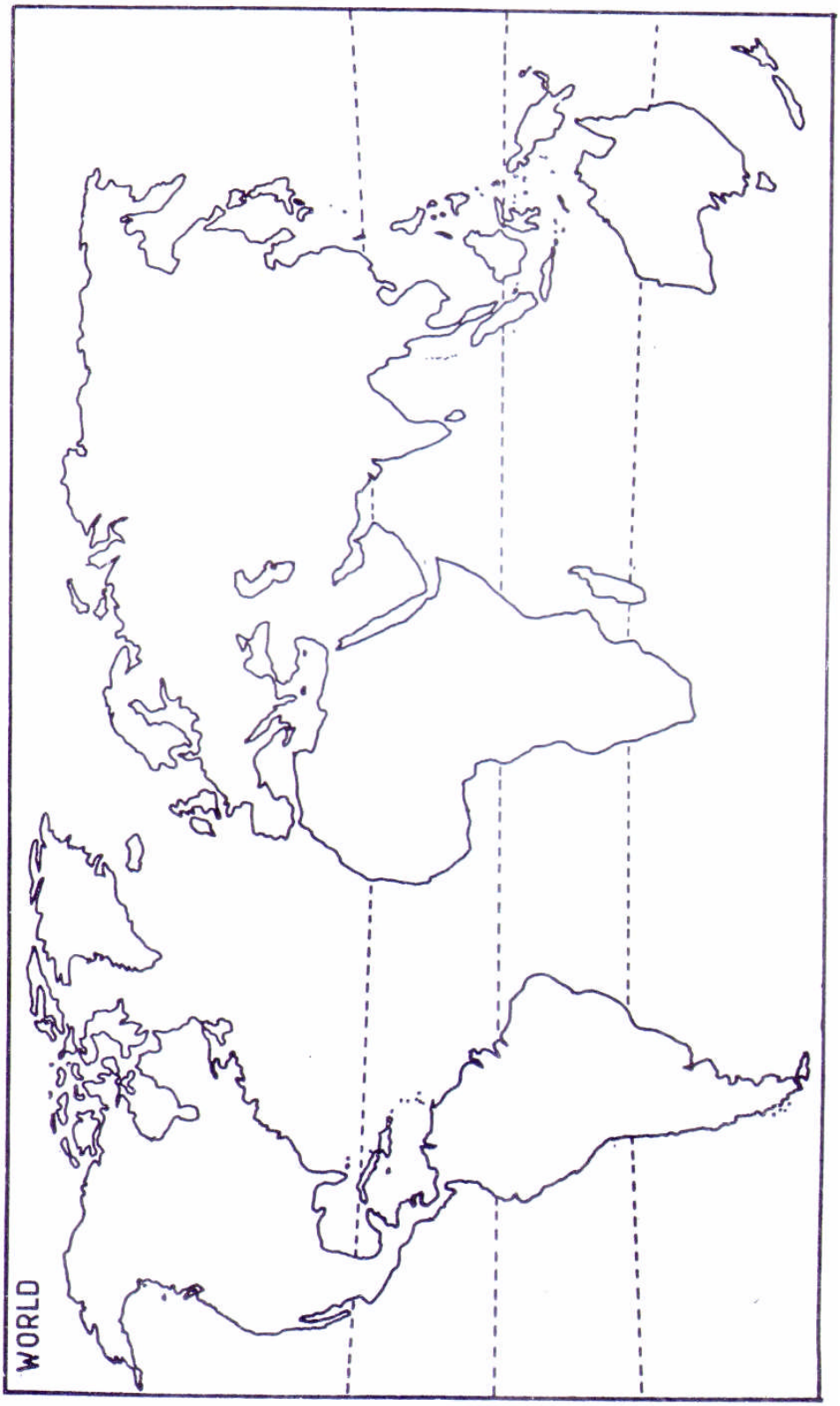
Mumbai to Moscow air route

Alps mountain

Leading fishing bank in North Sea


WORLD


WORLD


WORLD

❖❖❖❖

Environmental Studies- Semester I

Duration: 03 Hours **Marks: 100**

Notice: 1) all questions are compulsory and carry equal marks
2) Use of map stencils and simple calculator is allowed.
3) Attach the given maps along with your answer book.

Q.1. (a) Read the world thematic nap and answer the question of following (10)

i. What is the theme of the map?

ii. Describe the Cartographic technique used in the map

iii. Which country has the highest Gross National Income Per Capita in 2015?

iv. Which country has the lowest Gross National Income Per Capita in 2015?

v. What is the value of Gross National Income Per Capita for USA and Canada?

Q1. B] On the given outline map of Mumbai mark and name the following (10)

i. Atlantic Ocean

ii. Ganga River

iii. Thar Desert

iv. North America

v. Himalaya Mountain Range

vi. Coniferous Forest Region

vii. Mumbai

viii. Bhuj Earthquake Prone Area

ix. Tokyo Million City

x. Bay of Bengal

Q2. Attempt any two questions from the following:

A] Define Environment and describe the different components of an Environment.

B] What is an Ecosystem? Explain different types of Ecosystems with suitable examples.

C] Describe Food Chain, Food Web and Ecological Pyramid with examples.

Q3. Attempt any two questions from the following:

A] What do you mean by Renewable Energy Sources? Explain types of Renewable Energy Sources.

B] Explain the different methods of Natural Resource Conservation.

C] What is water pollution? Explain its causes and effects.

Q4. Attempt any two questions from the following:

A] What are the causes and effects of Population Growth in India.

B] Divide the world into major population density zones.

C] What is Demographic Transition Theory and Explain its stages.

Q5. Attempt any two questions from the following:

A] What is Migration? Explain different types of migration.

B] What is a Smart City? Explain in detail.

C] What are the causes of Urbanization? Mention the positive and negative effects of Urbanization.